Clinical Procedures for Safer Patient Care

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Thompson Rivers University Edition

RENÉE ANDERSON; GLYNDA REES DOYLE; AND JODIE ANITA MCCUTCHEON

THOMPSON RIVERS UNIVERSITY
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About the Book

Clinical Procedures for Safer Patient Care – Thompson Rivers University Edition was adapted by Renée Anderson, Thompson Rivers University from Glynda Rees Doyle & Anita McCutcheon, British Columbia Institute of Technology's textbook *Clinical Procedures for Safer Patient Care*. The original textbook content was produced by Glynda Rees Doyle & Anita McCutcheon and is licensed under a Creative Commons Attribution 4.0 International license. The changes and additions noted below are © by Renée Anderson and are licensed under a Creative Commons Attribution 4.0 International license

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The 2018 adaptation (TRU edition) includes the following changes: all learning objectives have been modified and are titled learning outcomes. All broken video links have been deleted. 'Physician orders' has been changed to 'prescriber's orders'. 'Hospital' has been changed to 'agency'. All new figures that have been added have been attributed. Figures without attribution are present from the first edition. All critical thinking exercises have been modified. Where possible reference lists have been added to, some links have been updated. 'Perform point of care risk assessment for PPE' has been added to each appropriate checklist. In addition:

Chapter 1: Infection Control

- Section 1.4 added video 'Donning and Doffing of PPE'
- Section 1.5 changed 'principles of sterile technique' to 'principles of asepsis' and added two principles; added video 'Principles of asepsis'
- Section 1.7 now called 'Surgical Hand Scrub, Applying Sterile Gloves and Preparing a Sterile Field'; added video 'Applying Sterile Gloves' and 'Simple sterile dressing change'

Chapter 2: Patient Assessment

- Reorganization of the entire chapter into short chapters reflecting each body system
- Section 2.1 new learning outcomes
- Section 2.2 minor wordsmithing
- Section 2.3 added figure 2.2; added table 2.1
- Section 2.4 Added information about choosing the correct cuff size. Added information about vital signs normal ranges; Added figure 2.3; new critical thinking exercises
- Section 2.5 expanded discussion on head to toe versus systems approach to assessment; new critical thinking exercises
- Section 2.6 – 2.12 new content, critical thinking exercises, figures, links to resources, videos
- Section 2.13 Now called Quick Priority Assessment (formerly chapter 2.5 initial and emergency assessment); critical thinking questions
- Section 2.14 added references Alberta Health Services, 2009; BCGuidelines.ca., 2014; Braden, B. & Bergstrom, N., 1989; British Columbia College of Nursing Professionals (BCCNP), 2018; Brodovicz, K., et al. 2009; Christensen, B., & Kockrow, E., 1999; Critical Care Services Ontario, 2014; Davis, C., Chrisman, J., & Walden, P., 2012; Heart and Stroke Foundation, 2019; Hill, D., & Smith, R., 1990, Lapum, J. et al. 2018; Lloyd H., & Craig, S., 2007; Our Lady Children's Hospital, Crumlin (OLCHC), 2016Pasero, C. 2009; Perry, A., Potter, P., & Ostendorf, W., 2018; Potter, P., Perry, A., et al., 2019; Registered Nurses Association of Ontario (RNAO), n.d.; Registered Nurses Association of Ontario (RNAO), 2013. Registered Nurses Association of Ontario (RNAO), 2016; Royal Children's Hospital Melbourne (RCH), 2015; Royal Children's Hospital Melbourne (RCH), 2017; Safer Health Care Now. 2015; Taylor, T. n.d..

Chapter 3 now called Safer Patient Handling, Positioning,

Transfers and Ambulation

- Section 3.2 added to Table 3.1 Factors that contribute to an MSI (force, repetition, work posture, local contact stress); added Figure 3.2 Pivot transfer.
- Section 3.3 now called Risk Assessment for Safer Patient Handling; added to Checklist 24 Risk assessment: risk assessment also involves knowing any activity restrictions associated with recent surgery/ injury; added link to Safe Patient Handling Assessment for from Winnipeg Region Health Authority
- Section 3.4 now called 'Levels of Assistance'; included expanded discussion about this. Table 3.4 clarified to include general levels of assistance. Types of transfers moved to a table in Section 3.6.
- Section 3.5 now called 'Assistive Devices'; added air transfer mattress, slider sheets, monkey bar, sit to stand lift, transfer board added. Added figures 3.3 – 3.6.
- Section 3.6 now called Types of Patient Transfers; Table 3.6 expanded to include sit to stand, mechanical/ ceiling track and information about appropriateness of each type of transfer.
- Section 3.7 now called 'Types of Patient Transfers: Transfers without Mechanical Assistive Devices'; provided clarity in Checklist 26 'moving a patient from bed to stretcher' in relation to the role of individual care giver during a transfer; Checklist 27 now called 'Bed to wheelchair transfer – 1 person assist'; added video 'Assisting from Bed to Chair with a Gait Belt or Transfer Belt'.
- Section 3.8 now called 'Types of Patient Transfers: Transfers using Mechanical Aids'; Added videos 'Sit to stand mechanical assist',How to use a ceiling lift', 'How to use a hammock sling', 'How to use a hygiene sling'; added Table 3.6 Choosing a Sling to be used with the Ceiling Lift; added special considerations.
- Section 3.9 now called 'Positioning Patients in Bed; added figure 3.7.
- Section 3.10 now called 'Assisting a Patient to Ambulate using Assistive Devices'; Checklist 29 Assisting a Patient to a sitting position' moved here; modified Checklist 31 'Assisting to ambulate using a gait belt/ transfer belt'; added video 'How to ambulate with or without a gait belt or transfer belt'; modified checklist 32 'Ambulating with a walker'; Added figure 3.8 – 3.14; added checklist 33 'Ambulating with Crutches'; added video 'How to Ambulate with Crutches'; added checklist 34 'Ambulating with a cane'; added video 'How to Ambulate with a Cane'.
- Section 3.11 added video 'Assisted Fall'
- Section 3.12 added references Clevelandclinic.org (3 references); Handicare, 2018; Hovertech International, 2016; Perry et al., 2018; Potter et al., 2017; Salience Health, n.d.; WHO, 2018; WRHA, 2008

Chapter 4: Wound Care

- Added Section 4.3 Wound Infection and Risk of Infection
- Added Section 4.4 Wound Management
- Section 4.5 Checklist 33: included note about principles of asepsis; added sample charting & video 'Simple sterile dressing change'
- Section 4.6 changed the title of section to 'Advanced wound care: Wet to moist dressing and wound irrigation and packing'; Introduction changed; Checklist 36 now 'Wet to moist dressing changes'; Adjusted some procedural steps; added sample charting. Added Table 4.7 Wound Care Products; added video 'Wound irrigation and wound packing'
- Section 4.7 added Figure 4.2 suture technique and Figure 4.3 simple interrupted sutures; added sample charting; added videos 'Intermittent suture removal' and 'Removal of continuous blanket sutures'
- Section 4.8 added Figure 4.4 Surgical staples after total hip replacement; added video 'Staple removal'
- Section 4.9 added sample charting; added video 'JP Drain Removal'
- Section 4.10 added references: Alavi & Archibald, 2015; British Columbia College of Nursing Professinals, 2019; British Columbia Provincial Skin and Wound Committee, 2011; Ebberlein & Assadian, 2010; Harris et al., 2018; Healthwise, 2017; International Wound Infection Institute, 2016; Munteanu et al., 2016; Norton et al., 2018; Perry et al., 2018; Wiegand et al., 2015

Chapter 5: Oxygen Therapy

- Section 5.2 changed to oxygenation. Info added regarding four functional components of the respiratory system and health conditions that might present challenges in terms of increasing risk of impaired oxygenation
- Section 5.5 note added to simple face mask in Table 5.3; added Figure 5.2 Non re-breather mask; deleted Partial re-breather mask; added Figure 5.3 Oxygen concentrator / nubulizer / humidifier; added Figure 5.4 High flow therapy; Checklist 41 added Professional practice considerations when choosing O_2 delivery system and sample charting
- Section 5.8 added video 'Oral suctioning'
- Section 5.9 added Strickland et al., 2013; and Perry, Potter, & Ostendorf, 2018 references to intro; added Figure 5.6 Structures of the mouth and pharynx; added Figure 5.7 Suction regulator & canister; Checklist 43 added Risks associated with oral and nasal route; added information about recovery time between suction passes; added sample charting; added videos 'Oropharyngeal Suctioning' and 'Tracheal Suctioning Closed (in line) Method'

- Section 5.10 added references Astle & Duggleby, 2019; BTS, 2017; Considine, 2007; BCCNP, 2018; Fisher & Paykel, 2018; Fournier, 2014; McCance et al., 2014; Perry et al., 2018; Strickland et al., 2014; WHO, 2011

Chapter 6: Non Parenteral Medication Administration

- All checklists updated with clarity around bringing MARs to bedside whenever possible; clarity about when 3 checks should happen; labelling medications prepared away from the bedside; all checklists direct reader to Table 6.2
- Section 6.1 rearranged introduction
- Section 6.2 revised Table 6.2 Principles for Safer Medication Administration: added 'assessment comes before, during, and after medication administration'; 'strive to give medications on time'; 'when possible take MARs to the bedside', 'open medication packages at the bedside'; 'label medications prepared away from the bedside'; 'use a system to help you keep track of which meds you've prepared'; 'Follow seven rights….'; 'complete 3 checks…'; Added Table 6.2 Acute care guidelines for timely administration of scheduled medications (ISMP); added Medication Reconciliation paragraph; deleted Checklist 43 (info integrated into Table 6.2)
- Section 6.3 Checklist 45 now includes specific oral medication safety considerations; added Figures 6.1 – 6.6; expanded paragraph discussing administering medication via a gastric tube; Checklist 46 now includes specific G tube medication safety considerations.
- Section 6.4 added Figures 6.9 – 6.10. Checklist 47 now includes specific rectal medication safety considerations; Checklist 48 now includes specific vaginal medication safety considerations
- Section 6.5 added Figures 6.13 – 6.19; Checklist 98 now includes specific opthalmic medication safety considerations; Checklist 50 now includes specific otic medication safety considerations; Checklist 51 now includes specific nasal medication safety considerations
- Section 6.6 added Figure 6.21 – 6.28; Checklist 52 now includes specific small volume nebulizer safety considerations; expanded paragraph discussing MDIs; Checklist 53 now includes specific MDI safety considerations; Added paragraph 'Medication by Dry Powder Inhaler (DPI)'; added Checklist 54 'Medication by Dry Powder Inhaler (DPI)'
- Section 6.7 added Figures 6.29 – 6.31; Checklist 55 now includes specific transdermal patch safety considerations; Checklist 56 now includes specific topical safety considerations; deleted Checklist 55 'Applying Topical Powder'
- Section 6.8 added references Baker et al., 2004; Bell et al., 2011; Boullata, 2009; ISMP, 2011; ISMP 2017a; ISMP 2017b; ISMP 2018; Lilley et al., 2016; Lung Association of Saskatchewan, 2018; Martindate Pharma, nd; Nursing, 2007; Perry et al., 2018; Ramadin & Sarkis, 2017; Royal

Children's Hospital Melbourne, 2017; Saskatoon Health Region, 2017; Zed et al., 2008

Chapter 7: Parenteral Medication Administration

- Section 7.2 now called 'Preparing Medications From Ampules and Vials'; added Figures 7.3 – 7.13. Added videos 'Preparing Medications from a Vial'; 'Preparing Medications from an Ampule'; 'Reconstitution of Powdered IV Medication and Administration via a MiniBag'
- Section 7.3 now titled 'Intradermal Injections'
- Section 7.4 now Subcutaneous Injections; Added Figure 7.15-7.21; added videos 'Administering a Subcutaneous Injection', 'Insertion of an Indwelling Subcutaneous Device aka 'subcutaneous butterfly"
- Section 7.5 added Figure 7.23 & 7.25; caution about meds that are incompatible or whose compatibility cannot be verified cannot be given simultaneously from the same syringe; information about independent double checks; labelling syringes for injectables prepared away from the bedside; STAB, GRAB, ASPIRATE, INJECT; added videos 'Preparing medication from a vial'; 'Preparing medication from an ampule'; 'Landmarking deltoid'; 'Administering IM injection Z track method / Landmarking ventrogluteal'; 'Administering IM injection Z track method / Landmarking vastus lateralus'; 'Administering IM injection Z track'
- Section 7.6 added information about the nurse must consult their agency parenteral practices manual and / or drug monographs for specific information about IV direct administration times for individual medications. Administering a medication intravenously virtually eliminates the process of *first pass* by directly depositing it into the blood; all references to 'Posi flow valve' and 'MaxPLus' changed to 'needleless cap'; added 'IV access devices such as PICCS and central lines which remain insitu for long periods have the potential for medication residue to build up in the lumen of the catheter posing a risk for occlusion and reaction with non compatible medications'; Checklist 60: now titled 'Administering Medications IV Direct into a Locked / Capped IV; (PVAD Short, Midline, PICC, Percutaneous Non-Hemodialysis CVC)'; rewrote steps; added 'Attempt to have half of the syringe emptied in half of the recommended infusion time'; added 'use 10ml syringes for flushing reduces risk of fracturing IV cannula'; deleted 'Use a push-pause method to inject the medication' and replaced with 'Administer the medication slow and steady. Attempt to have half of the syringe emptied in half of the recommended infusion time'; added 'Never administer an IV medication into an IV line that isn't patent'; added 'Aspirating on a PICC, midline and percutaneous non hemodialysis CVAD should reveal blood flash back. If you suspect the line is not patent, or partially occluded, follow agency guidelines (this usually involves consulting the IV team / PICC nurse)'; Checklist 61 new title: 'Administering

medications IV direct into an infusing IV – with compatible solution: (PVAD short, midline, PICC, percutaneous non hemodialysis CVC)'. Rewrote steps; deleted step 'If IV solution is on an IV pump, pause the device. Pinch IV tubing above the lowest access port or use blue slider clamp'; deleted 'removes used medication syringe….flush 3-5 ml at the SAME rate… unpinch / unclamp the IV tubing' (formerly steps 10,12 & 13) ; deleted 'restart IV on opposite arm'. Checklist 62 new title: 'Administering medications IV Direct into an infusing IV with Incompatible IV Solution: (PVAD short, midline, PICC, percutaneous non hemodialysis CVC)'; rewrote steps; deleted 'clamp or pinch the IV line…' and changed to 'stop the infusion'; deleted 'clamp IV tubing above the lowest port…'; deleted 'Use a push-pause method to inject the medication' and replaced with 'Administer the medication slow and steady. Attempt to have half of the syringe emptied in half of the recommended infusion time'; 'watch' changed to 'clock'. Table 7.9 added 'Correctly identify the VAD and use agency flushing and locking protocols for correct administration'; added 'Check patency of the line (PICCs and percutaneous non-hemodialysis CVAD lines aspirate for blood return)'; added 'Aspirating on a PVAD short often does not reveal blood flash back despite the site being patent. Assess for patency of PVAD short during the flush'; added video 'Administering Medications: Direct IV – Into a Locked IV (PVAD short)' and 'Administering medications: Direct IV – into an IV with an infusion'

- Section 7.7 deleted 'A piggyback medication is given through an established IV line that is kept patent by a continuous IV solution or by flushing a short venous access device (saline lock)'; Checklist 63: now titled 'Administering an intermittent IV medication by a minibag (initial dose)'; added 'Set the infusion rate according to PDTM'; added 'Ensure the medication to be hung is compatible with the medication in the previous minibag…If they are compatible simply hang the new bag…If they aren't compatible, either change the secondary line or back flush / back fill. Close the clamp on the secondary IV line. Empty the drip chamber into the minibag. Remove the old mini bag from the secondary IV tubing. Hang the new minibag onto the IV pole. Remove sterile blue cover on new medication bag, and insert the spike of the secondary IV tubing into it.'; Checklist 64: now titled 'Administering an intermittent IV medication by a minibag – Using Existing Secondary Line'; deleted 'Prime the secondary IV line by "back filling" using the empty IV mini bag attached to the secondary IV line'; added 'Set the infusion rate according to PDTM'; added 'Ensure the medication to be hung is compatible with the medication in the previous minibag…If they are compatible simply hang the new bag…If they aren't compatible, either change the secondary line or back flush / back fill. Close the clamp on the secondary IV line. Empty the drip chamber into the minibag. Remove the old mini bag from the secondary IV tubing. Hang the new minibag onto the IV pole. Remove sterile blue cover on new medication bag, and insert the spike of the secondary IV tubing into it.'; added 'An electronic infusion device …MUST be used for specific medications like IV insulin and high dose KCL'; added video 'Reconstitutingof Powdered IV Medication and Administration via a Mini-bag' ; added Figure 7.33

- Section 7.8 added 'heparin given IM instead of SC' as example of wrong location for medication; 'total parenteral nutrition' changed to 'parenteral nutrition'; differentiated references ISMP 2014 into 2014a and 2014b; Table 7.10 added 'if precipitates are noted in the tubing, stop the infusion. Prime a new IV line and change at the cannula site. Flush IV catheter with normal saline'; added information about infiltration and extravasation; added 'Document and notify prescriber. Report incident as per agency policy'
- Section 7. 9 added references Astle & Duggleby, 2019; Children's Hospitals and Clinics of Minnesota, 2018.Dawkins, et al., 2000; Goossens, 2015; Perry et al., 2018, 2014; Shah et al., 2016

Chapter 8: Intravenous Therapy

- Chapter 8.2 title changed to 'IV therapy: Guidelines and Potential Complications'; added 'IV sites must be assessed regularly. Check your agency for specific guidelines. Some guidelines may suggest every 5 minutes, others hourly, others every 12 hours'; In the absence of guidelines exercise some clinical judgement and consider that sites requiring more frequent assessment include those that have an infusion versus those that are locked; in an acute care environment versus a home environment; patient conditions where cognitive and sensory changes inhibit their ability to voice concerns; types of solutions – vesicants require more frequent site assessment than solutions with less potential for harm if infiltrated; location and type of catheter – areas of flexion have higher risk of infiltration; central venous access have higher risk of air emboli if equipment fails ; Table 8.1 now called Potential Local Complications of IV Therapy; Table 8.3 now called Potential Systemic Complications of IV Therapy; included preventative strategies; added references Gorski et al., 2015; RCH 2014; RNAO 2005, Singh et al., 2015
- Section 8.3 now called 'Types of Venous Access'; added Figure 8.1, 8.2, 8.4, 8.6-8.14; PVAD short – with infusion; regarding PVAD short site changes; added 'Some literature challenges this firm timeline and suggests that sites should be assessed individually for decisions about removal'; added 'Midline Catheters'; added specific information about CVAD dwell times – Non tunneled percutaneous CVAD – several days – weeks / IVADs can remain in place and function for many years / PICCs can remain in place as long as there is no evidence of complications; added Table 8.4 Potential Complications associated with CVADs specifically; added info about Mulitlumen CVCs; added info about Valve Technology: Open ended versus closed ended lumens; added Table 8.5 Characteristics of open versus closed eneded CVC lumens;
- Section 8.5 now called 'IV Administration Equipment'; deleted A peripherally inserted catheter is usually replaced every 72 to 96 hours, depending on agency policy; added As of

2017, the CDC is saying no recommendation can be made regarding the frequency for replacing intermittently used administration sets; deleted 'Ideally, the IV solution should be 90 cm above patient heart level'; added Table 8.6 Common IV equipment including Figures 8.13 – 8.16

- Section 8.7 now called Priming IV Tubing / Changing IV Fluids / Changing IV Tubing; Checklist 66: Priming IV Tubing- added 'Hang IV bag on hook or IV pole in a way that will allow gravity to help you'; added 'Only if absolutely necessary, remove protective cover on the end of the tubing and keep sterile'; Checklist 68: now called ' Changing IV Tubing'; deleted let it dry for 30 seconds. Now says 'let it dry'; deleted 'check for signs and symptoms of phlebitis'. Now says 'check for evidence of complications'; added 'If the extension isn't present and / or you are changing the extension set – Loosen the IV tubing from the IV cannula; PVAD short occlude the vein / CVAD – open ended … use clamps / CVAD – closed ended …lumens have valves to prevent reflux'; 'IV fluid administration set' changed to 'IV administration set'; added 'Understanding the structure and function of different IV access devices helps to determine risk of air emboli / exposure to BBF and subsequent safety considerations and need for clamping'; added videos 'Priming IV lines', 'Changing IV bags', 'Converting an IV to a saline lock – Extension Present', 'Converting an IV to a saline lock – No Extension Present'
- Section 8.8 now called Flushing and Locking – PVAD short, midlines, CVCs (PICC, non hemodialysis lines); added Table 8.11 Sample flushing and Locking Protocol; Checklist 69 now called 'Flushing a PVAD short saline Lock'; Checklist 70 now called 'Flushing a CVAD (PICC and percutaneous CVC non hemodialysis)' with corresponding steps and additional information and figures added; added videos 'Converting an IV to a saline lock (PVAD short) – extension present'; added video 'Converting an IV to a saline lock (PVAD short) – no extension present'; added video 'CVAD care and maintenance – lumens with valves'; added video 'CVAD care and maintenance – lumens without valves'; Added figures 8.21-8.23.
- Section 8.9 now called 'Removal of a PVAD short, midline catheter, percutaneous non hemodialysis CVC and PICC'; added 'before IV access is discontinued…added 'Is the patient using an epidural/PCA and need IV access as part of safety protocols?'; added 'Do you have an order from the prescriber or are you doing this under your independent scope of practice? If the later, is this in agreement with agency policy?'; deleted Checklist 72: 'converting IV to a saline lock' and replaced with 'Removing a PVAD short cannula / peripheral midline catheter'; Checklist 72 now called 'Removing a percutaneous non hemodialysis CVC / PICC' with corresponding steps, additional information and figures; added 'If purulent drainage is present consider a swab for C&S. Report using the agency's patient safety learning system (incident report)'; added 'This provides follow-up data for potential infection. Reporting of events contributes to the culture of patient safety'; added video 'Removing PVAD short cannula'; added Figures 8.24 – 8.26.
- Section 8.10 new section IV Site Dressing Changes; Checklist 73 now called changing an IV

site dressing – no additional securement devices with accompanying steps and additional information; added videos 'PVAD short dressing', 'PICC dressing change'; Checklist 74 now called Changing an IV site dressing – involving a securement device including steps, additional information and Figures 8.27-8.30

- Section 8.11: Jehovah Witnesses changed to Jehovah's Witnesses. Checklist 75 added clarity around having a primed IV line ready in the event of transfusion reaction; differentiated allergic reaction actions versus other actions; Checklist 75 now called 'pretransfusion preparation'; added 'Some blood products require refrigeration. Complete the preparation BEFORE calling for delivery of the blood / blood product'; added 'If the product does require refrigeration and cannot be administered immediately, return it to TMS (transfusion medical services) for safe storage'; added 'Medications given prior to transfusion are only considered for persons with documented moderate to sever reactions. Typically medications are administered 30 minutes prior to the transfusion. Examples of meds include diphenhydramine, acetaminophen, furosemide. Remember these medications can also mask a potential reaction'; added 'Check that the patient identification and TMS identification band are correct'; 'if no identification band, apply one. If no TMS (aka blood band) present, STOP, notify TMS. Only TMS can apply blood bands. If any discrepancies STOP, do not proceed until the discrepancy is resolved'; added 'Group, screen and cross match must be completed within 96 hours of the transfusion to establish any new antibody formation and to ensure current compatibility. If group and screen are outdated, initiate processes for new testing.'; added 'step 6 verify correct infusion equipment'; added 'Packed RBCs require filter tubing to remove clots, debris, and coagulated protein. Glass bottles containing albumin and IVIG require vented tubing'; added step 8 'Ensure prescriber has obtained consent. Nurses verify consent and ensure the patient is informed about the rationale, possible risks. Nurses to document confirmation of consent; Blood products require consent prior to administration. Consent is obtained by the prescriber. If unable to verify consent, notify the prescriber'; 'in addition assess for other symptoms that may be confused with transfusion reaction'; added Figures 8.31-8.32
- Section 8.12 TPN changed to PN; Tables retitled; altered Table 8.8 to include referencing of other tables earlier in the text
- Section 8.13 Added references: British Columbia College of Nursing Professionals (BCCNP), 2018; Canadian Blood Services, 2017a; Canadian Blood Services, 2017b; Canadian Blood Services,2017c; Center for Disease Control, 2017; Ferroni, A. et al, 2014; Fraser Health Authority, 2014; Goossens, 2015; Gorski, L. et al., 2016 ; Gorski, L. et al., 2012; Ho, C. & Spry, C., 2017; Interior Health, 2012; Interior Health, 2018; Perry, A. G., Potter, P. A., & Ostendorf, W. R., 2018; Registered Nurses' Association of Ontario (RNAO), 2005; Rosenthal, K., 2007; Royal Children's Hospital Melbourne (RCH), (n.d.); Singh, A., et al., 2015.

Chapter 9: Blood Glucose Monitoring

- Section 9.4 added references: Accu-Chek, n.d.; Canadian Diabetes Association, 2018; Kaiser Permanente, n.d.

Chapter 10: Tubes and Devices

- Section 10.2 reorganized existing text information into Table 10.1'Guidelines for Caring for Patients with Tubes and Attachments'
- Section 10.3 clarified naso gastric tubes used for feeding versus naso gastric tubes used for gastric decompression; added reference Stewart, 2014; Checklist 78 insertion a nasogastric tube simplified procedure; added videos 'Insertion of an NG tube', 'Nasogastric tube removal'; added reference Lilley et al., (2016)
- Section 10.5 rewrote introduction; added Figure 10.1- 10.5 , 10.7; added Table 10.2 Parts of a Tracheostomy Tube; modified Checklist 82 Tracheal suctioning – open method; added videos 'Tracheal Suctioning – Closed Method', 'Replacing and Cleaning an Inner Tracheal Cannula', 'Changing a Tracheostomy Site Dressing', 'Replacing Tracheotomy Ties'; added references BTS, 2014; RCH, n.d.; St George's University Hospital, n.d.; Lewarski, 2005
- Section 10.6 added Figures 10.8-10.10; enlarged 10.11, added Figure 10.12, 10.15; added Table 10.4 The differences between a Dry suction Chest Drainage System and a Wet Suction Chest Drainage System; added 'accidental chest tube removal kit' including a description of contents; Table 10.5 added complication 'The drainage unit has tipped over'; modified Checklist 86 Care and Management of a Closed Chest Tube Drainage System; Checklist 86 added sample documentation; added references Atrium, 2009; Perry et al., 2018; RNAO, 2019; Teleflex, 2018; Zisis et al., 2015
- Section 10.7 added images 10.16 – 10.17; added clarity around retracted stomas and use of a convex flange; added references: Oxford University Hospital, 2013; Birmingham Bowl Clinic, 2011; deleted Checklist 88 'changing an ostomy appliance (urostomy)' and incorporated information into Checklist 87 'Changing an Ostomy Appliance (flange and pouch)'; slight modifications to Checklist 87 by combining 2 steps; added sample documentation; added resources Convatec Ostomy Care Video Library and Hollister Ostomy Care Resources ; added Table 10. 6 'How changing a urostomy pouch is different than a colostomy/ ileostomy'

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Introduction

In Canada, there continues to be overwhelming evidence that significant preventable harm and patient care errors continue to occur despite the fact that most health care providers are committed to providing safe patient care and to do no harm (Baker et al., 2004; Butt, 2010). Health care-associated errors or near misses are rarely the result of poor motivation, negligence, or incompetence, but are based on key contributing factors such as poor communications, less than optimal teamwork, memory overload, reliance on memory for complex procedures, and the lack of standardization in policies and procedures in health care (Canadian Patient Safety Institute, 2011). In addition, patient care errors are rarely the result of just one person's mistake, but, instead, often reflect predictable human failings in the context of poorly designed systems. Despite current research into human factors as direct contributors to patient care errors, many of our complex medical procedures are based on perfect memory, even though we humans are prone to short-term memory loss (Frank, Hughes, & Brian, 2008).

In health care education, students must have the knowledge, skills, attitudes, and experience to be able to anticipate, identify, and manage situations that place patients at risk. To become competent in clinical skills, students practice in the classroom and laboratory, and then apply what they have learned to practice with supervision and support in the clinical setting. However, students today are often faced with less than optimal clinical exposure and assessment to develop the expertise and experience they need to be fully competent by graduation. Furthermore, inter-professional teamwork creates shared patient care environments, where many disciplines will care for patients and their conditions, and patient information and care management moves frequently among health care providers. Successful patient treatment is reliant on many different health care providers and their skill sets, and each discipline teaches clinical skills differently. The lack of consistency in training and in the use of the latest evidence-based research in health care education makes it challenging to ensure safe care.

These issues contribute to unsafe care and preventable medical errors. In the delivery of health care and professional health care practice, it is no longer acceptable that preventable errors continue to take place in modern-day health care. Health care providers need a method to improve patient care, and standardization of processes and approaches, such as is provided by practice guidelines and checklists, will contribute to the development of safer patient care (Canadian Nurses Association, 2004).

In reviewing incidents and preventable errors, significant factors, including human factors, have been identified, and strategies have been introduced to reduce the likelihood of errors and to create a safe standard of care. The creation of guidelines for the execution of processes will not

change culture, but can encourage us to find a level of practice that contributes to standardizing safe care and helps us deal with our human failings as we try to always perform perfectly in a complex environment. Change should be focused on creating robust safety systems. Among these, the point-of-care checklist has been proven to be a safe strategy, and is now becoming more common in health care (Frank, Hughes, & Brien, 2008).

Use of Checklists

Checklists are the predominant format used in this resource, following the work of Dr. Atul Gawande, described in his book *The Checklist Manifesto: How to Get Things Right* (2010). Dr. Gawande believes that although the modern world has given us knowledge and experience, avoidable medical errors continue to occur. Dr. Gawande posits that the reason for this is simple: the volume and complexity of health care today has exceeded our ability as individuals to properly deliver it when caring for people consistently, correctly, and safely. He argues that we can do better by using the simplest of methods: the checklist. The most often-cited example of Dr. Gawande's work is a simple surgical checklist from the World Health Organization that has been adopted in more than 20 countries as a standard of care and has been heralded as "the biggest clinical invention in thirty years" (*The Independent*, cited in Gawande, 2010). Just one example of its success comes from the United States: when the State of Michigan began using a checklist for central lines in its intensive care units, the infection rate dropped 66% in three months. In 18 months, the checklist saved an estimated $175 million and 1,500 lives (Shulz, 2010). Checklists allow for complex pathways of care to function with high reliability by giving the users an opportunity to review their actions individually and with others, and to proceed in a logical, safe manner.

This open educational resource (OER) was developed to ensure best practice and quality care based on the latest evidence, and to address inconsistencies in how clinical health care skills are taught and practiced in the clinical setting. The checklist approach aims to provide standardized processes for clinical skills and to help nursing schools and clinical practice partners keep procedural practice current.

How to Use This Book

This book should be used in conjunction with existing courses in any health care program. This book is not intended to replace core resources in health care programs that provide comprehensive information concerning diseases and conditions. An understanding of medical terminology, human anatomy, physiology, and pathophysiology is a required asset to use this

book effectively. The development of technical skills is based on the knowledge of, practice to achieve proficiency in, and attitudes related to the skill, and an awareness of how our roles affect our patients and other health care professionals. This book contributes to enhancing safer care for patients by outlining evidence-based practices, and looking beyond just the technical skill to understanding the types of expertise and knowledge required to decrease adverse events. In each of the 89 checklists throughout this book (and summarized in Appendix 2), rationale for each step is provided in the form of *Additional Information*.

Each skill/procedure is covered in a chapter that has learning outcomes, a brief overview of the relevant theory, checklists of steps for procedures with the rationale behind each step of the process, and a summary of key takeaways. Photographs and diagrams (referred to as figures) relevant to the topic are included. The checklists are extendable across all health care professions and are relevant to nursing (RN, NP, LPN, RPN, and CA), allied health, and medical students. They also provide an opportunity for further sharing and collaboration among health care professionals. Students will find this resource valuable at the point of care to reduce the risk of adverse events and to provide a deeper understanding of safety considerations, infection control practice, injury prevention, and the value of consistency in clinical processes. Some key terms are set in bold and explained in the Glossary in Appendix 1.

Our hope is that not only will the checklists in this resource provide clear and concise guidelines for performing clinical skills in the health care setting, but that they will also improve patient safety and quality of care.

Note: For the sake of consistency, the term **patient** and client are used interchangeably to refer to any person who is being cared for in the health care setting.

Suggested Online Resources

Patient Safety

1. BC Patient Safety and Quality Council. This website provides information on the latest initiatives from the BC Ministry of Health to improve clinical issues such as preventing (Deep Venous Thrombosis) DVTs; introducing the 48/6 model of care; improving hand hygiene; creating pathways of care for conditions such as heart failure, stroke, and (transient ischemic attacks) TIAs; reconciling medication; caring for the critically ill; and developing the surgical checklist.

2. Canadian Patient Safety Institute (CPSI). This website provides access to resources, toolkits,

events, education, and conferences related to making patient safety happen in health care. It also reviews the latest initiatives.

3. Institute for Healthcare Improvement Open School. Free online courses about health care leadership, patient safety, improving capability, improving patient- and family-centred care, and population health can be found on this resource.

4. Institute for Safe Medication Practices. This is an excellent resource for the latest safety alerts and ways to advance safe administration of medication.

Interprofessional Education (IPE)

1. University of British Columbia Interprofessional Practice Education. This resource provides online modules for students to review strategies to work effectively across disciplines.

2. Institute for Healthcare Improvement (IHI). Free resources and strategies on how to improve health and healthcare around the world are listed on this website. It also offers free online courses to enhance teamwork, communication, and other topics related to safety in health care.

References

Baker, G., Norton, P., Flintoff, V. et al. (2004). The Canadian adverse events study: The incidence of adverse events among hospital patients in Canada. *CMAJ* 170:1678-1686.

Butt, A. R. (2010). Medical error in Canada: Issues related to reporting of medical error and methods to increase reporting. *McMaster University Medical Journal*, 7(10), 15-18.

Canadian Nurses Association and University of Toronto Faculty of Nursing. (2004). Nurses and patient safety: A discussion paper. Retrieved on Aug 26, 2015, from http://www.cna-aiic.ca/~/media/cna/files/en/patient_safety_discussion_paper_e.pdf?la=en

Canadian Patient Safety Institute. (2011). Canadian framework for teamwork and communication. Literature review, needs assessment, evaluation of training tools and expert consultations. Retrieved on Aug 26, 2015, from http://www.patientsafetyinstitute.ca/en/toolsResources/teamworkCommunication/pages/default.aspx

Frank, J. R., & Brien, S. (eds.) on behalf of the Safety Competencies Steering Committee. (2008). *The*

safety competencies: Enhancing patient safety across the health professions. Ottawa, ON: Canadian Patient Safety Institute.

Gawande, A. (2010). *The checklist manifesto: How to get things right.* New York City, NY: Metropolitan Books.

Hughes, R. G. (2008). Nurses at the "sharp end" of patient care. Chapter 2 in *Patient safety and quality: An evidence-based handbook for nurses*. Retrieved on Aug 26, 2015, from http://www.ncbi.nlm.nih.gov/books/NBK2672/

Shulz, K. (2010). *Check, please: Atul Gawande's The Checklist Manifesto.* Retrieved from Huffington Post, Retrieved on Aug 26, 2015, from http://www.huffingtonpost.com/kathryn-schulz/check-please-atul-gawande_b_410507.html

Disclaimer

The field of health care is constantly changing and evolving. Procedures and policies in schools and health care agencies will change in accordance with research and practice. This resource will require updates to remain in accordance with these changes, but the authors do not assume responsibility for these updates.

Health care professionals must ensure that they have a strong foundation of knowledge in medical conditions and surgical procedures related to clinical skills and techniques before using this resource to guide their practice. Health care professionals should always put agency policy above the information in this resource and be mindful of their own safety and the safety of others. Any health care professional using this resource should do so in the appropriate environment and under the supervision of other relevant health care professionals, in accordance with their governing professional body and within their scope of practice.

It is the responsibility of any health care professionals using this book to take all appropriate safety precautions and to determine best practice unique to the patient and the context of the situation. The authors do not assume responsibility for any injury or damage to persons or property pertaining to the use of the material and information in this resource.

CHAPTER 1. INFECTION CONTROL

1.1 Introduction

In healthcare, the use of effective and safe infection prevention and control practices is everyone's responsibility. Infection prevention and control guidelines are mandated in hospitals to protect patients, healthcare personnel, and families from the transmission of organisms that cause infections. This chapter will review the principles of infection prevention and control practices, and the use of additional precautions and personal protective equipment to control and prevent the spread of infection in acute healthcare settings. The chapter also will explore surgical asepsis, the principles of sterile technique, and procedures related to sterile technique in the operating room and during invasive procedures.

Learning Outcomes

- Define infection prevention and control practices.
- Explain what is meant by chain of infection.
- Describe routine practices for infection prevention and control.
- Describe what is meant by point of care risk assessment.
- Differentiate between the three types of additional precautions: contact, airborne, and droplet.
- Explain how and when to use additional precautions and personal protective equipment (clean gloves, gown, face shield, eye protection, N-95 mask, procedure mask).
- Define blood or body fluid exposure and the steps to take if exposed.
- Explain six or more principles of asepsis.
- Describe when surgical asepsis and sterile technique are used.
- Demonstrate the following skills: hand hygiene with soap and water, hand hygiene with alcohol based hand rubs (ABHR), preparing a sterile field, application of sterile gloves, and donning and doffing of PPE.

1.2 Infection Prevention and Control Practices

Infection prevention and control (IPAC) practices are evidence-based procedures and practices that can prevent and reduce disease transmission, and eliminate sources of potential infections (PIDAC, 2012). When used consistently, IPAC practices will prevent the transfer of **healthcare-associated infections (HAIs)** in all healthcare settings. HAIs, also known as **nosocomial infections**, are infections that occur in any healthcare setting as a result of contact with a pathogen that was not present at the time the person infected was admitted (World Health Organization, 2009a).

Two types of techniques are used to prevent infection in the hospital setting. The first, **medical asepsis** or **clean technique**, has been used in the past to describe measures for reducing and preventing the spread of organisms (Perry, Potter & Ostendorf, 2014). The second, **sterile technique**, also known as **sterile asepsis**, is a strict technique to eliminate all microorganisms from an area (Perry et al., 2014). When a patient is suspected of having or is confirmed to have certain pathogens or clinical presentations, **additional precautions** are implemented by the healthcare worker in addition to routine practices (PIDAC, 2012). These additional precautions are based on how an infection is transmitted, such as by contact, droplet, or air. Additional precautions use personal protective equipment (PPE), such as gowns, eyewear, face shields, and masks, along with environmental controls to prevent transmission of infection.

To reduce and prevent the spread of HAIs, a system of recommended IPAC **routine practices** are to be used consistently with all patients at all times in all healthcare settings (Public Health Agency of Canada, 2012b). The principles of routine practices are based on the premise that all patients are potentially infectious, even when asymptomatic, and IPAC routine practices should be used to prevent exposure to blood, body fluids, secretions, excretions, mucous membranes, non-intact skin, or soiled items (PIDAC, 2012).

To learn the steps for routine practices, see Checklist 1.

Checklist 1: Routine Practices

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Routine practices must be used by all healthcare professionals, at all times, with all patients/residents/clients in all healthcare settings. Routine practices will prevent transmission of microorganisms from patient to patient, patient to staff, staff to patient, and staff to staff.
- The presence of a pathogen does not predict the onset of an infection. The **chain of infection** must be present. If the chain of infection is broken, an infection will not occur. Routine practices are used to break or minimize the chain of infection.
- Be aware of factors that increase a patient's risk of becoming colonized or infected in the hospital. Increased acuity, advanced age, use of invasive procedures, immuno-compromised state of the patient, greater exposure to microorganisms, and an increased use of antimicrobial agents and complex treatments are common risk factors.
- Reduce patient susceptibility to infection by encouraging immunizations, providing adequate rest and nutrition, and protecting the body's defences from infection (cover open wounds, keep drainage systems closed and intact, maintain skin integrity).
- HAIs can cause symptoms ranging from asymptomatic colonization to septic shock and death, resulting in increased suffering for patients and increased healthcare costs for Canadians. Ensure additional precautions guidelines are followed for all suspected and confirmed cases of infections and communicable diseases.
- The most common sites for HAIs are the urinary and respiratory systems, and central line-associated bloodstream infections. Consider practices that will reduce infections related to these systems.
- The most common types of HAIs in Canada are ***methicillin-resistant Staphylococcus aureus* (MRSA)**, vancomycin-resistant *Enterococci* (VRE), and ***Clostridium difficile* (CDI)**. Ensure all healthcare providers and visitors follow the additional precautions policies.

Steps	*Additional Information*

1. Complete a risk assessment to determine your need for PPE (gown, clean gloves, mask, face shield, or eyewear). The Public Health Agency of Canada (PHAC) provides an algorithm for Point of Care risk assessment	Consider: Will your face, hands, skin, mucous membranes, or clothing be exposed to blood, excretions, or secretions by spray, coughing, or sneezing? Will you have contact with the patient's environment / surfaces? Is an infection or communicable disease suspected or confirmed?
2. Perform hand hygiene (hand washing) following hospital policy.	Hand hygiene is considered the most important and effective measure to prevent HAIs. HAIs are most commonly spread by the hands of healthcare workers, patients, and visitors. Healthcare workers, patients, and visitors spread about 80% of all HAIs. Always perform hand hygiene after using the washroom, coughing, or sneezing, and before and after eating. Using an alcohol-based hand rub (ABHR) is the recommended method for hand hygiene if hands are not visibly soiled.

3. Follow proper cleaning or disinfecting procedures of patients and the environment (room etiquette). These environmental controls will control the site or source of microorganism growth.	Dispose of soiled linens and dressings in appropriate receptacle bin. Avoid contact of soiled item with uniform. Clean contaminated objects and sterilize or disinfect equipment and patient rooms according to agency policy. Discard any item that touches the floor. Control sources of wound drainage and body fluids; change soiled dressings. Avoid shaking bed linen or clothes; dust with a damp cloth as required. Microorganisms can be expelled through the air and inhaled by patients and healthcare workers. Provide all persons with their own linen and personal items. Place syringes in designated puncture-proof containers. Keep table surfaces dry and clean. Empty and dispose of drainage containers as per agency policy.
4. Follow respiratory etiquette.	Wear a mask if coughing or sneezing. Wear a mask if suffering from a respiratory condition, and consider staying home. Avoid talking, sneezing, or coughing over open wounds and sterile dressings. Practise coughing or sneezing into your upper arm, not your hands. Follow hospital policies related to creating healthy workplaces. Do not come to work ill or with symptoms of a communicable disease (flu or cold) that puts co-workers or patients at risk.

5. Wear clean gloves for appropriate activities based on a risk assessment. Use clean gloves when handling all blood and body fluids.	Follow recommendations for assessing each situation and the need for clean gloves. Improper glove use has been linked to the transmission of microorganisms. Do not wear gloves for activities that do not pose a risk, such as feeding or taking blood pressure. Clean gloves are task specific and for single use only. Handle all blood, body fluids, and laboratory specimens as if infectious. Always perform hand hygiene after taking off clean gloves to reduce the potential of contamination from pathogens on gloves.
6. Use additional precautions guidelines for suspected or known infections or communicable diseases. Use PPEs based on mode of infection transmission (contact, droplet, or airborne).	Follow agency guidelines essential to prevent and reduce transmission of infections. Single rooms, **cohorting** (placing patients with the same infections in the same room if a private room is not available), restricting visitors, and implementing additional environmental controls may be required. Provide instruction and signage for appropriate use and disposal of PPE for visitors, patients, and all healthcare workers. Remove PPE immediately after single use and perform hand hygiene.
7. Do not eat or drink in the patient / client, or resident areas.	Eating and drinking increases the risk of transmission of infection between healthcare providers and patients.
8. Use avoidance procedures and actions to minimize the risk of infection transmission.	If a patient has uncontrolled diarrhea, wear a gown when changing linen to prevent contamination of clothing and hands. If a patient is coughing, sit next to, rather than in front of, the patient when talking to that patient.
Data sources: CDC, 2007, 2014; Perry et al., 2018; PIDAC, 2012; PHAC, 2012b, 2013; WHO, 2009a	

Critical Thinking Exercises

1. Name six elements in the chain of infection.
2. Identify two things that can be done at each of the points in the chain of infection to break the chain.
3. What types of patients are at an increased risk for an HAI?
4. How can healthcare providers reduce patient susceptibility to infection?

1.3 Hand Hygiene and Non-Sterile Gloves

Hand Hygiene

Hand hygiene is the most important part of practice for healthcare workers and is the single most effective way to stop the spread of infections; failure to properly perform hand hygiene is the leading cause of HAIs and the spread of multi-drug-resistant organisms (MDROs) (BC Centre for Disease Control, 2014; WHO, 2009a). **Hand hygiene** is a general term used to describe any action of hand cleaning and refers to the removal or destruction of soil, oil, or organic material, as well as the removal of microbial contamination acquired by contact with patients or the environment. Hand hygiene may be performed using an alcohol-based hand rub (ABHR) or soap and water. A surgical hand scrub is also a method of hand hygiene (WHO, 2009a).

To break the chain of infection, there are five key moments at which to perform hand hygiene when working in healthcare, as outlined in Checklist 2 and illustrated in Figure 1.1.

Checklist 2: Five Key Moments in Hand Hygiene

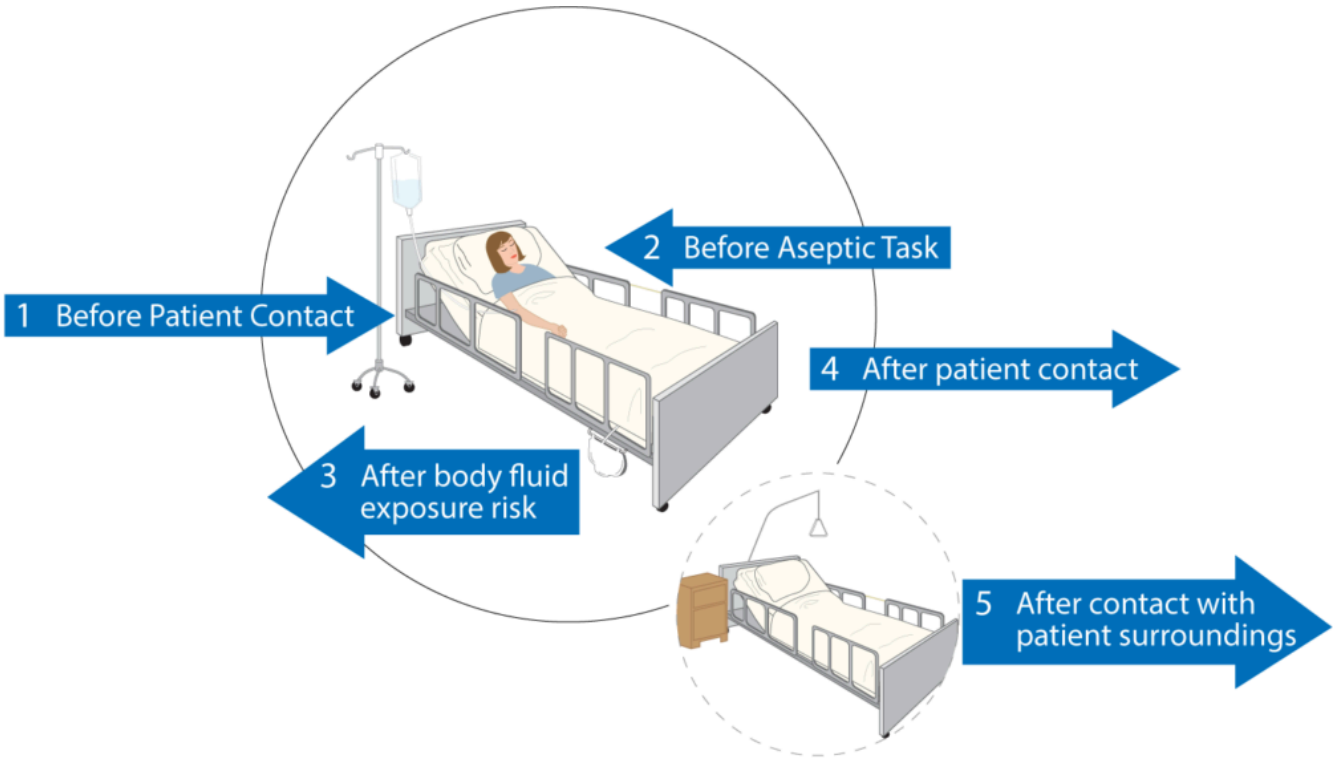
Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- If contact dermatitis occurs, use soap and water for hand hygiene.
- Instruct patients and family on the importance of hand hygiene, proper technique, and ways to incorporate routines into everyday practice.
- Certain practices can increase the risk of skin irritation and should be avoided. For example, washing hands regularly with soap and water immediately before or after using an alcohol-based product is not only unnecessary but may lead to dermatitis.
- Always wash hands whenever in doubt.

Key Moments	*Additional Information*
1. Before initial contact with a patient, client, resident, or the environment.	Before touching a patient (e.g., feeding, toileting, or personal care) Before touching the patient's environment Before adjusting an IV rate Before taking a pulse or blood pressure
2. Before any clean (routine) or aseptic (sterile) procedure	Before applying clean or sterile gloves Before performing a sterile dressing change Before feeding a patient Before performing oral or dental care Before inserting eye drops Before inserting Foley catheter Before preparing medication

3. After blood or body fluid risk or exposure	After contact with body secretions, mucous membranes, or non-intact skin After glove removal (clean or sterile gloves) After handling waste (urine, drainage, wound care) After wound care or a sterile procedure When moving from a contaminated area on the body to a non-contaminated area
4. After contact or touching the patient, client, or resident	After taking a blood pressure or pulse, touching a urinary catheter, or feeding or dressing a patient
5. After contact with the patient's, client's, resident's environment	After touching a bed table or bathroom light After touching personal toiletries After touching walkers or wheelchairs After touching electronic IV devices After taking blood pressure or pulse After changing bed linen
Data source: Kampf & Loffler, 2003; WHO, 2009a, 2009b	



1 Before Patient Contact	When?	Clean your hands before touching a patient when approaching him or her
	Why?	To protect the patient against harmful germs carried on your hands
2 Before An Aseptic Task	When?	Clean your hands immediately before any aseptic task
	Why?	To protect the patient against harmful germs, including the patient's own germs, entering his or her body
3 After Body Fluid Exposure Risk	When?	Clean your hands immediately after an exposure risk to body fluids (and after glove removal)
	Why?	To protect yourself and the health-care environment from harmful patient germs
4 After Patient Contact	When?	Clean your hands after touching a patient and his or her immediate surroundings when leaving
	Why?	To protect yourself and the health-care environment from harmful patient germs
5 After Contact With Patient Surroundings	When?	Clean your hands after touching any object or furniture in the patients immediate surroundings, when leaving - even without touching the patient
	Why?	To protect yourself and the health-care environment from harmful patient germs

Figure 1.1 Five moments in hand hygiene from the World Health Organization

Safety Alert: Factors that Reduce Hand Hygiene Effectiveness

- Jewellery: Rings and bracelets increase microbial count on hands. Rings also increase the risk of torn or pierced gloves. Jewellery should not be worn during patient care (Longtin, Sax, Allegranzi, Schneider, & Pittet, 2011). All jewellery must be removed. In an instance where a

bracelet may not be removed due to religious reasons, the bracelet may be pushed as high as possible above the wrist before performing hand hygiene.

- Skin integrity: The condition of the hands can influence the effectiveness of hand hygiene, and proper skin care is essential for infection control (Bissett, 2007). Skin cracks, dermatitis, or cuts can trap bacteria and may place patients at an increased risk (CDC, 2007). Inspect hands for cuts and open sores, and cuticles for tears. Open cuts, sores, or abrasions should be covered prior to starting work. Use barrier creams and lotion after patient care to keep skin healthy and hydrated.
- Artificial nails and nail extenders: Artificial nails and nail extenders increase the viral load of bacteria up to nine times compared with bacteria found on hands. Extenders or artificial nails are not recommended for healthcare workers (Kennedy, 2013).
- Nail length: Nails should be a maximum of 1/4-inch long and should not extend past the end of the finger (Patrick & Van Wicklin, 2012). Most microbes on hands come from under the fingernails. Subungual areas (under the fingernails) can harbour higher concentrations of microorganisms (Kennedy, 2013). In addition, long nails are harder to clean and may lead to more frequent puncture in gloves from the thumb and forefinger (Patrick & Van Wicklin, 2012).
- Nail polish: Nail polish should be freshly applied and be free from chips or cracks. Studies have shown that chipped nail polish and polish older than four days can harbour microorganisms (Patrick & Van Wicklin, 2012).
- Water temperature and products: Warm water removes less protective oils than hot water, whereas hot water increases the likelihood of skin damage (WHO, 2009a). To prevent contamination, products must be dispensed in a disposable pump container that is not topped up. An adequate amount of soap is required to dissolve fatty materials and oils from hands as water alone is not sufficient to clean soiled hands (WHO, 2009a).

How to Wash Hands: Types of Hand Hygiene

Two types of hand hygiene are commonly used in the healthcare setting: hand hygiene with an alcohol-based hand rub (see Figure 1.2) and **hand hygiene with soap and water**.

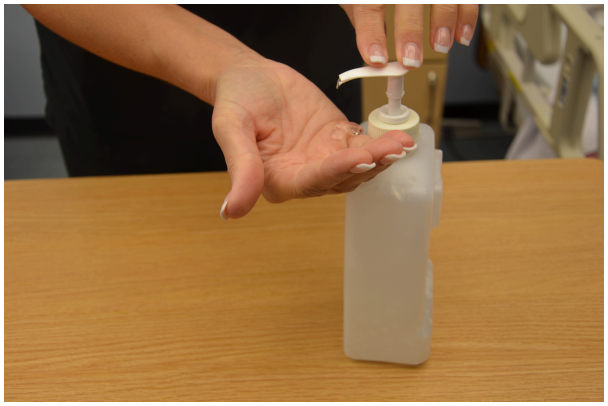


Figure 1.2 Alcohol-based hand rub

Alcohol-based hand rub (ABHR) is a product containing 60% to 90% alcohol concentration and is recommended for hand hygiene in healthcare settings (CDC, 2012). ABHR is the preferred method of hand hygiene and is more effective than washing hands with soap and water (WHO, 2009a). ABHRs:

- Kill the majority of germs (including viruses) from hands.
- Require less time to use than soap and water (20 to 30 seconds).
- Are easy to use and have high levels of availability at the point of care.
- Provide better skin tolerability.

See Checklist 3 for the steps to take when washing hands with ABHR.

Checklist 3: Hand Hygiene with ABHR

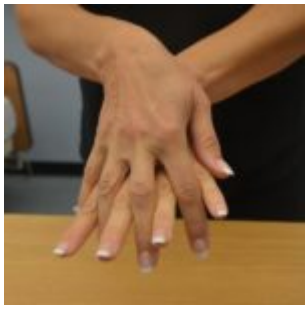
Disclaimer: Always review and follow your agency policy regarding this specific skill.

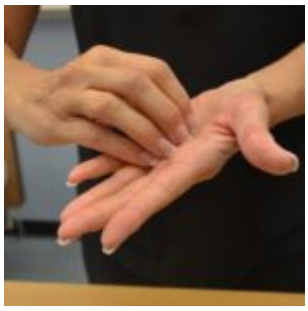
Safety considerations:

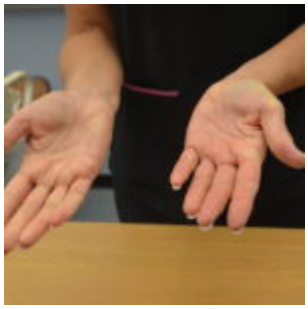
- Do not use in combination with soap and water. This practice may increase skin irritation.
- Use ABHR that contains emollients (oils) to help reduce skin irritation and overdrying.
- Allow hands to dry completely before initiating tasks or applying clean or sterile gloves.
- ABHR may be used for all five moments in hand hygiene (see Checklist 2) as long as hands are not contaminated or visibly soiled.
- DO NOT use ABHR if patient is suspected to have or confirmed with *Clostridium difficile*, norovirus, or *Bacillus anthracis*. ABHR will not kill spore-forming pathogens.

Steps	*Additional Information*

1. Remove all jewellery on hands. Apply 1 to 2 pumps of product into palm of dry hands.	 *Remove jewellery* Product should not be applied to wet hands, as this will dilute the product. Enough product should be applied to thoroughly wet hands and fingers (approx. 30 ml) for the entire procedure of 20 to 30 seconds.  *Apply ABHR onto hands* Always follow the manufacturer's guidelines.

2. Rub hands together, palm to palm.	Rubbing hands together ensures palm surfaces are covered by the product.  *Rub alcohol over entire surface of palms*
3. Rub the back of the hands.	Rubbing the back of the hands allows all surfaces of the fingers to be exposed to the product.  *Rub back of hands*
4. Rub the alcohol between all the fingers to cover all the fingers.	Rubbing between the fingers allows all surfaces of the hands to be exposed to the product.  *Rub between the fingers*

5. Press fingertips into the palm of opposing hand and rub back and forth.	Pressing fingertips into opposing palms and rubbing ensures fingertips and nails are exposed to the cleaning product. Nails harbour more bacteria than do hands.  *Clean with ABHR under the fingernails*
6. Rub each thumb in a circle in the palm of the opposite hand.	Rubbing each thumb provides complete coverage of the product on the thumb.  *Clean the surface of thumb*

7. Rub hands together until they are dry. Do not use a paper towel to dry hands.	Rubbing hands together provides adequate time for the alcohol to dry. The minimum time required for proper rubbing technique when using ABHR is 20 to 30 seconds.  *Rub hands until dry*
8. Hands are now safe to use.	 *Clean hands*
Data sources: CDC, 2012; PIDAC, 2012; PHAC, 2012b; WHO, 2009a, 2009b	

Hand Hygiene with Soap and Water

Hand hygiene with water requires soap to dissolve fatty materials and facilitate their subsequent flushing with water. Soap must be rubbed on all surfaces of both hands followed by thorough rinsing and drying. Water alone is not suitable for cleaning soiled hands (WHO, 2009a). The entire procedure should last 40 to 60 seconds and should use soap approved by the health agency. See the steps in Checklist 4.

Checklist 4: Hand Hygiene with Soap and Water

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

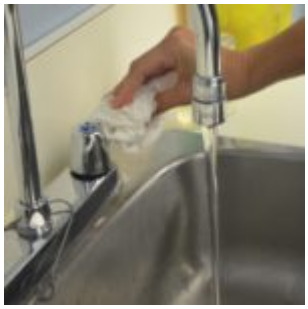
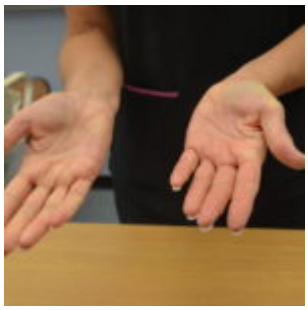
- Always wash hands with soap and water if hands are visibly dirty or soiled.
- When working with patients where *Clostridium difficile* (CDI), norovirus, or *Bacillus anthracis* is suspected or confirmed, soap and water must be used. CDI can remain dormant on surfaces for long periods of time.
- Always use soap and water if hands are exposed to blood or body fluids.
- Multi-step rubbing techniques using soap and water are required to promote coverage of all surfaces on hands. Friction and rubbing are required to remove oil and debris from hands.

Steps	*Additional Information*

1. Remove all jewellery. Wet hands with warm water.	 *Remove jewellery* A comfortable temperature of water should be used. Hot water may damage skin.  *Regulate water temperature*
2. Apply 1 to 2 pumps of soap.	Enough soap should be used to lather the palms, back of hands, fingers, and thumbs.  *Dispense soap*

3. Lather soap and rub palms together.	Ensure all surfaces of the palms are covered with soap, using friction to remove debris and oil.  *Lather hands with soap and water*
4. Rub in between fingers and around fingers.	Ensure all surfaces of the fingers are covered with soap, using friction to remove debris and oil.  *Rub hands to remove debris and oil*
5. Rub the back of each hand with the palm of the opposite hand.	Ensure all surfaces on the back of the hands are covered with soap, using friction to remove debris and oil.  *Rub the back of the hands*

6. Press and rub fingernails and fingertips into the palm of the opposite hand.	Ensure all surfaces around the fingertips are covered with soap, using friction to remove debris and oil.  *Clean tips of fingers and underneath nailbeds*
7. Rub each thumb in a circle with the palm of the opposite hand.	Ensure all surfaces around the thumbs are covered with soap, using friction to remove debris and oil.  *Clean around the thumb up to the wrist on both hands*
8. Rinse hands under water by keeping fingers pointing downward toward the drain.	Rinsing in this way allows the oil and debris to be washed off the hands and down the drain.  *Rinse soap and water off hands*

9. Pat hands dry using clean paper towel.	Use a gentle action to prevent skin irritation.  *Dry hands*
10. Using a clean paper towel, turn off faucet.	Using a paper towel prevents re-contamination of hands by touching dirty faucet handles.  *Turn off faucet with dry paper towel*
11. Hands are now safe to use.	 *Clean hands*
Data source: Accreditation Canada, 2013; CDC, 2014; PHAC, 2012a; WHO, 2009a	

Non-Sterile (Clean) Gloves

Both hand hygiene and clean glove use are strategies to prevent transmission of infections through hand contact. In the context of patient care, it makes sense to think of glove use and hand hygiene as complementary strategies to prevent transmission of pathogens. Gloves are critical to prevent the transmission of organisms when hand hygiene alone is not enough in an outbreak such as *Clostridium difficile* or the norovirus, or when a patient has a suspected or known pathogen. Studies have shown that gloves reduce transmission of microbes from the hands of healthcare workers (PIDAC, 2012).

Non-sterile gloves are single use and should be applied:

- Before an aseptic procedure
- When anticipating contact with blood or body fluid, non-intact skin, secretions, excretions, mucous membranes, or equipment or environmental surfaces contaminated with the above blood or body fluids
- When in contact with a patient or patient equipment or environment during additional precautions

Non-sterile gloves should be removed:

- If gloves are damaged and integrity is compromised
- When contact with blood, body fluid, non-intact skin, or mucous membranes has ended
- When contact with a single patient and that patient's surrounding or a contaminated body site on a patient has ended
- When there is an indication for hand hygiene

See Checklist 5 for steps on how to apply and remove non-sterile gloves.

Checklist 5: Applying and Removing Non-Sterile Gloves

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Hands must be clean and dry before putting on gloves. Gloves do not replace the need for hand hygiene.
- Hand hygiene must be performed every time gloves are removed. Gloves are not completely free of leaks or 100% tear-proof, and hands may become contaminated when gloves are removed.
- Gloves are for single patient use and must be removed after caring for one patient. Reuse of gloves has been associated with transmission of antibiotic-resistant organisms.
- Change or remove gloves if moving from a contaminated site to a non-contaminated site on the same person or if touching the environment.
- Wear gloves that fit properly. Different sizes are available.
- Gloves must be removed immediately and discarded in a waste bin after the activity for which they were used and before exiting a patient's environment.
- Gloves are not required for healthcare activities where contact is limited to intact skin, such as taking blood pressure.
- Indiscriminate or improper glove use (e.g., wearing gloves all the time) has been linked to transmission of pathogens.
- Gloves should fit snugly around wrists and hands for use with a gown to provide a better skin barrier.

How to Don (apply) Non-Sterile Gloves

Steps	*Additional Information*

1. Perform hand hygiene.	 *Hand hygiene with ABHR*
2. Select the appropriate size of non-sterile gloves. Remove gloves one at a time out of the box, touching only the top of the cuff.	 *Remove gloves from box*
3. Put hand through opening and pull up to the wrist.	 *Apply first glove*

4. Repeat procedure with the second hand.	 *Apply second glove*
5. Adjust gloves to cover wrists or gown as required.	Prevents the contamination of the wrists.
6. Complete care as required.	 *Non-sterile gloved hands*

How to Doff (remove) Gloves

Steps	*Additional Information*

1. Grasp glove on the outside about 1/2 inch below the cuff (edge of the glove opening). Do not touch the wrist with the other hand.	 *Grasp glove on the outside 1/2 inch below the cuff*
2. Pull down glove, turning it inside out. Hold the inside-out glove in the gloved hand.	 *Pull glove off ...*  *... inside out*

3. Gather the inside-out glove in the gloved hand.	 *Gather inside-out glove in remaining gloved hand*
4. Insert finger of the bare hand under the cuff of the gloved hand.	 *Insert finger under cuff of gloved hand*
5. Pull down the glove until it is inside out, drawing it over the first glove.	 *Remove second glove*

6. Discard gloves in a garbage container.	This step reduces the spread of microorganisms.  *Discard used non-sterile gloves*
7. Perform hand hygiene.	This step reduces the spread of microorganisms.  *Hand hygiene with ABHR*
Data sources: Braswell & Spruce, 2012; PIDAC, 2012; Poutanen et al., 2005; PHAC, 2012a; WHO, 2009a	

Latex Allergies and Non-Sterile (Clean) Glove Use

A **latex allergy** is a reaction to the proteins in natural rubber latex (American Academy of Allergy, Asthma and Immunology, 2014). When people come in contact with latex, an allergic reaction may occur. Most reactions are mild (asthma-like symptoms or contact dermatitis), but there are some rare severe cases (reactions). Many hospitals have moved away from using latex gloves, but latex is commonly used in many healthcare products such as IV tubing, urinary catheters, syringes, dressings, and bandages. People at risk for developing a latex allergy are:

- Healthcare workers and others who frequently wear latex gloves
- People who have had many surgeries (10+)

- People who are often exposed to natural rubber latex
- People with other allergies, such as hay fever (allergic rhinitis), or allergies to certain foods

Note that powdered latex gloves have also been associated with latex allergies. If an allergy to latex exists, the best treatment is to avoid latex and use a medical alert bracelet to inform others of the allergy (PIDAC, 2012).

Critical Thinking Exercises

1. Name four factors that decrease the effectiveness of hand hygiene.
2. What are two ways to reduce or prevent skin irritation with hand hygiene or non-sterile (clean) glove use?

1.4 Additional Precautions and Personal Protective Equipment (PPE)

Certain pathogens and communicable diseases are easily transmitted and require additional precautions to interrupt the spread of suspected or identified agents to healthcare providers, other patients, and visitors (PIDAC, 2012). Additional precautions are used in addition to routine precautions and are defined by how a microorganism is transmitted (Perry et al., 2014).

Point of Care Risk Assessment (PCRA) is the first step in routine practices. As such healthcare workers should be doing this with all patients for all care at all times. It involves assessing the infection risk posed to themselves and others by the patient, a procedure or a situation. Personal protective equipment (PPE) is chosen based on that risk (Vancouver Coastal Health, 2017).

Types of Additional Precautions

There are three categories of additional precautions: contact precautions, droplet precautions, and airborne precautions (CDC, 2007).

Contact precautions are are the most common type of additional precautions. They are used in addition to routine practice for patients who are known or suspected to be infected with microorganisms that can be transferred by direct (touching) or indirect (shared equipment) contact. Types of organisms in this category are **antibiotic-resistant organisms (AROs)** such as methicillin-resistant *Staphylococcus aureus* (MRSA), extended spectrum beta-lactamase (ESBL), *Clostridium difficile* (CDI), carbapenemase-producing organisms (CPO), diarrhea, and scabies. AROs are also known as multi-drug-resistant organisms (MDROs).

Droplet precautions are used in addition to routine practices for patients who are known or suspected to be infected with microorganisms that are spread through the air by large droplets. Types of organisms and unconfirmed conditions in this category include mumps, influenza, vomiting of unknown cause, norovirus, and unconfirmed cough.

Airborne precautions are used in addition to routine practices for patients who are known to have or are suspected of having an illness that is transmitted by small droplet nuclei that may stay suspended in the air and be inhaled by others. These particles can remain infectious for a long period of time when spread through the air. Types of organisms in this category

include tuberculosis (TB), measles, chicken pox (varicella), disseminated zoster, and severe acute respiratory syndrome (SARS).

Special considerations:

- Signage and accommodation: Signs must state the type of precaution required for the patient and be displayed on the door or at the foot of the bed. Accommodation in a private room, or cohorting patients with the same type of infection, is acceptable. Private bathrooms are preferred.
- Personal protective equipment (PPE): PPE is clothing or equipment worn to protect staff from catching or transmitting an infection. Depending on the type of additional precaution, PPEs are required when performing patient care tasks and may consist of a mask, gown, gloves, face shield, and/or eyewear.
- Consistent communication: Patients on additional precautions must be clearly identified on their patient chart or requisitions to ensure all hospital personnel, departments, or other healthcare settings know what additional precautions to use.
- Visitor information: Visitors must be informed of the precautions and must wear the appropriate PPEs and follow the routine practices for healthcare settings. Visitors also must wear the same PPEs as the healthcare provider if providing direct care for the patient.
- Multiple additional precautions: Some microorganisms may be transmitted by more than one mode and, therefore, more than one additional precaution is needed. For example, a patient with suspected or confirmed Ebola virus disease (EVD) would be on contact and droplet precautions.
- Aerosol procedures: Aerosol-generating medical procedures (such as tracheostomy care, CPR, nebulized therapy) may increase risk of transmitting infectious agents. Airborne precautions should be initiated during specific procedures when a patient is suspected of having or confirmed to have TB.
- Equipment is patient specific (i.e., BP cuffs, stethoscopes, BGMs) and not used on others unless thoroughly cleaned. Ideally all patient equipment stays in the room with that patient.

Tables 1.1, 1.2, and 1.3. summarize the three categories of additional precautions.

Table 1.1 Contact Precaution Guidelines				
PPE	*Private Room*	*Visitors*	*Patient Transport*	*Cleaning*
Gown, gloves	Private room preferred or cohort patients. Must have own dedicated equipment.	Gown and gloves must be worn if providing direct care. Must perform hand hygiene before and after care. Must not go into other patient rooms.	Patient: none required Staff: gown and gloves	Additional daily room cleaning may be required.
Data source: PIDAC, 2012; PHAC, 2013; Siegal, Rhinehart, Jackson, & HICPAC, 2007				

Table 1.2 Droplet Precautions				
PPE	*Private Room*	*Visitors*	*Patient Transport*	*Cleaning*
Gloves, gown, and a surgical mask if within two metres of the patient	Private room preferred or cohort. Must have own dedicated equipment.	Gown, gloves, surgical masks, and eye protection are worn for all activities within two metres of the patient. The patient must wear a surgical mask when leaving the room. The door may remain open. Strict adherence to hand hygiene must be observed. Gloves, gown, and surgical mask must be worn if providing direct care. Must perform hand hygiene before and after care. Visitors may not go into other patient rooms.	Patient: gown, surgical mask	Additional daily room cleaning may be required.
Data source: PIDAC, 2012; PHAC, 2013; Siegal et al., 2007				

Table 1.3 Airborne Precautions				
PPE	*Private Room*	*Visitors*	*Patient Transport*	*Cleaning*
Must wear N95 respirator prior to entering room. Strict adherence to hand hygiene. Must remove N95 respirator after exiting the room. No immune-compromised persons to enter room. Care providers should have current vaccines.	Yes. Must have a negative pressure room. Must have own dedicated equipment. Keep the door closed whether or not the patient is in the room. The room should have bathroom facilities. The room must be a single room, preferably one that is under negative pressure. When a negative pressure room is unavailable, refer to your health authority policy to determine whether a transfer to another facility is mandated.	Gloves, gown, and surgical mask required if providing direct care.Must perform hand hygiene before and after care. Must not go into other patient rooms.	Patient: must wear surgical mask Staff: N95 mask	Additional daily room cleaning may be required.
Data source: PIDAC, 2012; PHAC, 2013; Siegal et al., 2007				

Personal Protective Equipment (PPE)

Additional precautions require the use of **personal protective equipment (PPE)**, which is equipment or clothing worn by staff to prevent the transmission of infection from patient to

staff or to family member (PIDAC, 2012). All PPE must be applied and removed in a specific order to ensure the skin, nose, mouth, and eyes are covered to prevent transmission of infection to healthcare providers. Depending on the type of additional precaution or risk assessment, a gown, goggles, face shield, and mask (surgical or N95) may be used during patient care. Refer to Checklist 6 for steps to take when donning (putting on) PPE.

Checklist 6: Donning PPE

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- The selection of PPE is based on the nature of the interaction with the patient and the likelihood of transmission of infectious agents.
- PPE should be put on just prior to the interaction with the patient and should be removed immediately after the interaction, followed by hand hygiene.
- Donning of PPE is usually done outside the patient's room.
- Patients may feel depressed or lonely when isolated in a room or experiencing decreased contact with healthcare providers. Support for individuals on isolation must be provided. Conversely, some patients may appreciate the privacy of an individual room.

Steps	*Additional Information*
1. Remove rings, bracelets, and watches. Perform hand hygiene.	This prepares hands for direct patient care.  *Perform hand hygiene*

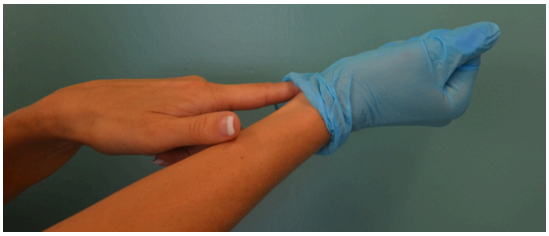
2. Apply waterproof long-sleeved gown. Tie the neck and waist strings.	Waterproof gown prevents any potential cross-contamination from blood or body fluids onto forearms and body.  *Apply waterproof gown*
3. Apply mask. Remember different masks are required for different situations. Ensure the fit is secure with no air leaks. Secure the metal band around the nose and pull mask over chin as required.	Wearing a poor-fitting mask is the number one reason for exposure to pathogens for healthcare providers. Masks should be worn if provider is within two metres of a coughing or sneezing patient or if there is a potential for spray of secretions or excretions.  *Surgical mask (left) and N95 mask (right)* Replace mask if it becomes wet or soiled.  *Apply mask*

4. Apply goggles or face shield.	Goggles or a face shield prevents accidental exposure to eyes, nose, and mouth. Goggles can be placed on top of eyeglasses. Prescription glasses are not an alternative to goggles as they do not protect the entire eye.  *Apply goggles*
5. Apply non-sterile gloves over top of the cuff of the gown.	Non-sterile gloves ensure complete coverage of skin on arms for direct patient care.  *Apply non-sterile gloves over top of sleeves*
Data source: Barratt, Shaban, & Moyle, 2011; PIDAC, 2012; PHAC, 2012b	

See Checklist 7 for steps on how to doff (or remove) PPE.

Checklist 7: Doffing PPE

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Steps	*Additional Information*
1. Remove gloves.	Grasp outer edge of glove by wrist and peel away from hand, rolling the glove inside out. Roll it into a ball in gloved hand. With the bare hand, reach under the second glove and gently peel down off the fingers.  *Place bare finger under glove to avoid contamination from glove* Drop glove into garbage bin. Always perform hand hygiene after removing gloves. Gloves are not tear- or leak-proof. Hands may have been contaminated upon removal of the gloves.

2. Perform hand hygiene.	Use soap and water if hands are visibly dirty.  *Perform hand hygiene*
3. Remove gown.	Remove gown in a manner that does not contaminate clothing. Starting at the neck ties, pull the outer (contaminated) part forward and, turned inward, roll into a ball. Discard in appropriate receptacle bin.  *Remove gown*

4. Perform hand hygiene.	Always perform hand hygiene after removing gown. Hands may have been contaminated upon removal of the gown.  *Perform hand hygiene*
5. Remove eye protection or face shield.	Arms of goggles and the headband on the face shield are considered clean. Handle these only by the sides. The front of the face shield or goggles is considered contaminated. Dispose them according to agency policy.  *Remove goggles* Ensure you are at least two meters from the patient when removing eyewear.

6. Remove mask or N95 respirator.	Ties, earlobe loops, or straps are considered clean and may be touched. If tied, remove bottom tie first, then top tie. Remove ear loops or straps by leaning forward to allow the mask to slip off your face. Masks are removed outside the patient room Dispose of the mask in the garbage bin.  *Remove mask*
7. Perform hand hygiene.	This step reduces the transmission of microorganisms.  *Perform hand hygiene*
Data source: Barratt et al., 2011; Perry et al., 2014; PHAC, 2012b; Siegal et al., 2007	

Watch the video *Donning and Doffing PPE* by Renée Anderson & Wendy McKenzie Thompson Rivers University

Please note the CDC offers another option for doffing PPE. See *How to Remove PPE Example 2 on page 3*
https://www.cdc.gov/hai/pdfs/ppe/ppe-sequence.pdf

Blood or Body Fluid (BBF) Exposure

A **blood and body fluid (BBF) exposure** is defined as an exposure to potentially infectious body fluids or blood through the following methods: a puncture wound by a sharp object or needle (percutaneous exposure), from a body fluid/blood splash onto your mucous membranes (permucosal exposure) or exposure through eczema, an open wound/skin or scratch (non-intact skin exposure) (BCCDC, 2015).

Post-exposure management is only required when (1) percutaneous, permucosal, or non-intact skin is exposed to a BBF; (2) the exposure is to blood or potentially infectious body tissue or fluid; (3) the source is considered potentially infectious (e.g., patient is part of a high-risk group, exposure occurred in a high-risk setting, or patient has a positive test); and (4) the exposed person is considered susceptible to HIV, hepatitis B, or hepatitis C. Checklist 8 explains what to do if exposed.

Checklist 8: BBF Exposure

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Evidence shows that antiretroviral therapy can reduce the transmission of HIV by 86%.
- The risks and benefits of the post-exposure immunoprophylaxis should be discussed and appropriate recommendations made by the physician to the exposed person.
- Despite the relatively low risk of infection from an exposure, the event is associated with stress and anxiety for the exposed person.
- Seek advice from a physician at a hospital, walk-in clinic, or community clinic within two hours of any BBF exposure.
- Not all body fluids are implicated in transmission of viruses. Search the CDC guidelines to understand which body fluids are implicated in transmitting HIV and hepatitis B and C.

Steps	*Additional Information*
1. Wash the exposed skin, mucous membrane, or eye.	Skin: Wash the area thoroughly with soap and water. Mucous membranes or eye: Rinse area with water or normal saline. Allow injury/wound site to bleed freely and then cover lightly. Do not promote bleeding of percutaneous injuries by cutting, scratching, or squeezing or puncturing the skin. This may damage the skin and increase uptake of any pathogens. Do not apply bleach or soak wound/injury in bleach.
2. Contact first aid for assistance and obtain proper forms. These forms are also available in emergency departments.	If unable to contact first aid, proceed to the emergency room.

3. Advise your supervisor or charge nurse of the incident. Ask them to complete the required form and return it to you. If available take the patient name & date of birth with you to the emergency department to allow for cross referencing and necessary follow up.	This step allows for follow-up by the manager, in relation to a BBF exposure.
4. A risk assessment should be completed within two hours. Go to the emergency room or urgent care centre and be assessed by a physician/NP. Inform the department personnel that an occupational BBF exposure has occurred. You will be assessed and blood work will be drawn.	Emergency rooms or other health agencies are supplied with antiretroviral kits from the BC Centre for Excellence in HIV/AIDS. Physicians will assess your risk of exposure and the risk of transmission from source.
5. Following treatment, return to your department and report the incident according to agency policy.	This ensures that the proper procedure is followed and the incident form is filled out to prevent or minimize further exposure.
Data source: BCCDC, 2015	

Critical Thinking Exercises

1. What is a point of care risk assessment?
2. What resources are available to the nurse when making decisions about implementing additional precautions?
3. A family member has come into the healthcare setting to visit his mother, who has been admitted with chicken pox. List four infection preventive measures to discuss with the family member.

1.5 Principles of Asepsis

Asepsis refers to the absence of infectious material or infection. **Surgical asepsis** is the absence of all microorganisms within any type of invasive procedure. **Sterile technique** is a set of specific practices and procedures performed to make equipment and areas free from all microorganisms and to maintain that sterility (Centre for Disease Control, 2007). In the literature, surgical asepsis and sterile technique are commonly used interchangeably, but they mean different things (Kennedy, 2013). Principles of sterile technique help control and prevent infection, prevent the transmission of all microorganisms in a given area, and include all techniques that are practised to maintain sterility.

Sterile technique is most commonly practised in operating rooms, labour and delivery rooms, and special procedures or diagnostic areas. It is also used when performing a sterile procedure at the bedside, such as inserting devices into sterile areas of the body or cavities (e.g., insertion of chest tube, central venous line, or indwelling urinary catheter). In healthcare, sterile technique is always used when the integrity of the skin is accessed, impaired, or broken (e.g., burns or surgical incisions). Sterile technique may include the use of sterile equipment, sterile gowns, and gloves (Perry et al., 2014).

Sterile technique is essential to help prevent **surgical site infections (SSI)**, an unintended and oftentimes preventable complication arising from surgery. It is simply post op infection that occurs at the surgical site (CDC, 2014). Preventing and reducing SSI are the most important reasons for using sterile technique during invasive procedures and surgeries.

Principles of Surgical Asepsis

All personnel involved in an aseptic procedure are required to follow the principles and practice set forth by the Association of periOperative Registered Nurses (AORN). These principles must be strictly applied when performing any aseptic procedures, when assisting with aseptic procedures, and when intervening when the principles of surgical asepsis are breached. It is the responsibility of all healthcare workers to speak up and protect all patients from infection.

Table 1.4: Principles of Asepsis

Safety considerations:

- Hand hygiene is a priority before any aseptic procedure.
- When performing a procedure, ensure the patient understands how to prevent contamination of equipment and knows to refrain from sudden movements or touching, laughing, sneezing, or talking over the sterile field.
- Choose appropriate PPE to decrease the transmission of microorganisms from patients to healthcare workers.
- Review hospital procedures and requirements for sterile technique prior to initiating any invasive procedure.
- Healthcare providers who are ill should avoid invasive procedures or, if they can't avoid them, should double mask.

Principle	*Additional Information*
1. All objects used in a sterile field must be sterile.	Commercially packaged sterile supplies are marked as sterile; other packaging will be identified as sterile according to agency policy. Check packages for sterility by assessing intactness, dryness, and expiry date prior to use. Any torn, previously opened, or wet packaging, or packaging that has been dropped on the floor, is considered non-sterile and may not be used in the sterile field.
2. A sterile object becomes non-sterile when touched by a non-sterile object.	Sterile objects must only be touched by sterile equipment or sterile gloves. Whenever the sterility of an object is questionable, consider it non-sterile. Fluid flows in the direction of gravity. Keep the tips of forceps down during a sterile procedure to prevent fluid travelling over entire forceps and potentially contaminating the sterile field.
3. Sterile items that are below the waist level, or items held below waist level, are considered to be non-sterile.	Keep all sterile equipment and sterile gloves above waist level. Table drapes are only sterile at waist level.

4. Sterile fields must always be kept in sight to be considered sterile.	Sterile fields must always be kept in sight throughout entire sterile procedure. Never turn your back on the sterile field, as sterility cannot be guaranteed.
5. When opening sterile equipment and adding supplies to a sterile field, take care to avoid contamination.	Set up sterile trays as close to the time of use as possible. Stay organized and complete procedures as soon as possible. Place large items on the sterile field using sterile gloves or sterile transfer forceps. Sterile objects can become non-sterile by prolonged exposure to airborne microorganisms.
6. Sterile objects can become non-sterile by prolonged exposure to airborne microorganisms.	Set up sterile field as close to the time of use as possible.
7. Any puncture, moisture, or tear that passes through a sterile barrier must be considered contaminated.	Keep sterile surface dry and replace if wet or torn.
8. Once a sterile field is set up, the border of one inch at the edge of the sterile drape is considered non-sterile.	Place all objects inside the sterile field and away from the one-inch border.
9. If there is any doubt about the sterility of an object, it is considered non-sterile.	Known sterility must be maintained throughout any procedure.
10. Fluid flows in the direction of gravity.	When cleaning a wound, clean the highest point first.
11. Sterile persons or sterile objects may only contact sterile areas; non-sterile persons or items contact only non-sterile areas. **** Skin cannot be sterilized. ****	The front of the sterile gown is sterile between the shoulders and the waist, and from the sleeves to two inches below the elbow. Non-sterile items should not cross over the sterile field. For example, a non-sterile person should not reach over a sterile field. When opening sterile equipment, follow best practice for adding supplies to a sterile field to avoid contamination. Do not place non-sterile items in the sterile field.

12. Movement around and in the sterile field must not compromise or contaminate the sterile field.	Do not sneeze, cough, laugh, or talk over the sterile field. Maintain a safe space or margin of safety between sterile and non-sterile objects and areas. Refrain from reaching over the sterile field. Keep operating room (OR) traffic to a minimum, and keep doors closed. Keep hair tied back. When pouring sterile solutions, only the lip and inner cap of the pouring container is considered sterile. The pouring container must not touch any part of the sterile field. Avoid splashes.
Data sources: Kennedy, 2013; Infection Control Today, 2000; ORNAC, 2011; Perry et al., 2014; Rothrock, 2014	

Watch the video *Principles of Asepsis* developed by Renée Anderson & Wendy McKenzie, Thompson Rivers University School of Nursing (2014).

Critical Thinking Exercises

1. When should a sterile field be opened (under normal circumstances)?
2. What part of the sterile field is considered non-sterile?

1.6 The Operating Room Environment

The operating room (OR) is a sterile, organized environment. As a healthcare provider, you may be required to enter the OR during a surgical procedure or to set up before a surgical procedure. It is important to understand how to enter an OR area and how the OR area functions to maintain an sterile environment.

Members of the surgical team work hard to coordinate their efforts to ensure the safety and care of their patients. The surgical team is in charge of the OR and makes decisions regarding patient care procedures. The OR environment has sterile and non-sterile areas, as well as sterile and non-sterile personnel. It is important to know who is sterile and who not, and which areas in the OR are sterile or non-sterile.

Sterile OR Personnel

- Surgeon
- Surgical assistant
- Scrub nurse

Non-Sterile OR Personnel

- Anesthesiologist
- Circulating nurse
- Technologist, student, or observer

There are specific requirements for all healthcare professionals entering the OR to minimize the spread of microorganisms and maintain sterility of the OR environment. Prior to entering the OR, show your hospital-issued ID and inform the person in charge of the purpose of your visit. Refer to Checklist 9 for the specific steps to take before entering an OR.

Checklist 9: Entering the OR

Disclaimer: Always review and follow your hospital policy regarding this specific skill.

Steps	*Additional Information*
1. Bring all required supplies to the OR. Sterilize or disinfect them as required.	This step prevents the need to unnecessarily leave the restricted area. Movement in the OR should be kept to a minimum to avoid contamination of sterile items or persons.
2. State the purpose of your visit to OR personnel and show your ID.	This step allows for clear communication with the healthcare team.
3. Artificial nails should not be worn, and nail polish should be fresh (not more than four days old) and not chipped.	Artificial nails, extenders, and chipped nail polish harbour more microorganisms than hands and can potentially contaminate the sterile area.
4. Remove all jewellery. Wedding bands may be permitted under agency policy.	Jewellery harbours additional microorganisms and must be removed prior to a surgical hand scrub.
5. Don surgical attire (top and bottom). Surgical attire must be worn only in the surgical area. Tuck top into pants.	Surgical attire must be worn only in the surgical area to avoid contamination outside the surgical area.
6. Cover shoes according to agency policy.	Shoe covers will protect work shoes from accidental blood or body fluid spills in the OR. Shoe covers must not be worn outside the OR area.
7. Perform a surgical hand scrub according to agency policy.	Surgical hand scrubs reduce the bacterial count on hands prior to applying sterile gloves. Hands are kept above waist at all times.

	Mask must cover nose, mouth, and chin for a proper seal. Mask should be changed if it becomes wet or soiled. A surgical mask or N95 mask may be required, depending on whether the patient is on additional precautions. Knowing what areas are sterile or non-sterile will prevent accidental contamination of sterile fields and delays in surgery.
8. Prior to entering the restricted or semi-restricted area: 1. Apply mask. 2. Apply head covering to cover earrings, beard, and sideburns. 3. Once in the OR, introduce yourself to the surgical staff and inquire about the sterile area and non-sterile areas.	**Sterile Persons/Area** The sterile field should be created as close as possible to the time of use. Covering sterile fields is not recommended. Sterile areas should be continuously kept in view. An unguarded sterile field is considered contaminated. Sterile persons should keep well within the sterile area. Sterile persons should pass each other back to back or front to front. A sterile person should face a sterile area to pass it and stay within the sterile field. **Non-Sterile Persons/Area** A non-sterile person should stay at least one foot away from the sterile field, and face the sterile field when passing it. A non-sterile person should not walk between two sterile fields or reach over the sterile field.
Data sources: Bartlett et al., 2002; Kennedy, 2013; ORNAC, 2011; Perry et al., 2014; Rothrock, 2014	

Critical Thinking Exercises

1. Why should the sterile field always be kept in sight by the scrub nurse or circulating nurse?
2. Name three healthcare providers who are considered sterile in the OR area.

1.7 Surgical Hand Scrub, Applying Sterile Gloves and Preparing a Sterile Field

Sterile procedures are required before and during specific patient care activities to maintain an area free from microorganisms and to prevent infection. Performing a surgical hand scrub, applying sterile gloves, and preparing a sterile field are ways to prevent and minimize infection during surgeries or invasive procedures.

Surgical Hand Scrub

Skin is a major source of microorganisms and a major source of contamination in the OR setting (CDC, 2010). Since skin cannot be sterilized, members of the surgical team must wear sterile gloves. The purpose of the surgical hand scrub is to significantly reduce the number of skin bacteria found on the hands and arms of the OR staff (Kennedy, 2013). A **surgical hand scrub** is an antiseptic surgical scrub or antiseptic hand rub that is performed prior to donning surgical attire (Perry et al., 2014) and lasts two to five minutes, depending on the product used and hospital policy. Studies have shown that skin bacteria rapidly multiply under surgical gloves if hands are not washed with an antimicrobial soap, whereas a surgical hand scrub will inhibit growth of bacteria under gloved hands (Kennedy, 2013).

Types of Surgical Hand Scrubs

Surgical hand scrub techniques and supplies to clean hands will vary among healthcare agencies. Most protocols require a microbial soap-and-water, three- to five-minute hand scrub procedure. Some agencies may use an approved waterless hand scrub product. See Checklist 10 for the steps to follow when scrubbing with medicated soap.

Checklist 10: Surgical Hand Scrub with Medicated Soap

Disclaimer: Always review and follow your hospital policy regarding this specific skill.

Safety considerations:

- All personnel entering the operating room (OR) for a specific sterile procedure must perform a surgical hand scrub.
- Hands must be free from rings, watches, and bracelets. Nails should be free from any nail enhancements, artificial extenders, acrylics, wraps, and tips. Nail polish must be free from chips or cracks. Research shows that the amount of bacteria is nine times higher on rings and on the skin beneath the fingernails.
- All skin on the forearm and hands (including cuticles) should be free from open lesions and breaks in skin integrity. Any allergies to the cleansing products should be reported to the manager.
- If hands touch anything during cleaning, the entire procedure must be started from the beginning.

Steps	*Additional Information*
1. Remove all jewellery.	Jewellery harbours microorganisms.  *Remove jewellery*
2. No artificial nails, extenders, or chipped nail polish should be worn in the OR.	Artificial nails, extenders, and chipped nail polish can harbour microorganisms.
3. Inspect hands for sores or abrasions; cover or report to supervisor as required.	Open sores can harbour microorganisms.
4. Ensure sleeves are at least two to three inches above the elbows.	This step prevents sleeves from becoming moist.

5. Clean hands with ABHR, or soap and water to remove visible debris.	Hand hygiene is recommended by the Association of periOperative Registered Nurses (AORN).  *Hand hygiene with ABHR*
6. Turn on water.	Regulate the temperature of the water. Warm water is recommended to prevent drying out of hands.  *Wet hands*
7. Apply the required amount of microbial soap to hands.	A good amount of soap is required to create lather for a three- to five-minute scrub.
8. Keeping hands above elbows, start timing; scrub each side of each finger, between fingers, under each nail with a nail file, and the back and front of hands for the recommended time, according to agency policy.	Nail files work more effectively than a nail brush. Clean the subungal area (under the fingernails) with a nail file. Nail brushes are not recommended as they may damage the skin around the nail.
9. Scrub the arms, using an up-and-down motion, keeping hands above the elbows at all times. Wash each side of the arm from wrist to elbow for one minute.	Keeping hands above the wrist allows for the microorganisms to slide off the hands into the sink.
10. Repeat the entire process with the other hand and forearm.	Use an equal amount of time to wash each hand.
11. With hands raised, rinse hands and arms by passing them through running water, letting the water drip down from the fingertips to the elbow.	This step allows for all the soap to be rinsed off from cleanest to dirtiest area.
12. Proceed into the operating room (keep hands above the waist), and dry arms using a sterile towel, starting at the fingertips and working down toward the forearms using a dabbing motion.	This step prevents contamination of the hands and adheres to the principles of sterile technique.

Data sources: Bartlett, Pollard, Bowker, & Bannister, 2002; Kennedy, 2013; WHO, 2009a

Applying Sterile Gloves

Sterile gloves are gloves that are free from all microorganisms. They are required for any invasive procedure and when contact with any sterile site, tissue, or body cavity is expected (PIDAC, 2012). Sterile gloves help prevent surgical site infections and reduce the risk of exposure to blood and body fluid pathogens for the healthcare worker. Studies have shown that 18% to 35% of all sterile gloves have tiny holes after surgery, and up to 80% of the tiny puncture sites go unnoticed by the surgeon (Kennedy, 2013). Double gloving is known to reduce the risk of exposure and has become common practice, but does not reduce the risk of cross-contamination after surgery (Kennedy, 2013).

To apply sterile gloves, follow the steps in Checklist 11.

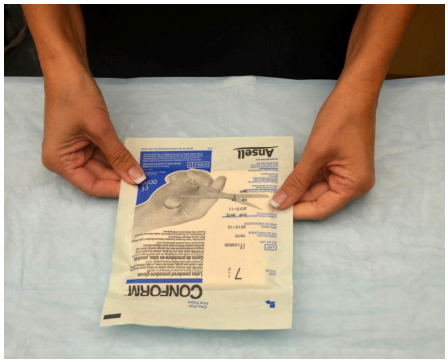
Checklist 11: Donning & Doffing Sterile Gloves

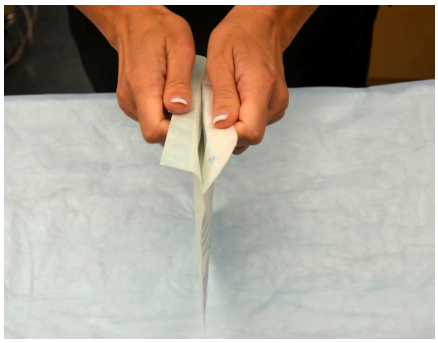
Disclaimer: Always review and follow your agency policy regarding this specific skill.

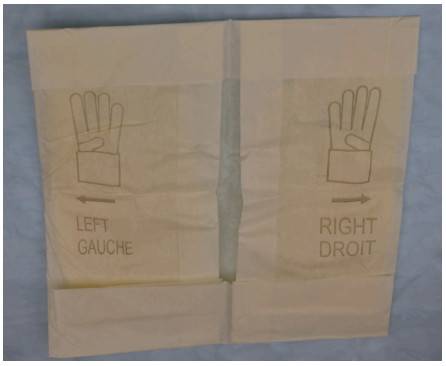
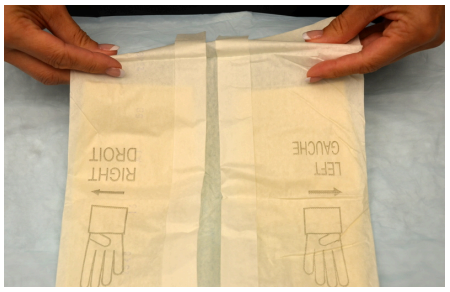
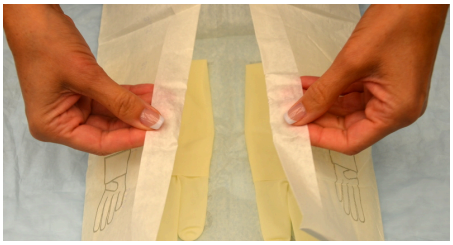
Safety considerations:

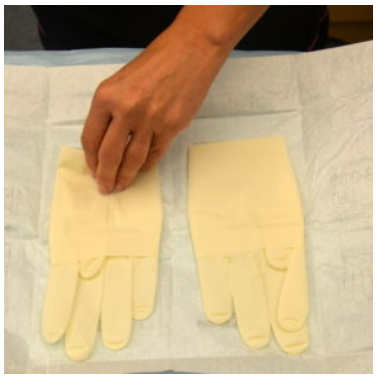
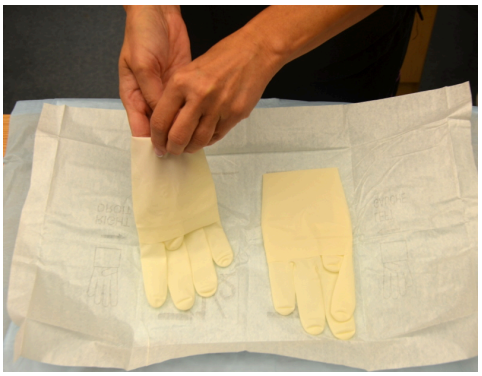
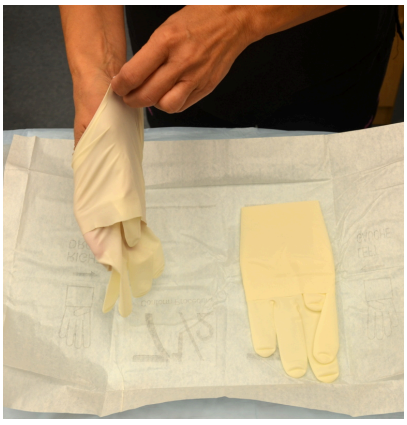
- Choose the right size of gloves. Gloves come in multiple sizes. Make sure the gloves are tight enough so that objects are easy to pick up.
- Sterile gloving does not replace hand washing. Hands must be washed before and after any procedure.
- Gather all supplies and prepare your patient for the procedure prior to applying gloves.
- Ensure the patient does not have a latex allergy prior to applying sterile gloves.
- Sanitize the surface you are working on with antiseptic wipes (or as per agency guidelines).
- Rings, jewelry, artificial nails, long nails, chipped polish all harbor microorganisms and increase risk to the patient.

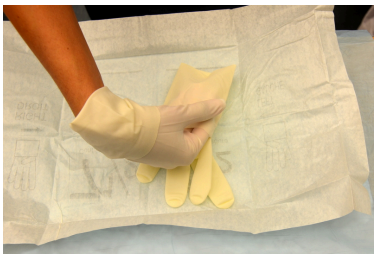
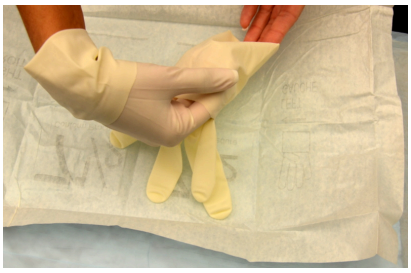
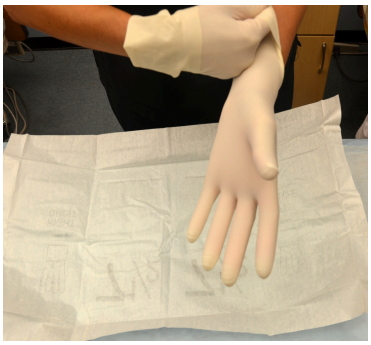
Steps	*Additional Information*
1. Remove all jewelry.	Jewelry harbors more microorganisms than do hands.  *Remove jewelry*
2. No artificial nails, extenders, or chipped nail polish should be worn.	Artificial nails, extenders, and chipped nail polish can harbor additional microorganisms.
3. Inspect hands for sores and abrasions. Cover or report to supervisor as required.	Open sores can harbor microorganisms.

4. Ensure sleeves are at least two to three inches above the elbows.	This step prevents sleeves from becoming moist, and prevents the transfer of microorganisms from the sleeves.
5. Clean hands with ABHR, or soap and water.	This step decreases the bacterial count on hands and prevents contamination of sterile equipment.  *Hand hygiene with ABHR*
6. Clean surface to open sterile field and raise its height to waist level.	All sterile items must be kept above waist level.
7. Inspect packaging for sterility.	All sterile items must be checked for sterility prior to use. Always examine sterile glove packaging for expiry date, intactness, and tears. The package should be dry. Sterile gloves have outer packaging that must be removed prior to starting the procedure of applying sterile gloves.  *Inspect outer packaging*

8. Open sterile packaging by peeling open the top seam and pulling down.	Open sterile packaging.  *Open sterile glove packaging*

9. Place inner package on clean working surface and open up to see right and left gloves. Start with dominant hand first. Open packaging.	This step prepares sterile surface to perform sterile application of gloves.  *Place inner packaging on clean surface*  *Start with dominant hand*  *Open packaging*

10. Pick up glove for dominant hand by touching the inside cuff of the glove. Do not touch the outside of the glove. Pull glove completely over dominant hand.	This step allows ease of application.  *Grasp the glove of the dominant hand*  *Insert hand into opening*  *Pull glove on up to wrist*

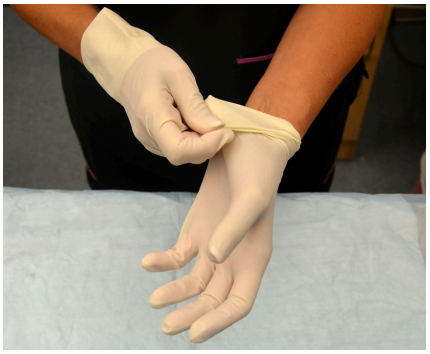
11. Insert gloved hand into the cuff of the remaining glove. Pull remaining glove on non-dominant hand and insert fingers. Adjust gloves if necessary.	This ensures proper fit of gloves.  *Place gloved hand under the cuff*  *Insert fingers*  *Pull glove up to wrist*

12. Once gloves are on, interlock gloved hands and keep at least six inches away from clothing, keeping hands above waist level and below the shoulders.	This step prevents the accidental touching of non-sterile objects or the front of the gown.  *Keep hands above waist level and away from clothing*

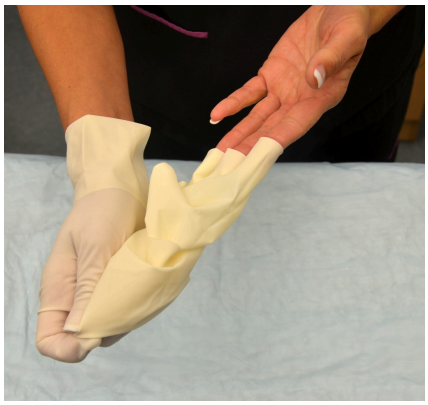
13. **DOFFING** sterile gloves.

To remove gloves, grasp the outside of the cuff or palm of glove and gently pull the glove off, turning it inside out and placing it into gloved hand.

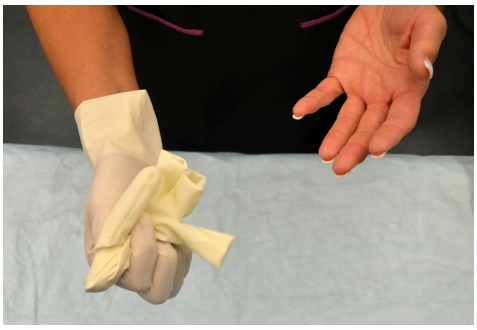
Doing this, prevents the contamination of the hand when removing glove.



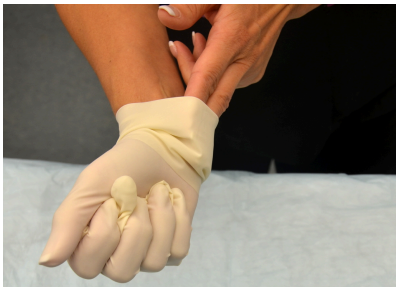
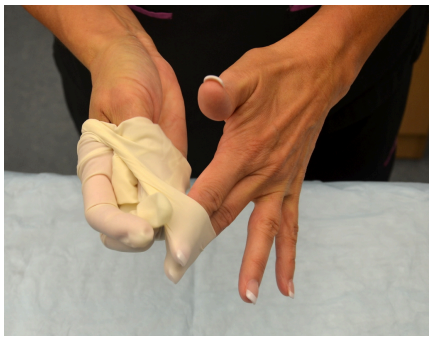
Grasp the outside of the glove 1/2 inch below the cuff



Turn glove inside out



Place inside-out glove in gloved hand

14. Take ungloved hand, place fingers inside the other glove, and pull glove off inside out.	This step prevents the contamination of gloved hand touching ungloved hand.  *Insert finger under the cuff*  *Remove second glove inside out*
15. Perform hand hygiene.	This removes powder from the gloves, which can irritate the skin; it also prevents contamination from potential pinholes in the gloves.  *Hand hygiene with ABHR*
Data sources: Berman & Snyder, 2016; Kennedy, 2013; Perry et al., 2014; Rothrock, 2014	

Watch the video *Applying Sterile Gloves* by Renée Anderson & Wendy McKenzie Thompson Rivers University

Preparing a Sterile Field

Aseptic procedures require a sterile area in which to work with sterile objects. A **sterile field** is a sterile surface on which to place sterile equipment that is considered free from microorganisms (Perry et al., 2014). A sterile field is required for all invasive procedures to prevent the transfer of microorganisms and reduce the potential for surgical site infections. Sterile fields can be created in the OR using drapes, or at the bedside using a prepackaged set of supplies for a sterile procedure or wound care. Many sterile kits contain a waterproof inner drape that can be set up as part of the sterile field. Sterile items can be linen wrapped or paper wrapped, depending on whether they are single- or multi-use. Always check hospital policy and doctor orders if a sterile field is required for a procedure. See Checklist 12 for the steps for preparing a sterile field.

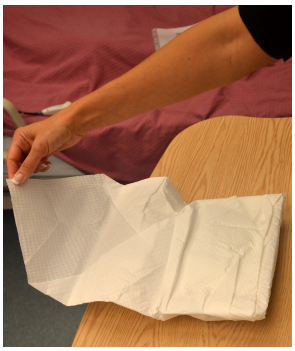
Checklist 12: Preparing a Sterile Field

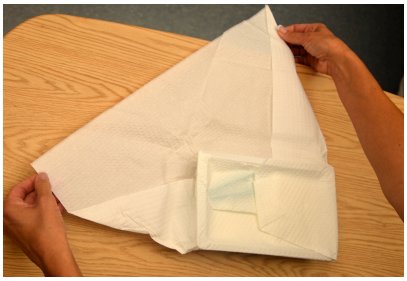
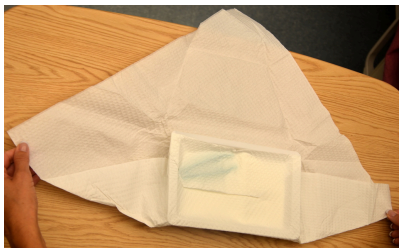
Disclaimer: Always review and follow your agency policy regarding this specific skill.

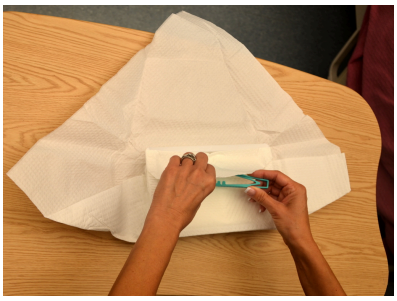
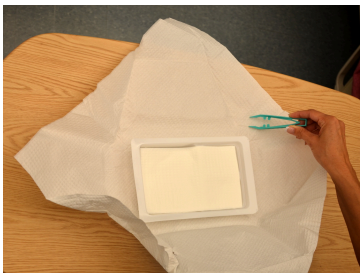
Safety considerations:

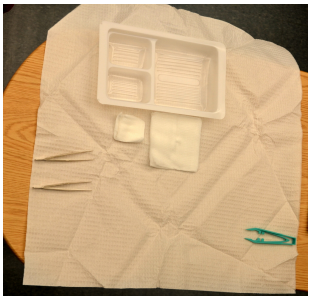
- Check physician orders and hospital policy regarding procedure.
- Instruct patient how to assist throughout the procedure (e.g., lying still, not talking over the sterile field, or not touching sterile objects).
- If required, check dressing on wound to assess for required supplies needed for the procedure.
- Offer analgesic and/or bathroom to ensure patient comfort throughout the procedure.
- Explain procedure to the patient and give an approximate time frame for completing the procedure.
- Clean the surface you are working on with antiseptic solution.

Steps	*Additional Information*
1. Perform hand hygiene, gather supplies, check equipment for sterility, and gather additional supplies (gauze, sterile cleaning solution, sterile gloves, etc.).	Gathering additional supplies at the same time will help avoid leaving the sterile field unattended. Prepackaged sterile kits may not have all the supplies required for each procedure.  *Hand hygiene with ABHR*

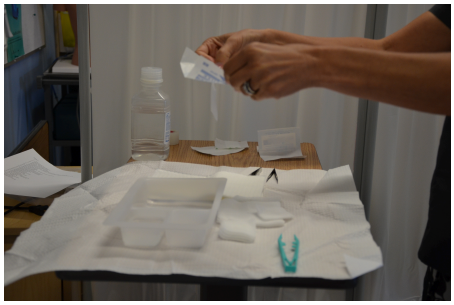
2. Place package on clean, dry, waist-level table.	A clean, dry surface is required to set up a sterile field. Items below waist level are considered contaminated. Prepare sterile field as close to the time of procedure as possible.  *Place package on waist-high, dry, clean surface*
3. Remove the outside sterile packaging and discard.	This allows more space to set up a sterile field.
4. Grab the outer surface's outermost tip (corner of folded drape) and open the flap away from you.	The one-inch border on the sterile field is considered non-sterile. Make sure your arm is not over the sterile field. The inside of the sterile packaging is your sterile drape. Stand away from your sterile field when opening sterile packaging.  *Open first flap*

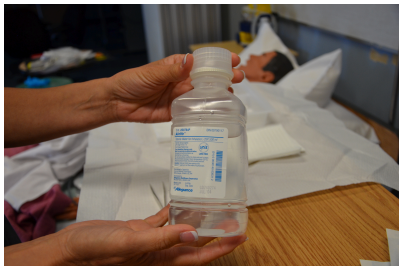
5. Grab the side flaps and open outwards, and let it lie flat on the table.	Touch only the one-inch border on the sterile field. Do not reach over the sterile field.  *Second flap*  *Third flap*

6. Grasping the outermost corner, pull the last flap toward you and lay it flat on the table.	This step creates an open sterile field.  *Remove forceps prior to opening last flap*  *Open last flap towards you using your hand*

7. Using sterile forceps, rearrange sterile equipment on the sterile field in order of usage.	This step saves time for completing sterile procedure; it also limits the amount of time the sterile field is exposed to air.  *Arrange sterile items on field*  *Sterile field*

Adding Sterile Items to a Sterile Field

8. Supplies can be opened (following packaging directions), then gently dropped onto the sterile field.	Gently drop items onto the sterile field or use sterile forceps to place sterile items onto the field. If using equipment wrapped in linen, ensure sterility by checking the tape for date and to view chemical indicator (stripes on the tape ensure sterility has been achieved). When using paper-wrapped items, they should be dry and free from tears. Confirm expiry date. Do not flip or toss objects onto the sterile field.  *Add sterile items to sterile field*  *Add sterile supplies*

9. Add solution to the sterile tray by pouring the solution carefully into the receptacle: • Verify solution and expiry date. • Open cap and place face-up on non-sterile surface. • Hold bottle two inches above receptacle and pour the required amount slowly and without splashing. • If bottle is multi-use, recap and label it with the date and time of opening. Most sterile solutions are good for 24 hours.	Do not touch the edge of the solution receptacle. Place the receptacle near the edge of the sterile field.  *Sterile solution*  *Add sterile solution to the sterile field* This ensures the sterility of the solution and the use of the correct solution. It also ensures the bottle of solution does not come in contact with the sterile field. Lastly, it verifies the type of solution required for the procedure. Be careful not to drip solution onto the sterile field, causing contamination. (When liquid permeates a sterile field it is called strike through.)
Data sources: Berman & Snyder, 2016; Kennedy, 2013; Perry et al., 2014; Rothrock, 2014	

Read *Surgical Aseptic Technique and Sterile Field* by Alberta Health Services (2013) for information about surgical asepsis and setting up a sterile field at the bedside.

For information on setting up a sterile field, watch the *Simple Sterile Dressing Change* video developed by

TRU School of Nursing (2014).

Critical Thinking Exercises

1. When preparing a sterile field, is the first flap opened toward or away from the healthcare provider?
2. Name two reasons for performing hand hygiene before and after applying sterile gloves.

1.8 Summary

Infection control and prevention practices are a critical component of patient safety in the healthcare environment. In order to protect the public and cut healthcare costs, all healthcare professionals must take part in preventing infections before they occur. The use of routine practices, effective hand hygiene techniques, additional precautions, and sterile procedures contribute to enhancing patient safety and eliminating significant healthcare risks such as healthcare-associated infections. If effectively applied, infection control and prevention practices will prevent and minimize transmission of infections in healthcare settings.

Key Takeaways

- Hand hygiene is the single most important part of infection prevention and control practices in the healthcare setting.
- Plan your care: Each healthcare worker is responsible to perform a risk assessment before every contact with a patient and/or patient's environment to ensure the proper control measures are in place to prevent transmission of infections.
- The most common sites for HAIs are the urinary tract and the respiratory tract. It is vital to implement preventive measures at all times during patient care or during procedures related to these areas.
- Be aware of potential risk factors of patients that make them more susceptible to infections. Susceptible patients include very young children; patients who are elderly, nutritionally deficient, or chronically ill; patients undergoing medical treatments such as chemotherapy or taking medications such as high doses of steroids; and individuals who are already ill or have open wounds (Perry et al., 2014).
- Be aware how the chain of infection works and implement ways to break the chain of infection in practice.
- Practice strict adherence to the principles of asepsis to prevent and minimize infections during sterile and invasive procedures.

Suggested Online Resources

1. BC Centre for Disease Control: Blood and body fluid exposure management. This resource outlines risk assessment and guidelines for potential exposures of percutaneous, permucosal, and non-intact skin to HIV, hepatitis B, and hepatitis C.
2. British Columbia: Home and community care – Policy manual. This manual offers guidelines for working in the community and residential care.
3. Centers for Disease Control and Prevention: Antibiotic/antimicrobial resistance. This

resource covers common viruses/bacteria found in the healthcare setting, such as:

- *Clostridium difficile* infection (CDI)
- Carbapenemase-producing organisms (CPO)
- Multi-drug-resistant organisms (MDRO) or antibiotic-resistant organisms (ARO): MRSA/VRE
- Severe acute respiratory syndrome (SARS)
- Middle East respiratory syndrome (MERS)
- Ebola virus disease (EVD)

4. Centers for Disease Control and Prevention: Guidelines for disinfection and sterilization in healthcare facilities. The goal of this document is to reduce the rates of healthcare associated infections. Each recommendation listed is categorized according to scientific evidence, theoretical rationale, and applicability.
5. Infection and Prevention Control Canada. (IPAC): Evidence-based guidelines. This website offers the latest reports, guidelines, standards, and policies related to infection control issues. US and international resources are also provided. These documents may be used to support your own documentation practice and best practices.
6. Ontario Agency for Health Protection and Promotion: Routine practices and additional precautions. This excellent resource provides routine practice and additional precautions in all healthcare settings. These were developed by the Ontario Provincial Infectious Disease Advisory Committee (PIDAC) on Infection Prevention and Control (IPC).
7. Provincial Infection Control Network of British Columbia (PICNet): BC infection control and hand hygiene module. This course teaches the basic principles of infection control in the healthcare system, sharps management, hand hygiene, blood and body fluid exposure and cleanup, the proper use of personal protective equipment, and isolation precautions.
8. Provincial Infection Control Network of British Columbia (PICNet): Infection control guidelines.Providing health care to the client living in the community.
   This document is intended to provide guidance in the writing of policies pertaining to infection prevention and control within community health care, and home care programs and settings.
9. World Health Organization: Clean care is safer care. This website provides links to the five moments in hand hygiene, diagrams on hand washing and hand rubs, and leaflets for teaching.

References

Accreditation Canada. (2013). Infection prevention and control. *Mentum Quarterly*, 5(4). Retrieved from http://www.accreditation.ca/sites/default/files/qq-spring-2013.pdf.

American Academy of Allergy, Asthma and Immunology. (2015). *Latex allergies: Tips to remember*. Retrieved from http://www.aaaai.org/conditions-and-treatments/Library/At-a-Glance/Latex-Allergy.aspx.

Barratt, R. L., Shaban, R., & Moyle, W. (2011). Patient experience from source isolation: Lessons from clinical practice. *Contemporary Nurse*, 39(2), 180-193. doi: 10.5172/conu.2011.180.

Bartlett, G. E., Pollard, T. C., Bowker, K. E., & Bannister, G. C. (2002). Effect of jewellery on surface bacterial counts of operating theatres. *The Journal of Hospital Infection*, 52(1), 68-70.

BC Centre for Disease Control (BCCDC). (2014). *Hand hygiene*. Retrieved from http://www.bccdc.ca/prevention/HandHygiene/default.htm.

BC Centre for Disease Control (BCCDC). (2015). *Communicable disease control. Blood and body fluid exposure management*. Retrieved from http://www.bccdc.ca/NR/rdonlyres/E6AF842F-A899-477F-BC90-5BFF6A4280F6/0/CPS_CDManual_BBFExpMangt_20150715.pdf.

Berman, A., & Snyder S. J. (2016). *Skills in clinical nursing* (8th ed.). Upper Saddle River, NJ: Pearson.

Bissett, L. (2007). Skin care: An essential component of hand hygiene and infection control. *British Journal of Nursing*, 16(16), 976-981.

Braswell, M. L., & Spruce, L. (2012). Implementing AORN recommended practices for surgical attire. *AORN Journal*, 95(1), 122-140. doi: 10.1016/j.aorn.2011.10.017.

Centers for Disease Control and Prevention (CDC). (2007). *Part III: Precautions to prevent the transmission of infectious agents*. Retrieved from http://www.cdc.gov/hicpac/2007IP/2007ip_part3.html.

Centers for Disease Control (CDC). (2012). *Frequently asked questions about Clostridium difficile for healthcare providers*. Retrieved from http://www.cdc.gov/HAI/organisms/cdiff/Cdiff_faqs_HCP.html.

Centers for Disease Control (CDC). (2014). *Types of healthcare-associated infections*. Retrieved from http://www.cdc.gov/HAI/infectionTypes.html.

Infection Control Today. (2000). *Asepsis and aseptic practices in the operating room*. Retrieved from

http://www.infectioncontroltoday.com/articles/2000/07/asepsis-and-aseptic-practices-in-the-operating-ro.aspx.

Kampf, G., & Loffler, H. (2003). Dermatological aspects of a successful introduction and continuation of alcohol based hand rubs for hygienic hand disinfection. *The Journal of Hospital Infection*, 55(1), 1-7.

Kennedy, L. (2013). Implementing AORN recommended practices for sterile technique. AORN *Journal*, 98(1), 14-26.

Longtin, Y., Sax, H., Allegranzi, B., Schneider, F., & Pittet, D. (2011). Hand hygiene. *New England Journal of Medicine*, 34(13) 24-28. Retrieved from http://www.nejm.org/doi/pdf/10.1056/NEJMvcm0903599.

Operating Room Nurses Association of Canada (ORNAC). (2011). *Standards, guidelines and position statements for perioperative registered nursing practice*. Retrieved from http://flex5114.weebly.com/uploads/1/4/5/1/14518934/ornac_standards.pdf.

Patrick, M., & Van Wicklin, S. A. (2012). Implementing AORN recommended practices for hand hygiene. AORN *Journal*, 9(4), 492-507. doi: 10.1016/j.aorn.2012.01.019.

Perry, A. G., Potter, P. A., & Ostendorf, W. R. (2014). *Clinical skills and nursing techniques* (8th ed.). St. Louis, MO: Elsevier-Mosby.

Provincial Infectious Diseases Advisory Committee (PIDAC). (2012). *Routine practices and additional precautions in all health care settings* (3rd ed.). Retrieved from http://www.publichealthontario.ca/en/eRepository/RPAP_All_HealthCare_Settings_Eng2012.pdf.

Poutanen, S. M., Vearncombe, M., McGeer, A. J., Gardam, M., Large, G., & Simor, A. E. (2005). Nonsocomial acquisition of methicillin-resistant Staphylococcus aureus during an outbreak of severe acute respiratory syndrome. *Infection Control Hospital Epidemiology*, 26(2) 134-137.

Public Health Agency of Canada (PHAC). (2012a). *Hand hygiene practices in healthcare settings*. Retrieved from http://publications.gc.ca/site/eng/430135/publication.html.

Public Health Agency of Canada (PHAC). (2012b). *Routine practices and additional precautions for preventing the transmission of infection in healthcare settings*. Retrieved from http://www.phac-aspc.gc.ca/nois-sinp/guide/ summary-sommaire/tihs-tims-eng.php.

Public Health Agency of Canada (PHAC). (2013). *The Chief Public Health Officer's report on the state of public health in Canada: Infectious disease, the never ending threat*. Retrieved from http://www.phac-aspc.gc.ca/cphorsphc-respcacsp/2013/infections-eng.php#a8.

Rees, J. (2017). *Putting on sterile gloves*. Retrieved from https://media.ed.ac.uk/media/Putting+on+sterile+gloves+VIMEO+%282017+remake%29/1_wjlyrirj.

Rothrock, J. C. (2014). *Care of the patient in surgery*. St. Louis, MO: Mosby Elsevier.

Siegel, J. D., Rhinehart, E., Jackson, M., & The Healthcare Infection Control Practices Advisory Committee (HICPAC). (2007). *Guidelines for isolation precautions: Preventing transmission of infectious agents in healthcare settings*. Retrieved from Centers for Disease Control website: http://www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf.

Vancouver Coastal Health. (2017). *Point of care risk assessment* (PCRA). *Infection prevention & control*. Retrieved from http://ipac.vch.ca/Documents/Routine%20Practices/PCRA%20Algorithm.pdf.

World Health Organization (WHO). (2009a). *WHO guidelines for hand hygiene in health care: First global patient safety challenge*. Retrieved from http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf?ua=1.

World Health Organization (WHO). (2009b). *Five moments for hand hygiene*. Retrieved from http://www.who.int/gpsc/tools/Five_moments/en/.

CHAPTER 2. PATIENT ASSESSMENT

2.1 Introduction

Assessment is an essential part of the nurse's role and is the first step in the nursing process (Potter et al., 2019). Care provided is based on the assessment findings that the nurse has collected and thought critically about. Nurses work collaboratively with clients and the healthcare team to create care plans that help optimize client health and help the client achieve their health goals.

Depending on the context, nursing assessment can take many forms. Nurses working in communities may perform community assessments; nurses working with particular populations may perform population related assessment; and nurses working in acute care may perform specific patient assessment. When an assessment is performed, the nurse should do so in a methodical fashion ensuring thoroughness.

This chapter will cover different approaches for nurses to physical health assessment, including health history, vitals, physical assessment with details about focused assessments pertinent to each system, as well as pain assessment and how to do a quick priority assessment. Sample nursing diagnoses are provided to help the learner begin to make connections between assessment and nursing diagnoses.

The skills of physical assessment are powerful tools for detecting both subtle and obvious changes in a patient's health. Along with this, the ability to think critically and interpret patient behaviours and physiologic changes are essential. The assessment skills outlined in this chapter are meant to provide a framework to develop assessment competencies applicable and salient to everyday practice as recommended by Anderson, Nix, Norman, and McPike (2014).

The content in this chapter is considered basic level for adult assessment. Learners are encouraged to seek other, in-depth resources about assessment to further develop their knowledge and skill.

Learning Outcomes

- Describe four different types of assessment and when they should be used to inform care.
- Describe the purpose of physical assessment.
- Discuss techniques to promote a patient's physical and psychological comfort during an examination.
- Identify data to collect from the nursing history before an examination.
- Incorporate health promotion and health teaching into an assessment.
- Use physical assessment techniques and skills during routine nursing care.
- Document assessment findings according to agency policy.

- Begin to identify nursing diagnoses following assessment of clients.

2.2 Health History

The purpose of obtaining a health history is to gather data from the patient and/or the patient's family, so the healthcare team and the patient can collaboratively create a plan that will promote health, address acute health problems, and minimize chronic health conditions. The health history is typically done on admission to hospital or a care agency, or with initial contact with community nursing services, but a health history may be taken whenever additional information may be helpful to inform care (Wilson & Giddens, 2013).

Data gathered may be subjective or objective in nature. Subjective data is information reported by the patient and may include symptoms described by the patient that are not noticeable to others. Subjective data also includes demographic information, patient and family information about past and current medical conditions, and patient information about surgical procedures and social history. Checklist 13 provides a guide for obtaining subjective data during a health history.

It should be noted that the theoretical underpinnings of the different components of a health history are beyond the scope of this textbook. However, the nurse should remember that using open-ended questions allows the patient to direct the interview and may reveal information otherwise missed through closed-ended questioning.

Objective data is information that the healthcare professional gathers during a physical examination and consists of information that can be seen, felt, smelled, and/or heard by the healthcare professional. When taking a health history, data obtained through diagnostic means (i.e., vital signs, blood work, chest x-ray, etc.) may be used by healthcare professionals to understand the client's health status.

Critical thinking is necessary to interpret and evaluate the assessment findings, and to use this to inform nursing judgement. The data gathered in a health history provides the healthcare professional an opportunity to assess health promotion practices and offer patient education (Stephen, Skillen, Day, Jensen, 2012).

It should be noted that although agency forms may differ slightly, all health histories should include main components similar to the ones listed in Checklist 13.

Checklist 13: Health History Checklist

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Steps	*Additional Information*
Biographical data	• Source of information • Name, age, gender • Living situation
Chief complaint; history of present illness; reason for seeking health care	• Chief complaint • Onset and duration of present health concern • What caused the health concern to occur? • Signs, symptoms, and related problems • Alleviating and aggravating factors • How the concern affects life and activities of daily living? • Previous history and episodes of this condition
Past health history	• Allergies (including reaction) • Immunization history (if applicable) • Chronic disease(s) • Acute diseases requiring treatment • Previous hospitalizations • Previous surgical interventions • Mental health history • Current medications: prescriptions, over-the-counter, herbal remedies • Alcohol consumption and recreational drug use • History of antibiotic resistant organisms (ARO)

Social data	• Reported quality of family or friend relationships • Cultural health-related beliefs and practices • Nutrition considerations related to culture • Social and community considerations: interpersonal relationships and resources; caregiver responsibilities • Religious or spiritual beliefs and practices • Language and ability to communicate • Pertinent health history of family members (heart disease, lung disease, cancer, hypertension, diabetes, tuberculosis, arthritis, neurological disease, obesity, mental illness, substance use and abuse, genetic disorders)
Lifestyle	Personal habits including: • Activity and exercise • Leisure and recreational activities • Sleep and rest • Nutrition and elimination • Occupational and environmental hazards
Developmental variables	• Relationship status • Significant physical and psychosocial changes or concerns
Mental status assessment	• Stressors experienced by the individual: their perception, how they cope, ability to communicate emotion • Coping and stress management
Patterns of health care	• What healthcare resources the client has used in the past and is currently using
Data sources: Assessment Skill Checklists, 2014; Lloyd & Craig, 2007; Potter et al., 2019	

Critical Thinking Exercises

1. Why is it important to obtain a complete description of the patient's present illness?
2. Identify one reason why it is important for the nurse to obtain a complete description of the client's lifestyle and exercise habits?

2.3 Pain Assessment

"Pain is whatever the experiencing person says it is, existing whenever the experiencing person says it does" (McCaffery, 1968, as cited in Rosdahl & Kowalski, 2007, p. 704).

Pain is a subjective experience, and self-reporting pain is the most reliable indicator of a patient's experience (RNAO, 2013). Determining pain is an important component of a physical assessment, and pain is sometimes referred to as the "fifth vital sign."

Figure 2.1 Example of a pain scale

Figure 2.2 Wong-Baker assessment of pain in children scale

Pain assessment is an ongoing process rather than a single event. A variety of pain assessment tools and visual analogues are available to help with pain assessment (see Figures 2.1 and 2.2). When someone's pain changes notably from previous findings, a more comprehensive and focused assessment should be performed. Sudden changes may indicate an underlying pathological process (Jarvis, Browne, MacDonald-Jenkins, & Luctkar-Flude, 2014). It is important to assess pain at the beginning of a physical health assessment to determine the patient's comfort level and potential need for pain comfort measures. Any time you think your patient is in pain, the mnemonic OPQRSTUV may help guide the questions to ask your patient. See Checklist 14 for more specificity regarding this approach.

Checklist 14: Pain Assessment

Disclaimer: Always review and follow your hospital policy regarding this specific skill.

Steps	*Additional Information*
O: Onset	• When did it begin? • How long does it last? • How often does it occur?
P: Provoking, palliation	• What brings it on? • What makes it better? • What makes it worse?
Q: Quality	• What does it feel like? • Can you describe it? (patient's own words)
R: Region, radiating	• Where is it? • Does it spread?
S: Severity	• What is the intensity (0 to 10) right now, at best, on average, at worst? • Are there other accompanying symptoms?
T: Treatment	• What treatments are you currently using? • How effective are they? • Any side effects? • What have you used in the past?
U: Understanding	• What do you believe is causing this symptom? • How is this symptom affecting you or your family?

V: Values	• What is your comfort goal?
Data source: RNAO, 2013	

In their "Clinical Best Practice Guidelines: Assessment and Management of Pain" (2013), the Registered Nurses Association of Ontario (RNAO) has published a variety of pain assessment tools for different populations including children, non-verbal adults, adults with cancer, and neonates. Table 2.1 is an assessment tool that can be used in adults with cognitive impairment.

Table 2.1 Pain Assessment Tools for Elders with Cognitive Impairment

Note: The screening tool is for the presence/absence of pain but NOT pain intensity.

Measure	*Characteristics*	*Considerations*
Pain Assessment in Advanced Dementia (PAINAD) Scale	• Observational behavioural tool of five items: breathing, facial expression, body language, negative vocalizations, and consolability • Each item rated on a scale of 0–2 for a total score from 0 (no pain) to 10 (severe pain); score 1 or 2 indicates some pain	• For use with people having advanced dementia • Feasible in clinical setting – can be completed in 1-3 min. • Clear and concise concepts, user-friendly • Tool can be used for screening and follow-up • Evidence of reliability and validity • Available online at http://dementiapathways.ie/_filecache/04a/ddd/98-painad.pdf
Pain Assessment Checklist for Seniors with Limited Ability to Communicate (PACSLAC)	• 60-item tool assessing four categories: facial expressions, activity/body movements, social and personality changes, and other (appetite or sleeping changes) • Items in each category are rated present or absent, for a total score of 60	• Feasible in clinical setting – can be completed in 5 min. • Helpful to consolidate training and nursing documentation • Evidence of reliability and validity • Available online at http://www.geriatricpain. org/Content/Assessment/Impaired/Pages/PACSLAC.aspx
DOLOPLUS-2 Scale	• Observations of somatic, psychomotor, and psychosocial behaviours • Items scored on scale of 0–3, total score range from 0–30 • Score of 5 or more indicates pain, maximum score 30	• For use with people having mild or moderate cognitive impairment and with proxy rating when a person is unable to self-report • User friendly – takes minutes to complete • Validation done in non-English speaking people • Available online at http://www.assessmentscales.com/scales/doloplus
Data source: RNAO, 2013		

Critical Thinking Exercises

1. You are caring for a patient who has just returned from a surgical procedure. How might the assessment of acute pain differ from assessment of chronic pain?
2. What is more important in pain assessment: the subjective or the objective data?

Attributions

Figure 2.1 Children's pain scale by Robert Weis is used under a CC BY SA 4.0 licence.

Figure 2.2 The Wong-Baker scale for assessment of pain in children by Intermedichbo is used under a CC BY SA 4.0 licence.

2.4 Vital Signs

Temperature, pulse, respiration, blood pressure (BP), and oxygen saturation (SpO_2), are measurements that indicate a person's hemodynamic status. These are the five vital signs most frequently obtained by healthcare practitioners (Perry, Potter, & Ostendorf, 2018). Vital signs can reveal important information about a person's health status including changes in a patient's condition. As such the nurse's responsibility is to consider patterns and trends in vital signs in anticipation of changes in health status, need for further investigation, and intervention (Perry, Potter & Ostendorf, 2018). Checklist 15 outlines the steps to take when checking vital signs.

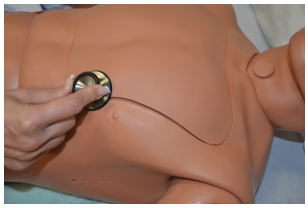
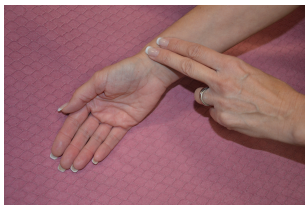
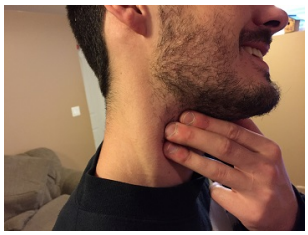
Checklist 15: Vital Signs

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

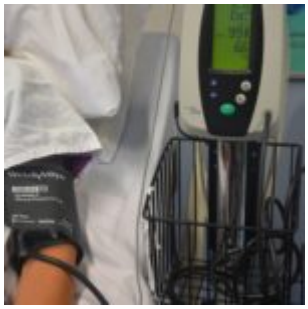
- Always compare findings with the patient's baseline.
- Consider growth and development in relation to vital signs. Vital signs vary depending on age.
- Consider factors that may be influencing vital signs. The pathophysiology behind these factors is beyond the scope of this textbook.
- Report concerns to the appropriate healthcare professional.
- Consider infection control practices.

Steps	*Further Information*	*Normal Values*
1. Temperature: 	**Oral temperature**: Place the thermometer in the mouth under the tongue and instruct patient to keep mouth closed. Leave the thermometer in place for as long as is indicated by the device manufacturer. **Axillary temperature**: Usually 1°C lower than oral temperature. Place the thermometer in patient's armpit and lower the patient's arm over the probe. Leave it in place for as long as is indicated by the device manufacturer. **Tympanic membrane (ear) temperature**: Usually 0.3°C to 0.6°C higher than an oral temperature. The tympanic membrane shares the same vascular artery that perfuses the hypothalamus. Do not force the thermometer into the ear and do not occlude the ear canal. **Rectal temperature**: Usually 1°C higher than oral temperature. Use only when other routes are not available. On adults, insert the probe approximately 3.5 cm into rectum toward the umbilicus. Use lubricant.	Normal (oral) = 35.8°C to 37.5°C

2. Pulse (a.k.a. heart rate):    *Figure 2.3 Assessing carotid pulse*	Pulses can be found at many points on the body and all could theoretically be used to assess heart rate. When palpating pulses use moderate pressure, as too much pressure can impair blood flow and occlude the vessel. In some agencies scales are used to document the strength of the pulse from bounding (+4); strong (+3); weak (+2); thready (+1); absent (0). If a pulse is regular, a 30 second count multiplied by two is generally acceptable. If a pulse is irregular, count for 60 seconds Common pulses for assessment include: **Radial pulse**: Use the pads of your first three fingers to gently palpate the radial pulse at the inner lateral wrist. **Apical pulse**: Taken as part of a focused cardiovascular assessment and when the heart rate is irregular. Apical pulses are assessed using a stethoscope placed over the 4th–5th intercostal space of the midclavicular line on the left side on adults. For accuracy, an apical heart rate should be taken for a full minute. When giving medications that are dependent on the heart rate, count the apical pulse for a full minute. Auscultate for rate and regularity. **Note**: It is suggested that beginner nurses concentrate on rate and regularity. With practice, and depending on where you work, your skill level with specific heart sounds may change and need to be more detailed. There are many online resources to support learning about normal and abnormal cardiac sounds. Here's one: • Last Second Medicine. (2017, June 12). *Complete heart sounds in 7 minutes – with heart sounds audio* [Video file] Retrieved from https://www.youtube.com/watch?v=6StYVx6BVLo. **Carotid pulse**: May be taken when radial pulse is not present or is difficult to palpate. Use the pads of your first three fingers to gently palpate on either side of the trachea.	Normal heart rate: • Newborn–1 month: 100–175 • 1 month–2 years: 90–160 • Age 2–6 years: 70–150 • Age 7–11 years: 60–130 • Age 12–18 years: 50–110 • Adult and older adult: 60–100

3. Respiration rate: 	Count respiratory rate unobtrusively by observing the rise and fall of the patient's chest or abdomen. Consider doing this while you are taking the pulse rate, so the patient is not aware that you are taking the respiration rate. If the respiratory rhythm is regular, count for 30 seconds and multiply times two to determine respiratory rate / minute. If the respiratory rhythm is irregular or less than 12 / minute, count for a full minute.	Normal respiratory rate per minute: • Newborn–1 month: 30–65 • 1 month–1 year: 26–60 • 1–10 years: 14–50 • 11–19 years: 12–22 • Adult & older adult: 10–20

4. Non-invasive blood pressure (NIBP):



Blood pressure cuff

Invasive BP readings involve direct readings from an artery and would occur in a critical care area.

The average blood pressure (BP) for a healthy adult is 120/80 mmHg, but variations are normal for various reasons. The **systolic** pressure is the maximum pressure on the arteries during left ventricular contraction. The **diastolic** pressure is the resting pressure on the arteries between each cardiac contraction.

Choosing the correct BP cuff size: The length of the cuff's bladder should be approximately 80% of the circumference of the upper arm. The width of the cuff should be approx 2/3 of the upper arm. In other words allow for approximately two finger widths between the axilla and the top of the cuff and two finger widths between the antecubital fossa and the bottom of the cuff.

The patient may be sitting or lying down with the bare arm at heart level.

Two step method auscultation method: The two step method will allow you to approximate the BP prior to the reading, thus helping to prevent false low readings.

Apply the BP cuff to the upper arm by ensuring correct size and lining the arrows up to the brachial artery. On the same arm, palpate the radial or brachial artery. Close the pressure bulb. Inflate the BP cuff until the pulse rate is no longer felt. Then inflate an additional 20 to 30 mmHg. This will give you an approximate systolic pressure and help you to determine the maximum inflation point.

Open the pressure bulb and deflate the cuff and wait approximately one minute.

Place the bell of the stethoscope over the brachial artery, place the stethoscope ear pieces in your ears. Close the pressure bulb. Inflate the cuff to the approximated systolic pressure and deflate the cuff slowly and evenly (approx 2–3 mmHg / second) noting the points on the manometer at which you hear the first appearance of sound (systolic BP), and the disappearance of sound (diastolic BP). After the last sound is heard, quickly deflate the cuff.

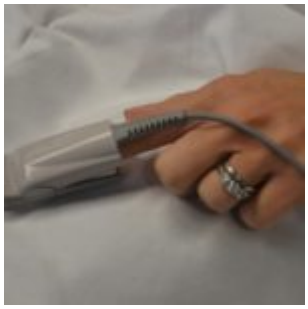
Using an NIBP: Ensure cuff size is correct. Align the artery with the arrows on the cuff. Operate the machine as per manufacturers instructions.

Additional resource:

Deans, B. (2013, March 20). *Choosing & positioning a blood pressure cuff* [Video file].

Normal blood pressure

Age	**Normal Systolic Range**	**Normal Diastolic Range**
Newborn to 1 month	45–80 mmHg	30–55 mmHg
One to 12 months	65–100 mmHg	35–65 mmHg
Young child (1–5 years)	80–115 mmHg	55–80 mmHg
Older child (6–13 years)	80–120 mmHg	45–80 mmHg
Adolescent (14–18 years)	90–120 mmHg	50–80 mmHg
Adult (19–40 years)	95–135 mmHg	60–80 mmHg
Adult (41–60 years)	110–145 mmHg	70–90 mmHg
Older adult (61 and older)	95–145 mmHg	70–90 mmHg

	Retrieved from https://www.youtube.com/watch?v=II0ioJNLnyg.	
5. Oxygen saturation (SpO_2):  *Pulse oximeter sensor*	A pulse oximeter sensor attached to the patient's finger or earlobe measures light absorption of hemoglobin and represents arterial SpO_2. Refer to Chapter 5.3 Pulse Oximetry for more information.	A healthy person should have an SpO_2 of ≥ 97%.

Data sources: Hill & Smith, 1990; Jarvis, Browne, MacDonald-Jenkins, & Luctar-Flude, 2014; Lapum, Verkuyl, Garcia, St-Amant, & Tan, 2018; Stephen, Skillen, Day, & Jensen, 2012

Critical Thinking Exercises

1. Identify four factors that can influence heart rate.
2. Identify two situations that can influence blood pressure.
3. Discuss why someone with a lung disease like COPD might have lower than normal SpO_2.
4. What is a normally accepted range for SpO_2 in a client with COPD?

Attribution

Figure 2.3 Assessing carotid pulse by author is licensed under a Creative Commons Attribution 4.0 International License.

2.5 Head-to-Toe / Systems Approach to Assessment

In the course of their work doing direct patient care, nurses use a combination of head-to-toe and focused assessments to gather data about the patient. The assessment findings, when considered with some level of clinical judgement and critical thinking, inform the healthcare professional about the patient's overall condition and form the basis of the plan of care (Potter et al., 2019).

Assessment includes the collection of subjective data – what the patient tells you. Assessment also includes the collection of objective data – what the nurse observes through their senses. Objective data is collected during the physical examination using the techniques of inspection, palpation, percussion, and auscultation as appropriate (Wilson & Giddens, 2013).

Head-to-toe assessments or systems assessments include all the body systems and a systematic approach to collecting data. They provide the nurse with an overall understanding of each patient. They are done when the nurse first meets the patient (for example, when the patient is admitted to the unit and at the beginning of a shift) and when prompted by a change in patient health status.

Focused assessments, sometimes called priority assessments, are often a part of a head-to-toe assessment. They involve the search for detailed information about a specific body system(s). Knowing which system(s) to focus on depends upon the client's presentation and the nurses' knowledge of nursing, pathophysiology, pharmacology, and other bodies of knowledge (Potter et al., 2019; RCH, 2017).

Unusual findings must always be considered in relation to the patient's health history. Some issues may be old and not fixable. New or emerging issues may require action (some rather urgently) to avoid harm to the patient.

The following sections are set up to provide the learner with general guide to objective and subjective data collection starting at the head and following a general systems approach to assessment for an adult. The sections include:

- Head & Neck / Neurological Assessment
- Chest / Respiratory Assessment
- Cardiovascular Assessment
- Abdominal / Gastrointestinal Assessment
- Genitourinary Assessment
- Musculoskeletal Assessment

- Integument Assessment

At the end of each section is additional information outlining details that may be included in a focused assessment should the nurse decide such detail is necessary. This is by no means an exhaustive list. The guide is primarily intended for a student and/or a beginning level nurse. Other more comprehensive texts will help the learner build knowledge around health assessment.

At the end of each section are sample nursing diagnoses to help you begin to understand how assessment findings inform nursing diagnosis.

Critical Thinking Exercises

1. Consider why having a systematic approach to assessment might be important.
2. Identify two situations where a focused priority assessment might be more appropriate than a full head-to-toe assessment.

2.6 Head-to-Toe Assessment: head and neck / Neurological Assessment

The neurological system is responsible for all human function. It exerts unconscious control over basic body functions, and it also enables complex interactions with others and the environment (Stephen, Skillen, Day, & Jensen, 2012). A neurological assessment begins when the nurse first interacts with the client and involves observations about appearance, communication patterns, and general behaviour. The first part of the checklist provides a general overview of performing a basic neurological assessment. In some situations a more focused neurological assessment is necessary. The last part of the checklist provides some guidelines for some elements of a focused neurological assessment.

Checklist 16 provides a guide for subjective and objective data collection in a neurological assessment.

Checklist 16: Head and Neck / Neurological Assessment

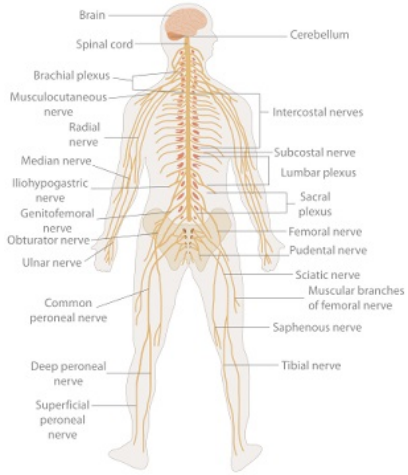


Figure 2.4 Nervous system

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Perform hand hygiene.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient.
- Be organized and systematic in your assessment.
- Use appropriate listening and questioning skills.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Document according to agency guidelines.

Objective Data

Consider the following observations.

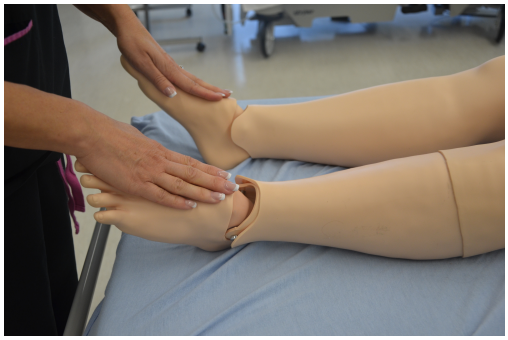
Steps	*Additional Information*
General appearance  *Figure 2.5 Observe general appearance*	Observations about general appearance may provide insight into other physical or psychosocial issues affecting the patient. If appearance is unkempt, it may suggest that the patient struggles with achieving activities of daily living. The nurse would further their questioning to elicit greater understanding, and potentially to refer to other healthcare professionals subsequently.
Level of consciousness (LOC)	Altered LOC may indicate substance use, fatigue, brain injury, neurological disorder, mania, or depression.
Inspect eyes & nose for drainage.	Drainage from eyes or nose may indicate infection, allergy, or injury.
Note nature of eye contact during interview.	The extent of eye contact may reflect cultural norms, individual way of being, or possibly mental health issues.

Glasses, contacts, hearing aids	People who need these devices but don't have them, or if the devices are not in working order, may experience some level of isolation because of difficulty interacting with the world around them.
Inspect for facial asymmetry.  *Figure 2.6 Observe for facial asymmetry*	Facial asymmetry may indicate neurological impairment or injury. Unusual findings should be followed up with a focused neurological system assessment.
Evidence of nasal trauma. Ability to breathe through nose.	Nasal flaring or use of accessory muscles when breathing may indicate altered breathing patterns. Unusual findings should be followed-up with a focused respiratory assessment.
Inspect mouth, tongue, and teeth for moisture, colour, dentures, hygiene.	Dry mucous membranes may indicated altered hydration. Dental disease can influence one's general health.
Ability to swallow	Difficulty swallowing may suggest neurological impairment. Frequent coughing or choking associated with eating or drinking may suggest risk of aspiration. Unusual finding should be followed-up with a swallow assessment and a referral to an occupational therapist.
Neck range of motion (ROM)	This includes flexion, extension (front and back, and side to side) and ability to rotate the neck side to side. Impaired neck ROM may indicate an old injury. Neck pain and stiffness (nuchal rigidity) may be related to old injury or signs and symptoms of a serious neurological illness.

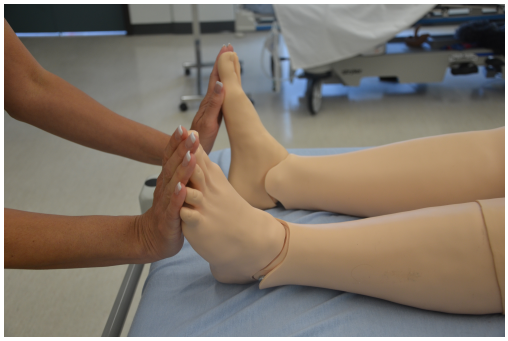
Ability to communicate	Difficulty communicating may be the result of a language barrier or neurological impairment. Communication barriers related to language differences between the patient and healthcare givers might be alleviated through interpreters making information available in the patient's language. Communication barriers related to neurological impairment require further investigation and a creative approach during patient care.

General arm and leg strength.

Figure 2.7 Assessing hand strength



Assess *dorsiflexion*



Assess *plantar flexion*

General arm and hand strength can be assessed by asking the patient to extend their arms and grip the nurse's hands simultaneously.

General leg strength can be assessed by asking the patient to dorsiflex, plantar flex, and bend each knee.

Dorsiflexion strength can be assessed by asking the patient to pull up on their feet while the nurse applies some resistance to the top of the feet.

Plantar flexion strength is assessed while the nurse applies some resistance to the bottom of the feet while asking the patient to push (i.e., step on the gas).

Always compare extremities.

Subjective Data

Ask about vision, hearing, headaches, neck stiffness, history of head injury, neurological disease, history of seizures, stroke, memory loss, mental health history.

Focused neuro assessment may also include:

Pain Assessment	See Chapter 2.42 Pain Assessment
Mental Status Exam (MSE): Is used in psychiatry to guide the examiner to collect data and form impressions about an individual's mental health.	MSE involves the following components: • Appearance, Motor, Speech, Thought Content, Thought Process, Perception, Intellect, Insight For more resources about MSE, go to RNAO's Nursing Best Practice Guidelines: Outline of a Mental Status Examination.
Mini-Mental State Exam (MMSE): Used to measure cognitive impairment and often performed in the context of persons with dementia.	For more information about the MMSE see BCGuidelines.ca (2014) Standardized Mini-Mental State Exam (SMMSE)

Glasgow Coma Scale (GCS): Used to guide assessment in patients with head injury, suspected brain bleeds, stroke, and cranial surgery, and in persons with altered level of consciousness. In general, the GSC measures assess:

- Best eye-opening response
- Best motor response
- Best verbal response

The lower the score, the more serious the neurological impairment. This assessment tool allows for objective assessment and greater reliability in terms of being able to observe patterns and trends in the patient's health status.

Glasgow Coma Scale (adapted from Jarvis et al., 2014, p. 699)

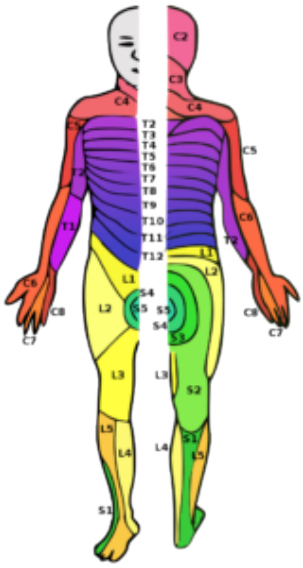
Best eye-opening response Record "C" if eyes closed due to swelling.	
1	No response
2	To pain
3	To speech
4	Spontaneously

Best motor response (to painful stimuli) Press fingernail bed, and record best upper-limb response.	
1	No response
2	Extension – abnormal
3	Flexion – abnormal
4	Flexion – withdrawal
5	Localizes pain
6	Obeys verbal command

Best verbal response • Record "E" if endotracheal tube is in place. • Record "T" if tracheostomy is in place.	
1	No response
2	Sounds – incomprehensible
3	Speech – inappropriate
4	Conversation – confused
5	Oriented × 3 (to person, place, and time)

For more information about neuro assessment go to Critical Care Services Ontario's Guidelines for Basic Adult Neurological Observation.

Assess **arm drift** by asking the patient to extend their arms in front of them and close their eyes.	Drift of one arm may suggest neurological dysfunction. Report concerns immediately.

Pupil Assessment: Assess pupils for size, equality, reaction to light, and consensual reaction to light. 	In a darkened room ask the patient to look at your nose. With a lit flashlight, shine the light moving from the lateral across the open eye to the space between the eyes. Note the pupil's reaction to light. Repeat on the other side. To test **consensual reaction**, have the patient look at your nose. Shine a flashlight from the hairline at the mid-forehead to the space between the eyes. Observe for the pupils to react equally at the same time. Pupils that are equal and reactive to light are described as PERL. Alterations may be a part of the patient's norm or they may indicate severe neurological dysfunction, and should be reported immediately.
Dermatome Assessment: Dermatomes are areas of skin supplied by a single spinal nerve. To perform a dermatome assessment use ice. Begin at the neck area. Move the ice downward along the side of the patient's body asking them to indicate if and when sensation changes. Continue to the lateral side of the foot. Repeat on the other side.  *Figure 2.8 Dermatomes*	Dermatome assessment may be indicated in persons with spinal cord injury or when patients receive spinal or epidural analgesics (local anesthetics). Depending on the context, changes in dermatome levels may indicate local anesthetic is moving up or down in the epidural space. In spinal cord injury, alterations in dermatomes may indicate improving or worsening changes in patient status. Document blocked dermatomes according to agency guidelines. E.g., Right side: T12-L1; Left side: L1-L4.

<table>
<tr>
<td>Sedation Score Assessment: Nursing assessment of opioid induced sedation is quick and easy. Having a guide provides some level of consistency between assessors and provides important information to the healthcare team about trends in the patient's level of sedation.</td>
<td>Sample Sedation Score Assessment
(adapted from Pasero, 2009)

<table>
<tr><td>1</td><td>Awake & alert</td></tr>
<tr><td>2</td><td>Slightly drowsy, easily aroused</td></tr>
<tr><td>3</td><td>Slightly drowsy, easily aroused</td></tr>
<tr><td>4</td><td>Somnolent, minimal or no response to verbal or physical stimulation</td></tr>
<tr><td>5 / S</td><td>Sleeping</td></tr>
</table>

Sedation scores may form a part of an agency's assessment protocol(s). Some agencies provide direction for opioid use based on the sedation score.</td>
</tr>
<tr>
<td>The National Institute of Health Stroke Scale (NIHSS): Used specifically when stroke is suspected. It is often a part of an institution's stroke protocol.</td>
<td>For reference see:

Heart and Stroke Foundation. (2019). Canadian partnership for stroke recovery. Retrieved from https://www.stroke.nih.gov/documents/NIH_Stroke_Scale_508C.pdf.</td>
</tr>
<tr>
<td colspan="2">Potential neurological related nursing diagnoses:

• Pain related to injury
• Risk of falls due to altered level of consciousness
• Risk for injury related to disturbed sensory perception</td>
</tr>
<tr>
<td colspan="2">Data sources: Alberta Health Services, 2009; Assessment Skill Checklists, 2014; Critical Care Services Ontario, 2014; Heart and Stroke Foundation, 2019; Jarvis, Browne, MacDonald-Jenkins, & Luctkar-Flude, 2014; Pasero, 2009; Perry, Potter, & Ostendorf, 2018; RCH, 2015; RNAO, n.d.; Stephen et al., 2012; Wilson & Giddens, 2013</td>
</tr>
</table>

Watch the video *Neurological Assessment – Basic* by Renée Anderson and Wendy McKenzie, Thompson Rivers University, 2019

Watch the video *Assessing Range of Motion and Strength* by Candace Walker and Wendy McKenzie, Thompson Rivers University

Critical Thinking Exercises

1. What patient situations would require a dermatome assessment?
2. When caring for a client post CVA, consider the difference between completing a Glasgow Coma Scale (GCS) assessment and a National Institutes of Health Stroke Scale (NIHSS).
3. Besides opioid induced sedation, identify one other situation where sedation score might be appropriate part of an assessment.

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Figure 2.5 A Man's Face by Christiaan Brigs is used under a CC BY-SA 3.0 license.

Figure 2.6 Bells Palsy by CDC and United States Department of Health and Human Services is in the public domain.

Figure 2.8 A Diagram Showing Human Dermatomes by Ralf Stephanis in the public domain.

2.7 Head-to-Toe Assessment: Chest / Respiratory Assessment

Checklist 17 provides a guide for subjective and objective data collection in a respiratory assessment.

Checklist 17: Chest / Respiratory Assessment

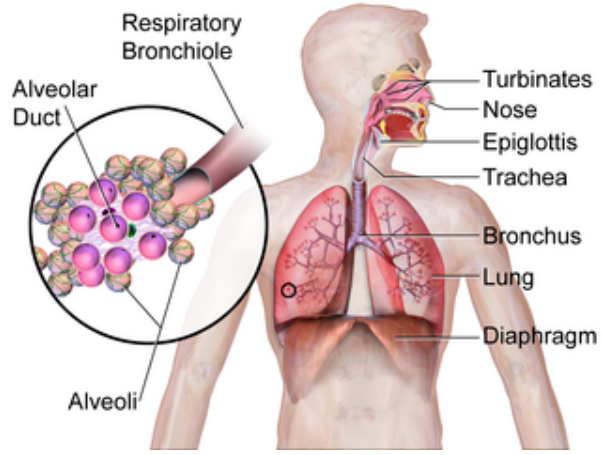


Figure 2.9 Respiratory System

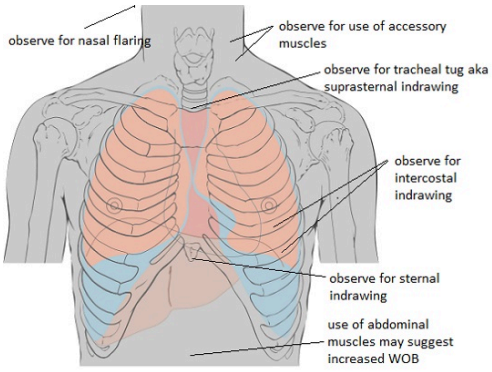
Disclaimer: Always review and follow your agency policies and guidelines regarding this specific skill.

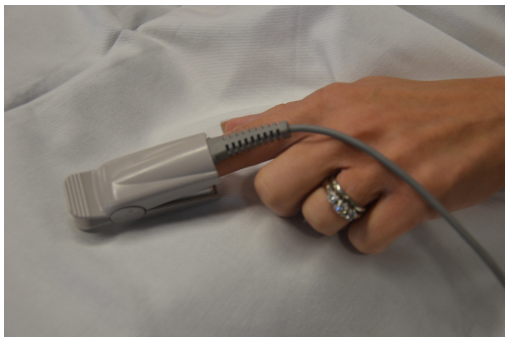
Safety considerations:

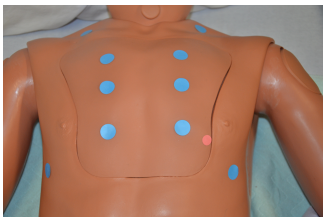
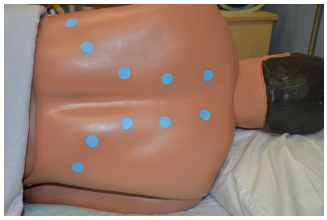
- Perform hand hygiene.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient.
- Be organized and systematic in your assessment.
- Use appropriate listening and questioning skills.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Document according to agency guidelines.

Objective Data

The data that we can observe with our senses.

Steps	*Additional Information*
Observe the **work of breathing** including use of accessory muscles.  *Figure 2.10 Observe for work of breathing*	Increased work of breathing may be observed through a spectrum of responses including a small amount of nasal flaring through to use of all accessory muscles. Increased work of breathing is often associated with an increased respiratory rate. The patient may appear distressed and/or feel anxious. Likewise they may not appear distressed, depending on the severity and other comorbidities. Ability to speak may be affected. Increased work of breathing may indicate respiratory compromise and impaired oxygenation caused by things like acute airway obstruction, pulmonary edema, atelectasis, and others. Unusual findings should be followed up with a focused respiratory assessment. More resources: • Khan Academy. (2012). *Respiratory distress*. Retrieved from https://www.youtube.com/watch?v=vO63j9m5grE. • Some agencies use the following for objectively assessing respiratory distress and work of breathing (see page 22): ◦ The Canadian triage & acuity scale. (2013). *CTAS • ÉTG*. Retrieved from http://ctas-phctas.ca/wp-content/uploads/2018/05/participant_manual_v2.5b_november_2013_0.pdf.
Expansion / Retraction of Chest Wall	The chest wall should expand and contract symmetrically. If not, consider if this is a new or pre-existing condition. Chest expansion may be asymmetrical with conditions such as atelectasis, pneumonia, fractured ribs, pneumothorax, or hemothorax.

Assess **respiratory rate** by inconspicuously observing breathing. One way to do this is to palpate radial pulse for a full minute but use some of that time to count respirations. Likewise, placing your hand on the patient's chest and counting the rise / fall cycles  *Assessing respiratory rate.*	Normal respiratory rate (interpreted as respirations per minute): • Newborn: 30–60 • Infant (6 months): 30–50 • Toddler (2 years): 25–32 • Children (3–12 years): 20–30 • Adolescents (13–18 years): 12-20 • Adults: 12–20 If a patient's respiratory status is stable, it may be appropriate to count respirations for 30 seconds and multiply by two to determine respiratory rate.
Pulse Oximetry: Consists of a probe with a light-emitting diode (LED) attached to the patient's finger, forehead, or ear. Beams of red and infrared light are emitted from the LED, and the light wavelengths are absorbed differently by the oxygenated and the deoxygenated hemoglobin (Hgb) molecules. The receiving sensor measures the amount of light absorbed by the oxygenated and deoxygenated Hgb in the arterial (pulsatile) blood. (Perry et al., 2018).  *Pulse oximetry*	The more Hgb that is saturated with oxygen, the higher the SpO_2, which should normally measure above 95% oxygen saturation (SpO_2) (Perry et al., 2018). See Chapter 5.3 Pulse oximetry.

Use a stethoscope to auscultate **breath sounds** anterior and posterior for quality of air entry and any adventitious sounds. Assess bilaterally comparing one side with the other in a systematic fashion.  	Diminished air entry may indicate atelectasis, pneumonia, hemothorax, pneumothorax, or collapsed lung. The presence of crackles or wheezing must be further assessed, documented, and reported. If such things are affecting the patient negatively, intervention is needed. Crackles may indicated mucous related to asthma or chronic obstructive pulmonary disease (COPD), or fluid related to pulmonary edema. Wheezing may indicate bronchoconstriction related to asthma, bronchitis, or emphysema. Friction rub (creaking) may indicate inflammation related to pleurisy. The nurse should always consider what interventions they can implement independently and what interventions have been ordered by the authorized prescriber to relieve impaired oxygenation. More resources: • Cable, C. (1997). *The auscultation assistant*. Retrieved from https://www.med.ucla.edu/wilkes/intro.html.
Cough & Sputum	The nurse might observe coughing and expectorated sputum. Reasons for coughing might include bacterial or viral infection, aspiration, or presence of sputum. Observe and ask if the cough is a concern for the patient. If sputum is present, observe or inquire about amount, colour, and consistency. Ask if sputum is normal for the patient.

Subjective Data

- If you don't already know, ask about respiratory diseases (COPD, asthma, cystic fibrosis). Presence of these may provide insight into explaining other respiratory assessment findings.
- Ask about use of respiratory medications. People with chronic respiratory disease often use one or more inhaled medications.
- Ask about breathing. Does the person experience trouble with breathing or shortness of breath?
- Do they have a cough?
- Is sputum present? If so what is the amount, colour, and consistency? Is this normal?
- Do they smoke? If so, what and how much?
- Ask about environmental exposures that may affect breathing. Some environmental allergies (airborne nut allergy, perfumes, cleaners) trigger respiratory difficulty.

Focused respiratory assessment may also include:

If a chest tube is present, ensure the tube is intact and secure and that the drainage system is functioning. Auscultate chest sounds, perform a respiratory assessment including palpating for evidence of subcutaneous emphysema at and near the chest tube insertion site. See 10.6 Chest Tube Drainage Systems

Arterial blood gasses (ordered by prescriber or as per agency protocol)

Potential respiratory related nursing diagnoses:

- Impaired oxygenation as evidenced by increased respiratory rate and use of accessory muscles to breathe.
- Risk of respiratory infection related to mucous production associated with COPD.
- Readiness to stop smoking.

Sources: Assessment Skill Checklist, 2014; Jarvis, Browne, MacDonald-Jenkins, & Luctkar-Flude, 2014; Perry, Potter, & Ostendorf, 2018; Potter et al, 2019; Stephen, Skillen, Day, & Jensen, 2012; Wilson & Giddens, 2013

Critical Thinking Exercises

1. A client is experiencing mild respiratory distress. Identify two important strategies to address this.
2. What potential respiratory issues might the nurse anticipate for the post op patient? Identify an important nursing intervention for each.
3. Identify two strategies the nurse might implement for the immobile client whose chest sounds reveal

decreased air entry to the bases.

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Figure 2.9 An Illustration Depicting the Respiratory System by BruceBlaus is used under a Creative Commons Attribution-Share Alike 4.0 International license.

Figure 2.10 Chest Landmarks, for Radiography and Other Chest Imaging Techniques by P. Lynch is used under a Creative Commons Attribution 2.5 license.

2.8 Head-to-Toe Assessment: Cardiovascular Assessment

Checklist 18 provides a guide for subjective and objective data collection in a cardiovascular assessment.

Checklist 18: Cardiovascular (CV) Assessment

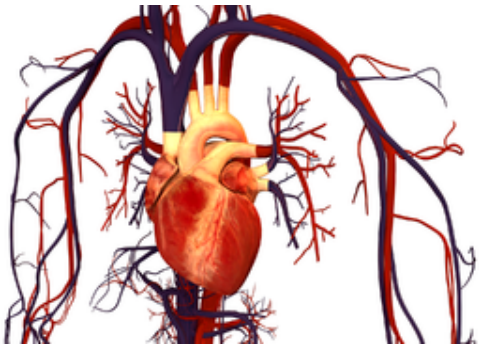


Figure 2.11 Cardiovascular system

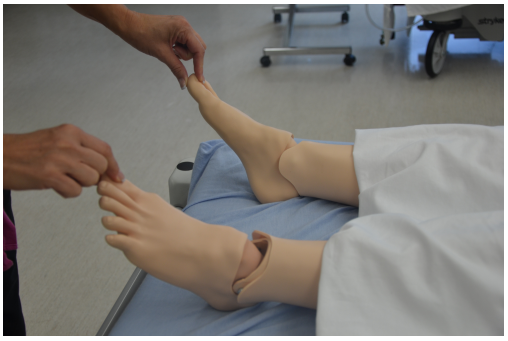
Disclaimer: Always review and follow your agency policy and guidelines regarding this specific skill.

Safety considerations:

- Perform hand hygiene.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient.
- Be organized and systematic in your assessment.
- Use appropriate listening and questioning skills.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.

Objective Data

Consider the following observations.

Steps	*Additional Information*
Colour of Skin & Mucous Membranes	Cyanosis (a bluish tinge) may suggest inadequate oxygenation and CV compromise
Temperature of Extremities	Hot skin may suggest fever and should be followed up with full vital signs, report to the primary prescriber, and investigation of any suspected sources of infection. Cold skin may suggest existing or new circulatory related issues.
Blood Pressure, Heart Rate, SpO_2	Baseline vital signs are important in any assessment. Vital signs should be compared to the patient's normal values. Patterns and trends outside of the normal range should be reported to the appropriate person. See Chapter 2.4 Vital Signs
Capillary Refill 	Press on the nail beds of toes and/or fingers until there is blanching (whiteness). Release the pressure and count how many seconds until the patient's full colour returns. • **Brisk capillary refill**: < (less than) 3 seconds • **Delayed capillary refill**: > (greater than) 3 seconds Delayed cap refill may suggest cardiovascular or respiratory dysfunction and should be followed-up with a focused assessment.

Edema

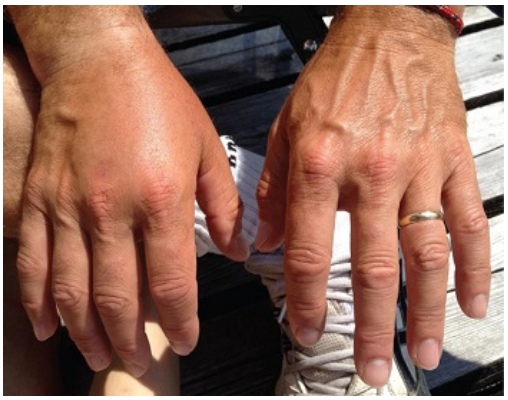


Figure 2.12 Hand edema

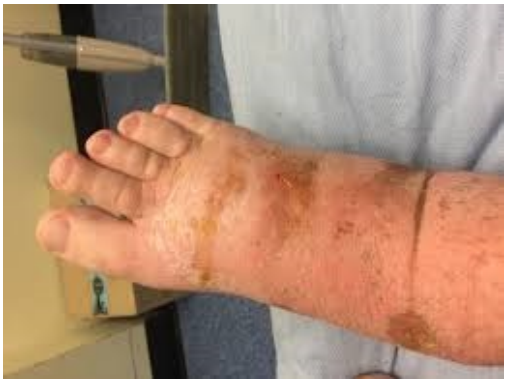


Figure 2.13 Foot and ankle edema

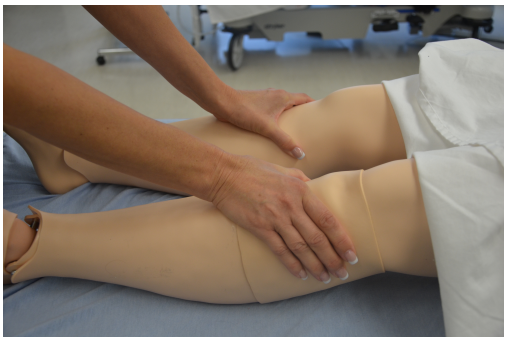
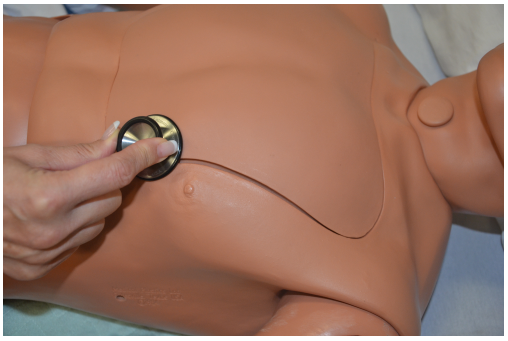
Edema can be the result of many things, including:

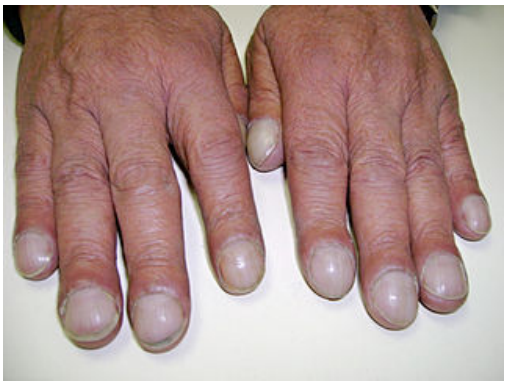
- Inflammatory response from things like bee stings, sprains, or injury
- Altered venous return
- Diseases of the lymphatics
- Fluid shifts
- Side effects of some medications
- Circulatory overload
- Heart failure

It is important to ask the patient if is this normal for them.

Observe limbs simultaneously in order to compare. Unilateral edema of the leg may suggest deep vein thrombosis (DVT).

Edematous tissue has a high risk of skin breakdown. Implement strategies to maintain skin integrity.

Palpate Extremities to Quickly Assess Colour, Warmth, Movement, and Sensation (CWMS), Capillary Refill of Hands and Feet 	**Colour** and **warmth** provide information about perfusion. **Movement** provides a brief overview about musculoskeletal function of extremities, which is affected by circulation. **Sensation**: by asking if the client has numbness and/or tingling in extremities the nurse gets a brief overview of client baseline. Altered sensation may be the result of impaired neurological function or impaired perfusion. Palpate pulses for symmetry in quality, rate, and rhythm. This provides information about perfusion. Asymmetry in relation to assessment findings may indicate a number of things including cardiovascular conditions, history of injury, or post surgical complications. Report concerns to the appropriate healthcare professional.
Auscultate: Apical Heart Rate for Rate and Rhythm 	Apical pulses are assessed using a stethoscope placed over the 4th–5th intercostal space of the midclavicular line on the left side on adults. For accuracy, an apical heart rate should be taken for a full minute. Identify S1 and S2 and follow up on any unusual findings. See Chapter 2.3 Vital Signs

Clubbing of Nails  *Figure 2.14 Clubbing of finger nails*	Clubbing of nails may suggest underlying cardio pulmonary disease

Subjective Data

Ask about chest discomfort, pain, or pressure. All of these may be indicative of a larger cardiovascular issue. Reports of these must be followed up with a more detailed assessment and notification to the appropriate healthcare provider.

A focused cardiovascular assessment may also include:

Rating of Edema Using an Objective Scale

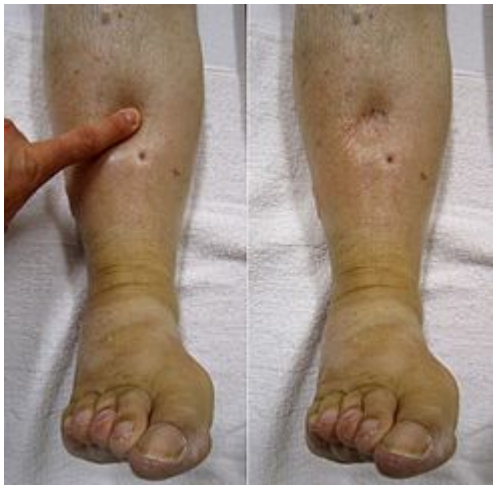


Figure 2.15 Pitting edema

Rating of Edema			
Grade	Description	Depth of Indent	Time to Return to Normal
+1	Slight pitting, no visible change in the shape of the extremity;	0–1/4 inch (< 6 mm)	Rapidly
+2	No marked change in the shape of the extremity	1/4–1/2" (6–12 mm)	10–15 seconds
+3	Noticeably deep pitting, swollen extremity	1/2–1" (1–2.5 cm)	1–2 minutes
+4	Very swollen, distorted extremity	> 1" (>2.5 cm)	2–5 minutes
Adapted from Brodovicz et al., 2009			

Jugular Vein Distension (JVD)

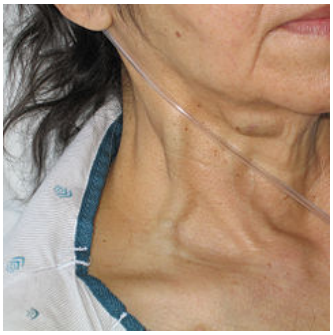


Figure 2.16 Jugular vein distension (JVD)

Jugular vein distension of more than 3 cm above the sternal angle while the patient is sitting at 45 degrees may indicate heart failure.

Rating of Peripheral Pulses Using an Objective Scale

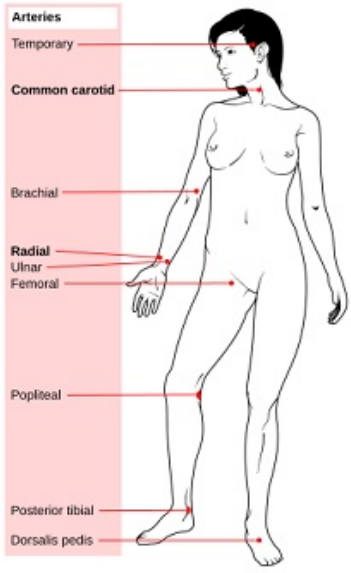


Figure 2.17 Pulse Sites

Pulse quality may be important to assess following surgery when the patient is at risk for arterial compromise (i.e., graft occlusion). A deterioration in pulse quality might suggest arterial occlusion.

Peripheral Pulse Rating Scale	
Rating	Description
0	No pulse
+1	Faint but detectable
+2	Slightly diminished compared to normal
+3	Normal
+4	Bounding
Adapted from Hill & Smith, 1990	

Auscultation of Heart Sounds	Depending on the context, nurses may need to have the skill to be able to assess specific heart sounds. Additional resources: • Last Second Medicine. (2017, June 12). *Complete heart sounds in 7 minutes – with heart sounds audio* [Video file]. Retrieved from https://www.youtube.com/watch?v=6StYVx6BVLo.

Potential cardiovascular related nursing diagnoses:

- Activity intolerance related to diminished cardiac function.
- Acute chest pain due to increased cardiac workload.
- Ineffective cardiac or peripheral tissue perfusion secondary to heart failure.
- Learning need in relation to risk factors associated with cardiovascular disease.

Data sources: Assessment Skill Checklist, 2014; BCCNP, 2018; Brodovicz et al., 2009; Hill & Smith, 1990; Jarvis, Browne, MacDonald-Jenkins, & Luctkar-Flude, 2014; Perry, Potter, & Ostendorf, 2018; Potter et al., 2019; Stephen, Skillen, Day, & Jensen, 2012; Wilson & Giddens, 2013

Critical Thinking Exercises

1. A client has +4 edema to bilateral feet and ankles. Identify two strategies to assist in maintaining skin integrity.
2. A client has just had a femoral popliteal bypass. Which peripheral pulses should be included in the assessment specific to determining arterial perfusion of the affected leg?

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2.9 Head-to-Toe Assessment: Abdominal / Gastrointestinal Assessment

Checklist 19 provides a guide for subjective and objective data collection in an abdominal / gastrointestinal assessment.

Checklist 19: Abdominal / Gastrointestinal Assessment

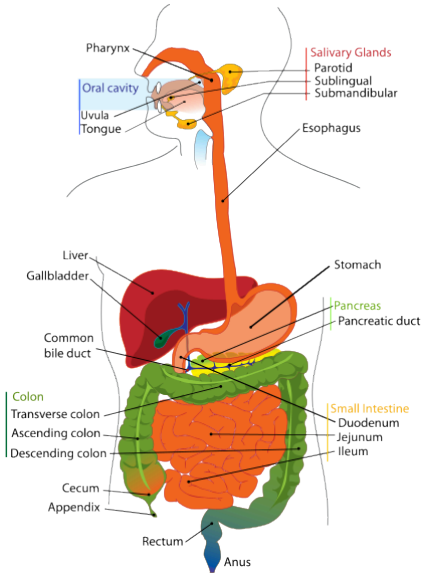


Figure 2.18 GI system

Disclaimer: Always review and follow your agency policy and guidelines regarding this specific skill.

Safety considerations:

- Perform hand hygiene.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient.
- Be organized and systematic in your assessment.
- Use appropriate listening and questioning skills.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.

Objective Data Consider the following observations:	
Steps	*Additional information*

Overall Appearance: Observe for abdominal distension, stretch marks, contour, symmetry, presence and type of ostomy, overweight or underweight.

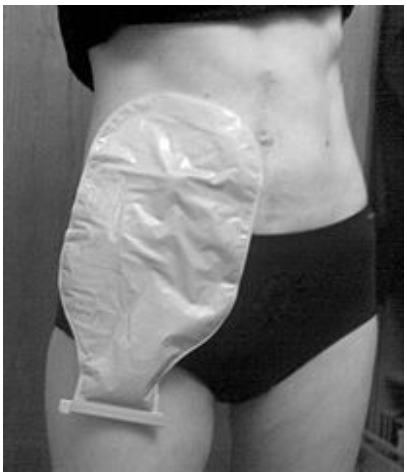


Figure 2.20 Ileostomy bag

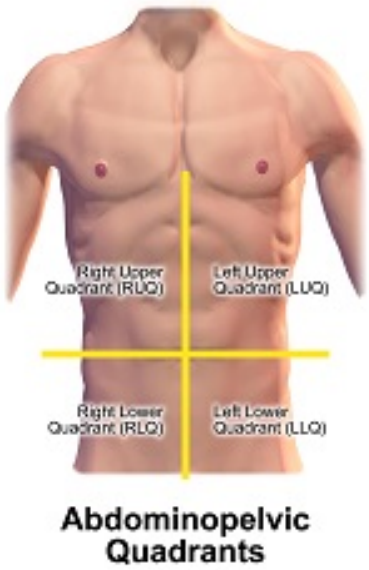
Figure 2.19 Abdominal distension

Abdominal distension may indicate ascites associated with conditions such as heart failure, cirrhosis, cancer, and pancreatitis.

An abdomen that appears thin with little adipose tissue might suggest nutrition issues.

It is important for the nurse to ask "is this normal for your abdomen" to help differentiate patient "norm" to signs and symptoms that may indicate an acute issue.

Unusual findings may indicate compromised GI function.

Auscultate Bowel Sounds  *Auscultate for bowel sounds*  *Figure 2.21 Abdominal quadrants*	Divide the abdomen into quarters. Auscultate in each quadrant for evidence of gurgling, which suggests peristalsis. Hyperactive bowel sounds may indicate bowel obstruction, gastroenteritis, or subsiding paralytic ileus. Hypoactive or absent bowel sounds may be present after GI surgery or when peritonitis or paralytic ileus are present.
Palpate Lightly in All Four Quadrants for Distension, Firmness, Masses, Pain 	Firmness may indicate excess gas, ascites, peritonitis. Always ask the patient “is this normal for you?”

Observe stool to identify important characteristics.	Sometimes observing stool is an important part of the assessment process. Characteristics of bowel movements can assist with diagnosis and to help determine effectiveness of treatment for bowel related conditions. Resource: Bladder and Bowel Foundation (nd). Bristol Stool Chart. https://www.bladderandbowel.org/wp-content/uploads/2017/05/BBC002_Bristol-Stool-Chart-Jan-2016.pdf

Subjective Data
• Ask about last bowel movements and normal bowel patterns. Changes to bowel patterns may indicate a larger GI issue. Normal bowel patterns vary across individuals. Knowing what is normal will help the nurse differentiate if there is a new or emergent concern requiring attention. • Ask about flatus, nausea, vomiting, and pain. Any of these may be symptoms of a GI issue. • Ask about dietary habits. What kinds of foods does the patient normally eat? Has this changed? • Ask about recent weight gain or weight loss. Unexplained weight loss or weight gain may indicate a larger issue and may need investigation. In the surgical context, significant weight loss can result in delayed wound healing and risk of wound dehiscence.
Focused GI assessment may also include ostomy assessment. See Chapter 11: Ostomy Care
Potential GI related nursing diagnoses: • Need for information in relation to low fat foods. • Alteration in bowel function (constipation or diarrhea) related to …. • Potential for delayed wound healing due to altered nutrition status (10 kg unexplained weight loss in 1 month) • Alteration in dietary intake secondary to slowed GI function post op
Data sources: Assessment Skill Checklist, 2014; Jarvis, Browne, MacDonald-Jenkins, & Luctkar-Flude, 2014; Potter et al., 2019; Stephen, Skillen, Day, & Jensen, 2012; Wilson & Giddens, 2013

Critical Thinking Exercises

1. A patient who experiences intermittent constipation asks what they might do to promote bowel regularity. Describe three nursing interventions that the nurse might discuss.
2. Describe the character of stool expected from an ileostomy.

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Figure 2.18 Gastrointestinal Tract by Mariana Ruiz, Jmarchn is in the public domain.

Figure 2.19 Big Man Big Stomach by Mike Baird is used under a CC BY 2.0 license.

Figure 2.20 Ileostomy with Bag by Remedios44 is used under a Creative Commons Attribution-Share Alike 4.0 International license.

Figure 2.21 Abdominopelvic Quadrants by Bruce Blaus is used under a Creative Commons Attribution 3.0 Unported license.

2.10 Head-to-Toe Assessment: Genitourinary Assessment

Checklist 20 provides a guide for objective and subjective data collection in a genitourinary assessment

20: Genitourinary Assessment

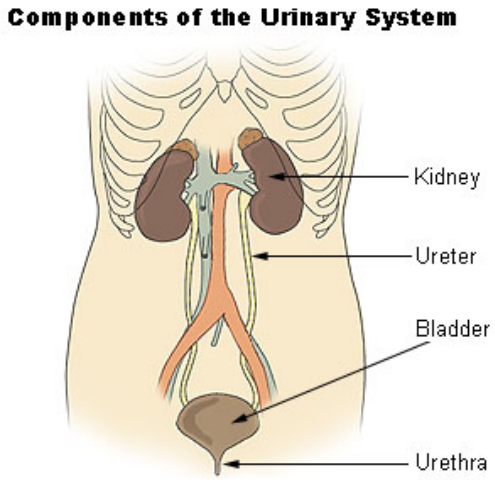


Figure 2.22 Genitourinary system

Disclaimer: Always review and follow your agency policy and guidelines regarding this specific skill.

Safety considerations:

- Perform hand hygiene.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient.
- Be organized and systematic in your assessment.
- Use appropriate listening and questioning skills.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.

Objective Data Consider the following observations.	
Steps	*Additional information*

Observe: Look for presence of urethral catheter, ileal conduit, nephrostomy tube(s), suprapubic catheter, and condom catheter. If present, note the colour, presence, and nature of any odour, and volume of urine in the urine collection system.

Observe the urinary meatus if urethral catheter present for signs of irritation, including skin integrity and urethral ooze.

Observe the genitalia, noting any lesions to suggest possible sexually transmitted infection

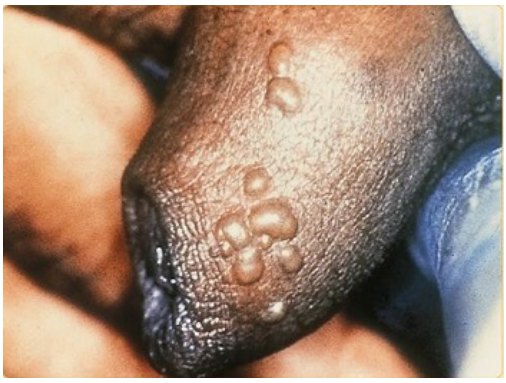


Figure 2.24 Observe genitalia for lesions

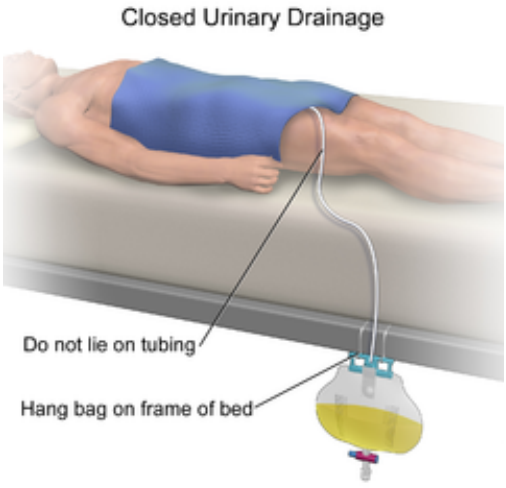


Figure 2.23 Urine drainage system

Urine drainage systems suggest compromised urinary function. All urine drainage systems require care and attention to reduce risk of urinary tract infection and other issues.

Urine drainage tubes should be secured to avoid tension at the insertion site and/or accidental removal.

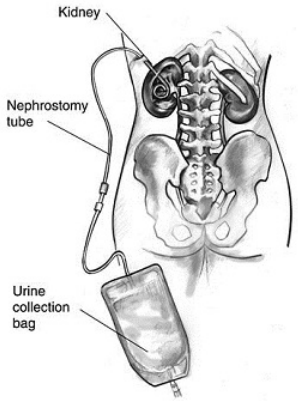
Unusual findings in voiding patterns or urinary output may indicate compromised urinary function. Follow up with a focused GU assessment.

Fever may suggest urinary tract infection. In the elderly, urinary tract infections can result in delirium and as a result present serious safety concerns for the patient.

The colour of urine might suggest hydration status.

Palpate the suprapubic abdomen to assess for pain, possible urinary retention	Palpation while asking about pain or urgency may suggest urinary retention. Bladder scan if equipment is available.

Subjective Data	
• Ask if the patient is experiencing any difficulty with voiding. • Ask the patient about colour of their urine. • Ask about history of urinary tract infections, burning, frequency, presence of blood in urine, sediment, odour with urine, and history of kidney, renal, and genital health issues. • Ask about nocturia and incomplete bladder emptying. In older males, alterations to urinary habits (frequency, urgency, nocturia) may suggest prostate disease. • Ask the client if they have any concerns about their sexual health.	
Focused GU assessment may also include:	
Bladder scan to assess for residual urine volume	Bladder scan according to manufacturer and agency guidelines. Read this journal article for more information on bladder scanning: • Davis, C., Chrisman, J., & Walden, P. (2012). To scan or not to scan? Detecting urinary retention. *Nursing Made Incredibly Easy!* doi: 10.1097/01.NME.0000415016.88696.9d.
In and out urethral catheter insertion for residual urine volume	Assist the patient to void and catheterize immediately following the attempt. Note the volume of the void and the volume associated with the catheterization. Catheterize as directed by prescriber or as per nurse's independent scope of practice and agency policy. See Chapter 10.4 Urinary Catheters

Presence of an ileal conduit (urostomy), nephrostomy  *Figure 2.25 Nephrostomy drainage system*	Note amount and character of urine. Urine via an ileal conduit passes through a piece of bowel, the character of the urine will likely be cloudy from mucous and likely foul smelling from the bacterial that lives in the ileal conduit. See Chapter 11.2 Ostomy Care • **Ileal conduit / urostomy**: Assess the stoma. • **Nephrostomy insertion sites**: Assess the drain insertion site and condition of the dressing. The insertion site should be covered with a sterile dressing.
Potential genito urinary related nursing diagnoses: • Altered pattern of urinary elimination (retention). • Risk of urinary tract infection due to urethral foley.	
Data sources: Assessment Skill Checklist, 2014; BCCNP, 2018; Davis, Chrisman, & Walden, 2012; Jarvis, Browne, MacDonald-Jenkins, & Luctkar-Flude, 2014; Perry, Potter, & Ostendorf, 2018; Stephen, Skillen, Day, & Jensen, 2012; Wilson & Giddens, 2013	

Critical Thinking Exercises

1. Identify two strategies to prevent urinary tract infection in the person with an indwelling urethral catheter.
2. A patient with an ileal conduit asks why their urine is cloudy. Explain.

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Figure 2.21 Illus. Urinary System by US Government is in the public domain.

Figure 2.23 Closed_Urinary_Drainage by BruceBlaus is used under a CC-BY SA license.

Figure 2.24 Genital Herpes by SOA Amsterdam is used under a CC- BY SA license.

Figure 2.25 Nephrostomy by United States Department of Health and Human Services is in the public domain.

2.11 Head-to-Toe Assessment: Musculoskeletal Assessment

Checklist 21 provides a guide for objective and subjective data collection in a musculoskeletal assessment

Checklist 21: Musculoskeletal Assessment

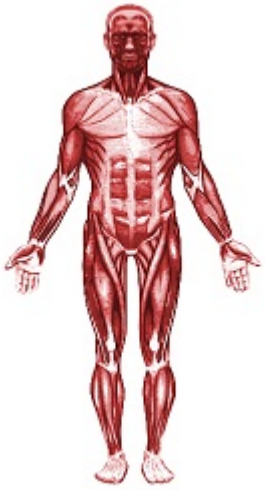


Figure 2.26 Muscular system

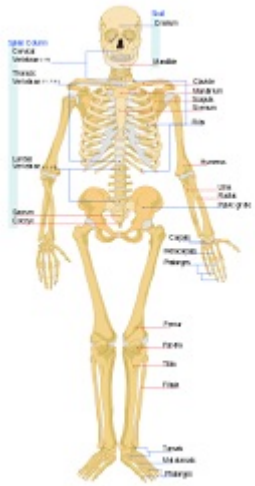


Figure 2.27 Skeletal system

Disclaimer: Always review and follow your agency policies and guidelines regarding this specific skill.

Safety considerations:

- Perform hand hygiene.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient.
- Be organized and systematic in your assessment.
- Use appropriate listening and questioning skills.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Document according to agency guidelines

Objective Data Consider the following observations.	
Steps	*Additional Information*
Observe ability to maintain trunk in upright position, mobility, assistive devices, bruising, curvature or abnormalities of the spine, presence of casts, braces, or splints.	General ability to move one's body and maintain upright position reveals information about muscle strength and need for assistance with mobility needs. Assistive devices should be in safe working order. Observe the patient's ability to use these safely. See Chapter 3.5 Assistive Devices. Any need for assistance, including mobility aids, should be included in the plan of care.
Observe range of motion (ROM) of upper and lower extremities.	Limitations in ROM may suggest articular disease or injury. CWMS (colour, warmth, movement, sensation) assessment encompasses many systems and is a quick way to rule out concern(s). View Assessing Range of Motion and Strength by Candace Walker and Wendy McKenzie Thompson Rivers University.
Inspect arms and legs for pain, deformity, edema, pressure areas, and bruises.	Unexpected findings should be followed with more detailed history and assessment, and reported to the appropriate healthcare provider. Compare limbs bilaterally.

Assess motor power through hand grips, dorsi and plantar flexion, and knee and hip flexion against resistance.

General arm and hand strength can be assessed by asking the patient to extend their arms and grip the nurse's hands simultaneously.

Apply slight resistance to top surface and ask patient to push against resistance.

Apply slight resistance to bottom of arms and ask patient to push against resistance.

Repeat with other arm

Figure 2.28 Assessing arm strength using resistance

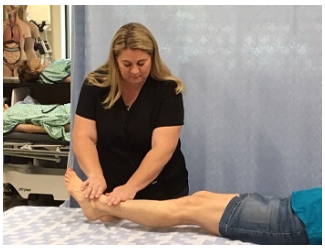
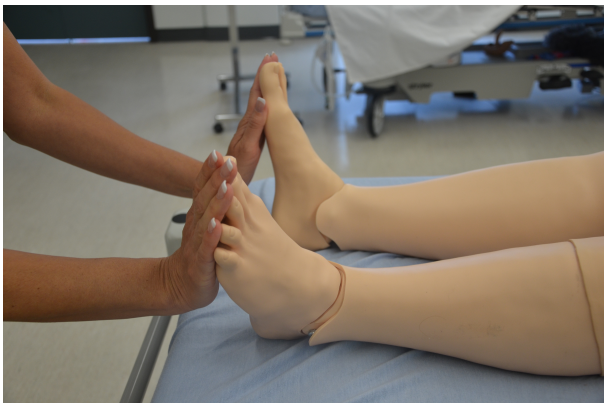
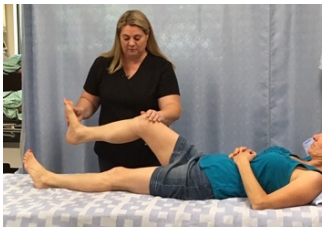


Figure 2.29 Assess leg strength using resistance

Asymmetrical findings may suggest underlying conditions, injury, effects of some medications, or post surgical complications.

General leg strength can be assessed by asking the patient to dorsiflex while the nurse applies some resistance to the bottom of the feet. Plantar flexion strength can be assessed by asking the patient to pull-up on their feet while the nurse applies some resistance to the top of the feet. Have the patient elevate one leg to 30 degrees and hold. Apply slight resistance to top surface and ask patient to push against resistance. Apply resistance to the bottom surface and ask the patient to push against resistance. Repeat with other leg.	 Figure 2.30 assess strength of dorsi flexion  *Figure 2.31 Assess leg strength against resistance*
Palpate limbs for abnormality.	Signs and symptoms of DVT include unilateral edema, pain, redness, and warmth at the site. Any abnormalities or concerns should be reported to the appropriate healthcare provider.

Subjective Data

Ask about pain function, activity levels, joint problems, medications, and previous injury to extremities that may influence assessment findings.

Focused musculoskeletal assessment may include:

Determine Weight Bearing Status	Check orders for weight bearing status if applicable. Some surgeries require the patient to be non- or partial weight bearing afterward to optimize healing. For example: non-weight bearing, partial weight bearing, feather weight bearing.
Falls Risk Assessment: Falls occur as a result of losing balance or inability to regain balance. A number of risk factors can be considered when predicting risk some of which are not modifiable (age) and others modifiable (diet, exercise, poor vision). Risk assessment tools help healthcare providers to predict risk and are the starting point of implementing strategies to reduce risk as much as possible.	Falls risk assessment is a routine part of nursing care in residential and acute settings. Communicate risk and appropriate interventions with the healthcare team and according to agency guidelines. See: • Safer Health Care Now. (2015). *Reducing falls and injuries from falls* (p. 131). Be aware of your agency's guidelines to reduce risk of falls and injury related to falls.
Mobility Risk Assessment	See Chapter 3.3 Risk Assessment for Safer Patient Handling
Motor Strength: Using an objective scale	**Sample Motor Assessment Associated with Epidural Analgesia** 0 — No motor block: No intervention required. 1 — Able to flex knees, but weak 2 — Able to flex ankles. Can not flex knees 3 — Cannot move ankles or knees Adapted from OLCHC, 2016 Follow your agency guideline for the specific motor strength assessment scale used at your facility.

Potential nursing diagnoses:

- Deconditioning related to immobility
- Risk of falls
- Altered mobility

Data Source: Assessment Skill Checklists, 2014; Jarvis et al., 2014; OLCH, 2016; Perry et al., 2018; Potter et al, 2019; Safer Health Care Now, 2015; Stephen et al., 2012; Wilson & Giddens, 2013

Potential musculoskeletal related nursing diagnoses:

- Deconditioning related to immobility
- Risk of falls
- altered mobility due to

Data sources: Assessment Skill Checklists, 2014; Jarvis, Browne, MacDonald-Jenkins, & Luctkar-Flude, 2014; OLCHC, 2016; Perry et al., 2018; Potter, Potter, & Ostendorf, 2019; Safer Health Care Now, 2015; Stephen, Skillen, Day, & Jensen, 2012; Wilson & Giddens, 2013

Critical Thinking Exercises

1. Identify three strategies to reduce falls risk in a client with unlimited mobility.
2. Besides nursing, identify interdisciplinary roles that can assist patients with mobility issues.

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Figure 2.27 Diagram of a Human Female Skeleton by LadyofHats Mariana Ruiz Villarreal has been released into the public domain by its author via Wikimedia.

2.12 Head-to-Toe Assessment: Integument Assessment

Checklist 22 provides a guide for objective and subjective data collection in an integument assessment.

Checklist 22: Integument Assessment

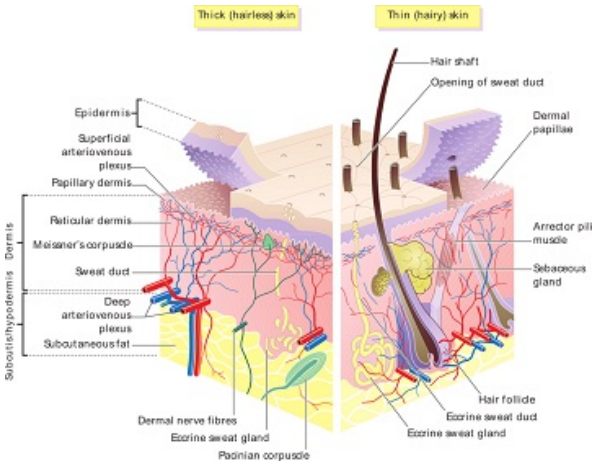
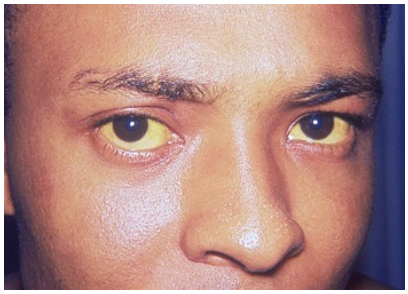


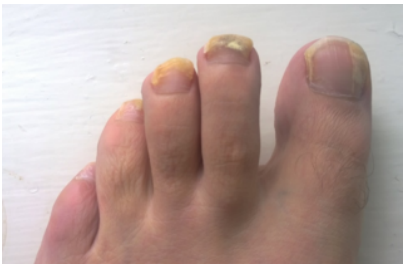
Figure 2.32 Integumentary system

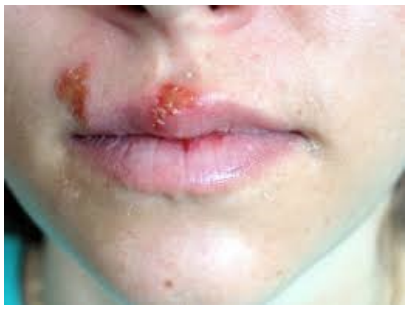
Disclaimer: Always review and follow your agency policies and guidelines regarding this specific skill.

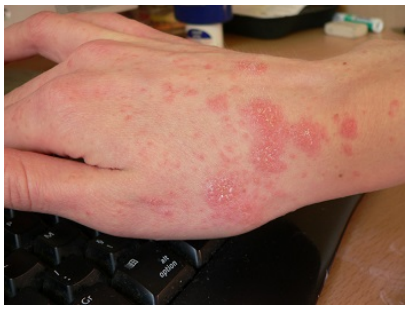
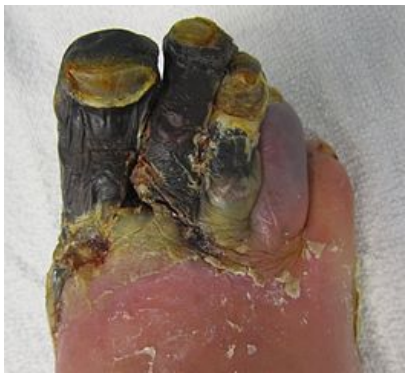
Safety considerations:

- Perform hand hygiene.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient.
- Be organized and systematic in your assessment.
- Use appropriate listening and questioning skills.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Document according to your agency's policies and guidelines.

Objective Data Consider the following:	
Steps	*Additional Information*
• Observe the skin from head to toe for colour, moisture, temperature, hair loss	Abnormalities in skin / sclera colour may indicate other health issues (i.e., jaundice)  *Figure 2.33 Jaundiced sclera* Consider causes of excessive moisture. Excess moisture may increase the patient's risk for skin breakdown. Excessive temperature may indicate infection. Further assessment is required.

• Observe condition of nails, eyes, and mucous membranes of nose and mouth	Neglect of nails may suggest difficulty with managing activities of daily living. Fungal infection of nails is common.  *Figure 2.34 Fungal nail infection (resolving)*

• Observe condition of mouth (evidence of oral care or lack thereof)	 *Figure 2.36 oral herpes*  *Figure 2.35 Oral candida* • Mucous membranes of the mouth should be moist. Lack of moisture may suggest dehydration. Further assessment is required. • Poor oral health can be evidence of larger health or social issues. Further assessment is required. • Oral candida can occur with antibiotic therapy and from inhaled corticosteroids. • Oral care should be a routine part of every patient's care plan. • Herpes infections are contagious. Risk assessment and implementation of PPE should be considered.

• Assess skin integrity for presence of lesions, rashes, or pressure injury.	The integumentary system is our body's first line of defense against invading organisms. Breaks in integument increase one's risk of infection. Any concerns should be reported to the appropriate healthcare provider immediately.  *Figure 2.37 Scabies*  *Figure 2.38 Gangrene*
• Inspect dressings and/or entry sites of all tubes, drains, and IVs.	Determine the rationale for all tubes. Tubes should be secured, intact, and functioning. See Table 10.1 Guidelines for Caring for Patients with Tubes and Devices. Dressings should be dry and intact.
• Note the amount, colour, and consistency of drainage from any tube.	The character of drainage provides insight into activities within the body.

Subjective Data

Ask if they have noticed any recent changes to their skin.

Focused integument assessment may also include:

Pressure Injury Risk Assessment **Braden scales** for measuring risk of developing a pressure injury are widely used in North America in the adult patient population. The tool consists of six subscales: sensory perception, moisture, activity, mobility, nutrition, friction, and shear. Using each of these elements, the nurse assigns a score. Low numbers translate to high risk of pressure injury.	See Braden Pressure Ulcer Risk Assessment Some agencies have guidelines about frequency of assessment and documentation using a Braden Scale. It is important for the nurse to remember that the Braden Scale is an assessment tool. The nursing process isn't completed unless risk is addressed through preventative strategies and evaluation of outcomes. Necessary interventions to prevent and treat pressure injury should be included in the plan of care.
Wound Assessment	See 4.2 Wound Healing and Assessment

Potential integument related nursing diagnoses:

- Impaired skin integrity due to incontinence.
- Risk of pressure injury due to immobility.
- Risk of wound infection due to contamination of coccyx wound with fecal matter.

Data sources: Braden & Bergstrom, 1989; RNAO, 2016; Potter et al., 2019

Critical Thinking Exercises

1. Identify the six components of the Braden Scale that suggest risk of pressure injury.
2. In five of those components, provide two possible preventative strategies to reduce risk of pressure injury.

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Figure 2.32 Layers of Skin by Madhero88 and M. Komorniczak is used under a Creative Commons Attribution-Share Alike 3.0 Unported license.
Figure 2.33 Jaundice Caused by Hepatitis A by CDC/Dr. Thomas F. Sellers/Emory University is in the public domain.
Figure 2.34 A Patient's Left Foot – After Ten Weeks of Terbinafine Oral Treatment by Dandandandandandandandan2014 is used under a Creative Commons Attribution-Share Alike 4.0 International license.
Figure 2.35 Thrush in a Child Who Has Taken Antibiotics by James Heilman, MD is used under a Creative Commons Attribution-Share Alike 3.0 Unported license.
Figure 2.36 Herpes Labialis by Jojo is in the public domain.
Figure 2.37 Scabies by Cixia is in the public domain.
Figure 2.38 Gangrene Toe by James Heilman, MD is used under a CC BY-SA license.

2.13 Quick Priority Assessment (QPA)

Sometimes the nurse will not have time to complete a detailed assessment on every client at the start of the shift. Quick priority assessments provide a guide for the nurse to quickly gather information to help in determining relative client stability and priorities for care. This approach is also helpful each time the nurse interacts with the client and in the event of an emergency. Any concerns are followed up with a more focused assessment and, if necessary, activation of the agency's emergency response system.

The QPA assessment includes the steps in Checklist 23.

Checklist 23: Quick Priority Assessment

Disclaimer: Always review and follow your agency policies and guidelines regarding this specific skill.

Steps	*Additional Information*
A	Airway. Does the patient's position allow their airway to be patent? For example, if someone has slumped down in the bed or wheelchair, they may require repositioning.
B	Breathing. What is the quality of the breathing? Are there any suggestions that breathing is compromised? Any concerns require further investigation.
C	Circulation. What is the patient's colour. Quickly palpate extremities for warmth. Any concerns require further investigation.
I	In. What is going in? Identify every solution going into the patient. Follow all tubes from their source to the patient. Are the volumes adequate? Are the rates accurate? Are the tube insertion sites intact and free of complications? Is the safety equipment (i.e., pumps) plugged in and working? Is there any evidence of complications?
O	Out. What is coming out? Are dressings dry and intact? Are any drainage tubes present? If so, what is the nature of the drainage? Follow all tubes from their source to the patient. Are the tubes patent? Are the tubes secured to avoid accidental or unintentional removal? Is there any evidence of complications?
P	Pain. Is the patient comfortable? Are analgesics given previously still effective? Does the patient need repositioning? Are they too warm or too cold? Do they need to use the washroom?
Safety	• Is the oxygen and suction equipment present and working? • Are the side rails up? • Are the patient's belongings and call bell within reach? • Are restraints applied correctly? • Are the bed or wheelchair brakes applied? • Is the area clutter free? • Does the patient have a clear path to the washroom? • Always ask "is there anything you need from me at this time?"
Adapted from: Christensen & Kockrow, 1999	

Critical Thinking Exercises

1. Initial assessment of your patient reveals that the patient is having trouble speaking. What would be your next steps?
2. Your patient is returning from surgery following an appendectomy. Outline an assessment plan using a systems approach

2.14 Summary

Key Takeaways

- Assessment is a cornerstone of nursing care.
- Whatever approach nurses take with assessment, it is important to approach assessment methodically and to consider objective and subjective information sources.

References

Alberta Health Services. (2009). Instructions for administration of minimental state examination (MMSE). Retrieved http://www.palliative.org/NewPC/_pdfs/tools/MMSE%20administration.pdf

Anderson, B., Nix, N., Norman, B., & McPike, H. D. (2014). An evidence based approach to undergraduate physical assessment practicum course development. *Nurse Education in Practice*, 14(3), 242-246.

Assessment Skill Checklists. (2014). Checklists from Nursing 1019: Clinical Techniques (BCIT BSN program course).

British Columbia College of Nursing Professionals [BCCNP]. (2018). Scope of Practice for Registered Nurses. Retrieved https://www.bccnp.ca/Standards/RN_NP/StandardResources/RN_ScopeofPractice.pdf

BCGuidelines.ca (2014). Standardized Mini – Mental State Examination (SMMSE). From Cognitive Impairment – Recognition, Diagnosis and Management in Primary Care: Standardized Mini-Mental State Examination. Retrieved https://www2.gov.bc.ca/assets/gov/health/practitioner-pro/bc-guidelines/cogimp-smmse.pdf

Braden B. & Bergstrom N. (1989). Clinical utility of the Braden Scale for Predicting Pressure Sore Risk. Decubitus, 2. pp. 44-51. Retrieved http://www.health.alberta.ca/documents/AADL-Braden-Assessment.pdf

Brodovicz, K., McNaughton et al., (2009). Reliability and Feasibility of Methods to Quantitatively Assess Peripheral Edema. Clincal Medicine and Research. Retrieved http://www.clinmedres.org/content/7/1-2/21.full

Christensen & Kockrow (1999). Foundations of Nursing (3rd ed.). St. Louis: Mosby. Retrieved http://www.cabrillo.edu/~ttaylor/Prep_forms/Quick%20Patient%20Assessment.pdf

Critical Care Services Ontario. (2014). Guidelines for Basic Adult Neurological Observation. https://www.criticalcareontario.ca/EN/Neurosurgical%20Care/Guidelines%20for%20Basic%20Adult%20Neurological%20Observation%20(2014).pdf

Davis, C., Chrisman, J., Walden, P. (2012). To scan or not to scan. Nursing Made Incredibly Easy! 10(4). Pp.53–54. doi: 10.1097/01.NME.0000415016.88696.9d

Retrieved https://journals.lww.com/nursingmadeincrediblyeasy/Fulltext/2012/07000/To_scan_or_not_to_scan__Detecting_urinary.13.aspx

Hill, D. & Smith, R. (1990). Chapter 30Examination of the Extremities: Pulses, Bruits, and Phlebitis. In Clinical Methods: The History, Physical, and Laboratory Examinations. 3rd edition. H. Walker & J. Hurst Eds. Boston: butterworths. Retrieved https://www.ncbi.nlm.nih.gov/books/NBK350/

Jarvis, C., Browne, A. J., MacDonald-Jenkins, J., & Luctkar-Flude, M. (2014). *Physical examination and health assessment*. Toronto, ON: Elsevier-Saunders.

Lapum, J., Verkuyl, M., Garcia, W., St-Amant, O., Tan, A. (2018). *Vital Sign Measurement Across the Lifespan – 1st Canadian edition.* Ryerson University. Retrieved https://opentextbc.ca/vitalsign/

Lloyd H. & Craig S. (2007). A guide to taking a patient's history. Nursing Standard, 22(13), pp. 42-28. Retrieved https://www.researchgate.net/publication/5610987_A_guide_to_taking_a_patient's_history

Our LadyChildrensHospital Crumlin [OLCHC]. (2016). Epidural Assessment. Retrieved

http://www.olchc.ie/Healthcare-Professionals/Nursing-Practice-Guidelines/Epidural-Assessment-Sheet-2016.pdf

Pasero, C., (2009). Assessment of Sedation During Opioid Administration for Pain Management. Journal of PeriAnesthesia Nursing, Vol 24, No 3 (June), 2009: pp 186-190. Retrieved

http://www.mghpcs.org/eed_portal/Documents/Pain/Assessing_opioid-induced_sedation.pdf

Perry, A., Potter, P., & Ostendorf, W. (2018). *Clinical skills and nursing techniques* (9th ed.). St Louis, MO: Elsevier-Mosby.

Potter, P., Perry, A., Stockert, P., Hall., Astle, B., Duggleby, W. (2019). Canadian Fundamentals of Nursing. 6th Edition. Milton Ontario: Elsevier.

RNAO (nd). Nursing Best Practice Guideline: Outline of a mental status examination. Retrieved http://pda.rnao.ca/content/outline-mental-status-assessment

Registered Nurses Association of Ontario [RNAO]. (2013). Assessment and management of pain: Best practice guidelines. Retrieved https://rnao.ca/sites/rnao-ca/files/AssessAndManagementOfPain_15_WEB-_FINAL_DEC_2.pdf

RNAO (2016). Clinical Best Practice Guideline: Assessment and Management of Pressure Injuries for the Interprofessional Team. Third Edition. Retrieved

https://rnao.ca/sites/rnao-ca/files/PI_BPG_FINAL_WEB_June_10_2016.pdf

Rosdahl, C. B., & Kowalski, M. T. (2007). *Textbook of basic nursing*. Philadelphia, PA: Lippincott Williams & Wilkins.

Royal Children's Hospital Melbourne [RCH]. (2015). Assessment of dermatome block. Retrieved https://www.rch.org.au/anaes/pain_management/Assessment_of_sensory_block/

Royal Children's Hospital Melbourne [RCH] (2017). Clinical Guidelines Nursing: Assessment. Retrieved https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Nursing_assessment/

Safer Health Care Now. (2015). Reducing falls and injuries from falls. Retrieved http://www.patientsafetyinstitute.ca/en/toolsResources/Documents/Interventions/Reducing%20Falls%20and%20Injury%20from%20Falls/Falls%20Getting%20Started%20Kit.pdf

Stephen, T. C., Skillen, D. L., Day, R. A., & Jensen, S. (2012). *Canadian Jensen's nursing health assessment: A best practice approach*. Philadelphia, PA: Wolters Kluwer-Lippincott.

Wilson, S. F., & Giddens, J. F. (2013) *Health assessment for nursing practice* (5th ed.) St Louis, MO: Mosby.

CHAPTER 3. SAFER PATIENT HANDLING, POSITIONING, TRANSFERS AND AMBULATION

3.1 Introduction

In healthcare, all patient-handling activities, such as positioning, transfers, and ambulation, are considered high risk for injury to patients and healthcare providers. This chapter reviews the essential guidelines for proper body mechanics and safe transfer techniques to minimize and eliminate injury in healthcare.

Learning Outcomes

- Describe body mechanics and principles of body mechanics.
- Define musculoskeletal injury (MSI).
- Discuss factors that contribute to an MSI, and ways to prevent an MSI.
- Discuss risk assessment and four areas of attention required when moving patients.
- Describe how different levels of assistance affect decisions about assisting with mobility and transfers.
- Describe various techniques for positioning a patient in bed and types of positions.
- Describe the process of a one person transfer assist from bed to a wheelchair including the use of any assistive device.
- Describe how to transfer a patient from a stretcher to a bed using an assistive device.
- Discuss situations where mechanical assistive devices are necessary when moving patients.
- Discuss falls prevention strategies.

3.2 Body Mechanics

Body mechanics involve the coordinated effort of muscles, bones, and the nervous system to maintain balance, posture, and alignment during moving, transferring, and positioning patients. Proper body mechanics allows individuals to carry out activities without excessive use of energy, and it helps prevent injuries for patients and health care providers (Perry, Potter, & Ostendorf, 2018).

Musculoskeletal Injuries

A **musculoskeletal injury (MSI)** is an injury or disorder of the muscles, tendons, ligaments, joints or nerves, blood vessels, or related soft tissue including sprains, strains, or inflammation related to a work injury. MSIs are the most common health hazard for healthcare providers (WorkSafeBC, 2013). Table 3.1 lists risk factors that contribute to MSI.

Table 3.1 Factors that Contribute to MSIs	
Factor	*Special Information*
Ergonomic risk factors	**Force**: Lifting, lowering, carrying, pushing, pulling, and grip all involve force. Strong forces and light forces present risk for MSI. **Repetition**: Refers to using the same group of muscles to complete a task over and over with little time for muscles to recover. **Work posture**: The position of different parts of the body, particularly awkward positions, can exert force on the muscles and bones, which causes strain. When a joint bends excessively or awkwardly, or outside its range of motion, MSI can occur. This also includes static postures. Workers need to change their body posture and move about periodically. **Local contact stress**: Refers to when hard or sharp objects come in contact with the skin, and the nerves and tissues become damaged by pressure.
Individual risk factors	Poor work practice; poor overall health (smoking, drinking alcohol, and obesity); poor rest and recovery; poor fitness, hydration, and nutrition
Data sources: Perry et al., 2018; WorkSafeBC, 2008; WorkSafeBC, 2013	

When healthcare providers are exposed to ergonomic risk factors, they become fatigued and risk musculoskeletal imbalance. Additional exposure related to individual risk factors puts healthcare providers at increased risk for MSI (WorkSafeBC, 2013). Preventing MSIs is achieved by understanding the elements of body mechanics; applying the principles of body mechanics to all work-related activities; understanding how to assess a patient's ability to position or transfer; and learning safe handling transfers and positioning techniques.

Elements of Body Mechanics

Body movement requires coordinated muscle activity and neurological integration. It involves the basic elements of body alignment (posture), balance, and coordinated movement. Body alignment and posture bring body parts into position to promote optimal balance and body function. When the body is well aligned, whether standing, sitting, or lying, the strain on the joints, muscles, tendons, and ligaments is minimized (WorkSafeBC, 2013).

Body alignment is achieved by placing one body part in line with another body part in a vertical or horizontal line. Correct alignment contributes to body balance and decreases strain on muscle-skeletal structures. Without this balance, the risk of falls and injuries increases. In the language of body mechanics, the **centre of gravity** is the centre of the weight of an object or person. A lower centre of gravity increases stability. This can be achieved by bending the knees and bringing the centre of gravity closer to the base of support, keeping the back straight. A wide **base of support** is the foundation for stability and is achieved by placing feet a comfortable, shoulder-width distance apart. When a vertical line falls from the centre of gravity through the wide base of support, **body balance** is achieved. If the vertical line moves outside the base of support, the body will lose balance.

The diagram in Figure 3.1 demonstrates: (A) a well-aligned person whose balance is maintained and whose **line of gravity** falls within the base of support; (B) balance is not maintained when the line of gravity falls outside the base of support; and (C) balance is regained when the line of gravity falls within the base of support.

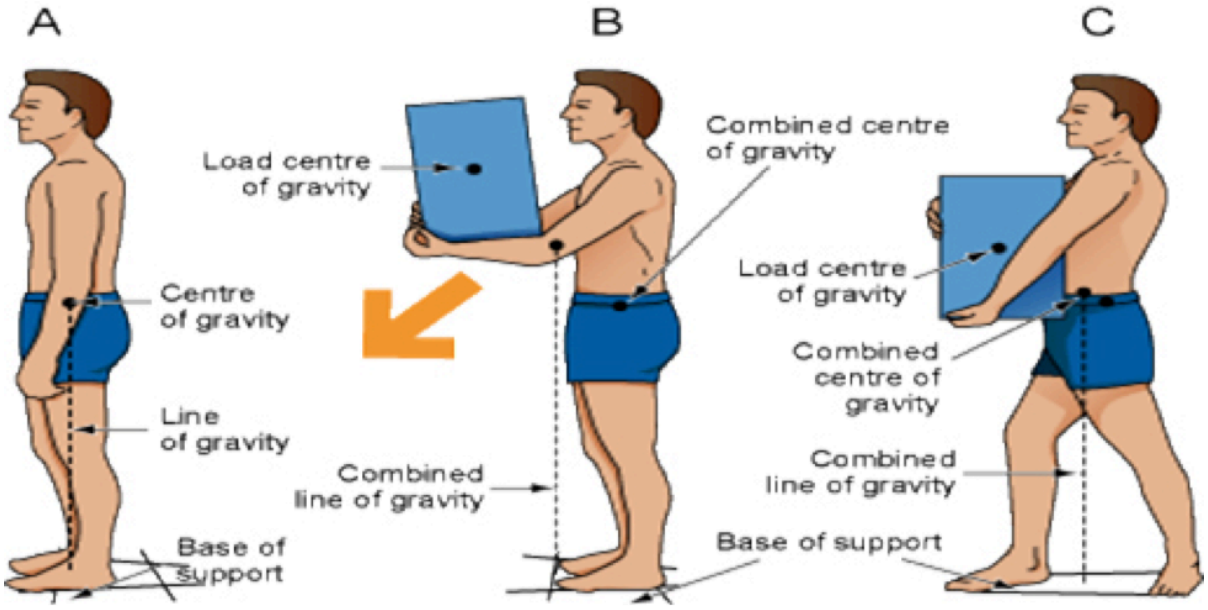
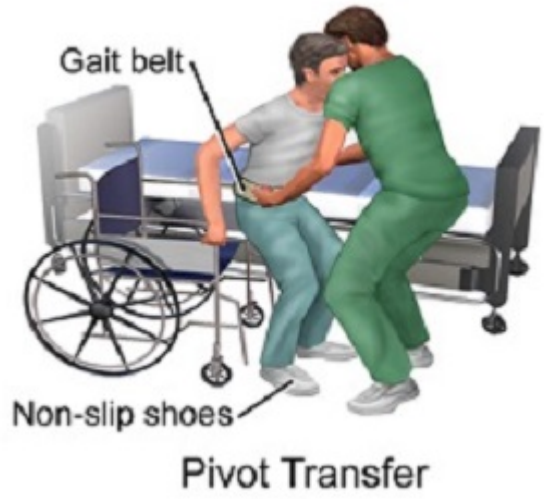


Figure 3.1 Centre of gravity

Principles of Body Mechanics

Table 3.2 describes the principles of body mechanics that should be applied during all patient-handling activities.

Table 3.2 Principles of Body Mechanics	
Action	*Principle*
Assess the environment.	Assess the weight of the load before lifting, and determine if assistance is required.
Plan the move.	Plan the move; gather all supplies; and clear the area of obstacles.
Avoid stretching and twisting.	Avoid stretching, reaching, and twisting, which may place the line of gravity outside the base of support.
Ensure proper body stance.	Keep stance (feet) shoulder-width apart. Tighten abdominal, gluteal, and leg muscles in anticipation of the move. Stand-up straight to protect the back and provide balance.

Stand close to the object being moved.	Place the weight of the object being moved close to your centre of gravity for balance.  *Hold objects close to your centre of gravity*  *Figure 3.2 Note the caregiver's center of gravity and proximity to the patient* Remain as close to the person as possible when you are about to transfer. Use the long and strong muscles of arms and legs, not the back muscles.
Face direction of the movement.	Facing the direction prevents abnormal twisting of the spine.

Avoid lifting.	Turning, rolling, pivoting, and leverage requires less work than lifting. Do not lift if possible; use mechanical lifts as required. Encourage the patient to help as much as possible. **Note**: Many agencies have "no lift" policies.
Work at waist level.	Keep all work at waist level to avoid stooping. Raise the height of the bed or object if possible. Do not bend at the waist.
Reduce friction between surfaces.	Reduce friction between surfaces, so that less force is required to move the patient. Special sliding sheets can be used to ease patient transfers or positioning.
Bend the knees.	Bending the knees maintains your centre of gravity and lets the strong muscles of your legs do the lifting.
Push the object rather than pull it, and maintain continuous movement.	It is easier to push an object than to pull it. Less energy is required to keep an object moving than to stop and start it.
Use assistive devices.	Use assistive devices (gait belt, slider boards, mechanical lifts) as required to position patients and transfer them from one surface to another.
Work with others.	The person with the heaviest load should coordinate all the effort of the others involved in the handling technique.
Data sources: Berman & Snyder, 2016; Perry et al., 2018; Registered Nursing, n.d.; WorkSafeBC, 2013	

Critical Thinking Exercises

1. How do body alignment and body balance contribute to proper body mechanics?
2. John is asked to transfer a client from the bed to a stretcher. Name five principles of body mechanics John can implement to prevent a MSI.

Attributions

Figure 3.2 An illustration depicting how to transfer someone using the pivot method by BruceBlaus is used under a CC BY-SA 4.0 license.

3.3 Risk Assessment for Safer Patient Handling

Risk Assessment for Safer Patient Handling

To prevent and minimize MSI injuries related to patient handling activities, a risk assessment must be done to determine a patient's ability to move, the need for assistance, and the most appropriate means of assistance (Provincial Health Services Authority [PHSA], 2010). There are four important areas to assess:

- The patient
- The environment
- The healthcare provider
- The organization of the work

Checklist 24 outlines these four areas of assessment and what to consider prior to positioning, ambulation, and transfers.

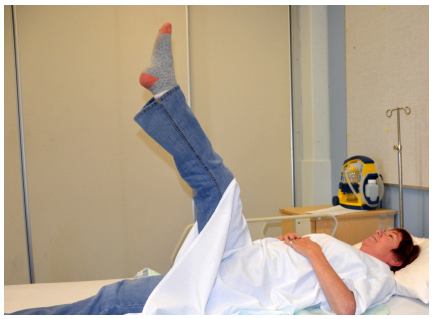
Checklist 24: Risk Assessment for Safer Patient Handling.

Disclaimer: Always review and follow your hospital policy regarding this specific skill.

Safety considerations:

- The assessment process should not override clinical judgment and patient-specific needs as determined by the healthcare team.
- An assessment should be performed before each handling procedure.
- Seek additional help if a procedure requires two or more persons.
- Use assistive devices (gait belts, slider boards, pillows, etc.) to perform the procedure safely.
- Assess the patient's ability to tolerate the movement. Acute pain, shortness of breath, and inability to follow direction will place the healthcare provider and patient at risk for injury.
- Always consider the principles of proper body mechanics prior to any procedure, such as raising the head of bed and tucking elbows in to help prevent injuries.
- Avoid lifting shoulders when positioning a patient.
- Never lift a patient; always use a weight shift to perform the procedure.
- When positioning a patient using a sheet, place palms of hands up. A palms-down technique increases risk for injury.
- Vision and hearing loss, and language barriers can make communicating with the patient difficult and can result in increased risk for injury.
- Ensure the plan of care is updated regularly.

Steps	*Additional Considerations*

1. Assess your **patient.**	There are three areas to assess: 1. Is the patient cooperative and able to follow directions? Ask patient to squeeze your hands. Is the behaviour predictable (non-aggressive, fearful, or fatigued)? Is the patient able to follow directions with cues? • If yes, proceed to next question. • If no, use a mechanical lift for transfers and/or assistive devices for repositioning in bed if patient has some abilities. 2. Can the patient bear weight? Ask patient to lift buttocks off the bed (also known as "bridging") and hold the position for five seconds. The healthcare provider may give cues on how to lift buttocks off the bed.  *Bridging hips strength test* After bridging, ask the patient to perform a straight leg raise by lifting one leg up off the bed and holding it for five seconds while the other leg is kept bent. Repeat with the opposite leg.  *Leg lift strength test* • If yes, proceed to next question. • If no, use an appropriate moving technique, such as a mechanical lift and/or assistive device, to transfer a non-weight-bearing patient.

	3. Can the patient sit up on the side of the bed without support? Can the patient sit forward on a chair or the edge of the bed without support?  *Sit unassisted on the bed* • If yes, decide on the amount of assist required (minimum, moderate, or maximum) according to your agency policy. • If no, use a mechanical lift for transfers and/or an assistive device for repositioning if patient has some movement abilities. Risk assessment also involves knowing any activity restrictions associated with recent surgery or injury.
2. Assess your **environment**.	Is there adequate space? Is available equipment in proper working order? Have all hazards been removed?
3. Assess **yourself** and readiness to perform procedures.	Complete all required training according to health agency regulations. Wear non-slip footwear. Maintain a neutral spine; do not twist or side bend; and use proper body mechanics when moving or positioning patients. Designate a leader if working in a team to mobilize or position a patient. Always use proper weight-shift techniques (side to side, front to back, and up and down).
4. Assess your **work organization**.	Ensure adequate number of caregivers. Ensure there is enough time to perform the procedure. Take rest breaks and vary activities to promote optimal back health. If patient is complex or bariatric, consult additional resources, seek assistance, and use assistive devices.
Data sources: Interior Health, 2013; National Institute of Occupational Safety and Health, 2010; PHSA, 2010; WorkSafeBC, 2010	

The following are useful resources to help you further develop your understanding of assessment and decision making around patient handling activities.

Read the *Mobility Decision Support Tool* flowchart, which was provincially developed, to guide decision making about transfers and ambulation.

Watch the *Assess Every Time* video, which was developed by WorkSafeBC, to review the quick assessment as described in Checklist 24.

Here is a sample of a *Safe Patient Handling Assessment Form* from the Winnipeg Region Health Authority (2015).

Critical Thinking Exercises

1. Name five things the healthcare worker should assess about themselves when considering their own ability to perform a patient-handling procedure?
2. Vision and hearing impairments, as well as language barriers, are risk factors when performing patient-handling procedures. What additional patient risk factors should be considered?

3.4 Levels of Assistance

Some patient conditions result in a decreased ability to perform activities of daily living including one's ability to be mobile. Some patients may require assistance to move around in bed, or to transfer from bed to wheelchair or bed to stretcher. Others may need assistance to ambulate. Changing patient positions in bed and mobilization are also vital to prevent contractures from immobility, maintain muscle strength, prevent pressure injury, and to help body systems function properly for optimal health and healing (Perry et al., 2018). The amount of assistance each patient will require depends on the patient's previous health status, age, type of illness, and length of stay (Perry et al., 2018).

General Description—Levels of Assistance

Commonly in acute and residential care settings, patients are assessed and assigned with a "level of assistance" designation. The level of assistance required is based on the patient's ability to transfer, stand, and cooperate in care activities. Terms to describe different levels of assistance are one way for health care providers to communicate with each other how much and what kind of assistance is required.

The terms may differ from one institution to the next and as such it is the healthcare provider's responsibility is to know the correct terms in the institutions they are working in (South Island Alliance, n.d.). The level of assistance needed is somewhat subjective can change over time. Thus, the need for constant reassessment and communication by and among the healthcare team (South Island Alliance, n.d.).

The level of assistance should be documented where healthcare providers can easily access the information. This might include the patient's Kardex, above the head of the bed, and/or in the patient's chart. Table 3.3 describes general levels of assistance and the terminology sometimes used in hospital and community settings to describe them.

Table 3.3 General Levels of Assistance

Level of Assistance Terminology	*Criteria*
Independent	The patient: • is able to transfer independently and safely.
Standby Supervision / One Person Assist	• requires no physical assistance but may require verbal reminder. • may also be learning to transfer independently using a wheelchair, walker, or cane.
Minimal Assist / One Person Assist	• is cooperative and reliable, but needs minimal physical assistance with the transfer. • requires minor physical exertion from healthcare worker during re-positioning, assisting to stand / sit, and when ambulating. • can consistently fully weight bear when standing. • is able to perform 75% of the required activity on their own.
Two Person Assist	• requires more than minor physical assistance. • often needs equipment to assist with transfers or mobilization. • is able to perform 50% of the required activity on their own.
Total Assist	• requires full physical assistance for re-positioning, standing, turning, transfers, and/or mobility. • may be unpredictable and uncooperative. • requires equipment to assist with re-positioning and transfers • is able to perform 0-25% of the required activity on their own.
Data sources: South Island Alliance, n.d.; Winnipeg Regional Health Authority (WRHA), 2008; Worksafe BC, 2006	

Special considerations:

- The weight, height, and general physical, mental, or emotional condition of the patient all influence the potential for injury to the patient and healthcare worker.
- If the patient is uncooperative or unable to follow commands, there is an increased risk for injury. In these cases, a mechanical lift or assistive device should be used to prevent injury to the healthcare provider and/or patient.
- Any patient-handling injuries must be reported using the **British Columbia Patient Safety and Learning System (BCPSLS)**, a web-based tool used to report and learn about safety events, near misses, and hazards in healthcare settings (BCPSLS Central, 2015).

Critical Thinking Exercises

1. A patient requires no assistance from the healthcare provider except for the occasional reminder to lift their feet while walking. What level of activity designation would you give to this patient?
2. A patient is assessed as needing a one-person pivot transfer. As the healthcare provider begins the transfer, the patient suddenly becomes uncooperative. What should the healthcare provider do next?

3.5 Assistive Devices

An **assistive device** is an object or piece of equipment designed to help a patient with activities of daily living, such as a walker, cane, gait belt, or mechanical lift (WHO, 2018). Assistive devices also allow the the healthcare worker to transfer and move patients in a way that reduces risk for injury to themselves and patients. Table 3.4 lists some assistive devices found in the hospital and community settings that can be used to help transfer patients in and out of bed and within the bed.

Table 3.4 Assistive Devices to Help Transfer Patients In and Out of Bed and Within the Bed

Type	*Definition*
Gait belt or transfer belt	Used to ensure a good grip on potentially unstable patients. The device provides added stability when transferring patients. It is a 5 mm (2 in) wide belt, with or without handles, that is placed around a patient's waist and fastened with Velcro. The gait belt must always be applied on top of clothing or gown to protect the patient's skin. A gait belt can be used with patients in both one-person or two-person pivot transfer, or in transfer with a slider board.  *Gait belt*

Slider board (stretcher board)	 *Slider board (red) on a stretcher*  *Placing a slider board (transfer board) under a patient* A slider board is used to transfer immobile patients from one surface to another while the patient is lying supine. The board assists healthcare providers move immobile, bariatric, or complex patients more safely.

Mechanical lift	A mechanical lift is a hydraulic lift, usually attached to a ceiling, used to move patients who cannot bear weight, who are unpredictable or unreliable, or who have a medical condition that does not allow them to stand or assist with moving.  *Mechanical lift*
Air transfer mattress	Using air assisted technology, air transfer mattresses allow caregivers to easily reposition and transfer patients laterally (i.e., bed to stretcher and vice versa). See: Product information for HoverMatt Air Transfer System.
Slider sheets	Nylon sheets used under the patient. Sometimes the nylon is the undersurface of the transfer sheet. Sometimes a combination of a transfer sheet's nylon surface in contact with a nylon surface fitted bed sheet can help to reduce friction during patient moves in bed.  *Figure 3.3 Slider sheet / turning sheet*

Monkey bar (a.k.a., medical trapeze)	A trapeze positioned above the patient near the head of the bed allows the patient to grasp and reposition themselves or to help with re-positioning. The trapeze can be fixed to the bed or free standing. They are contraindicated in some situations including new spinal cord injury, post abdominal surgery, and shoulder conditions.  *Figure 3.4 bed trapeze / monkey bar*
Sit to stand lift	Device used to assist patients from a sitting to standing position.  *Figure 3.5 Sit to stand mechanical lift*

Transfer board	Transfer boards (not to be confused with a slider or stretcher board) are small pieces of rigid wood or plastic used to bridge the gap between two surfaces. For example, between a wheelchair and a bed. When a patient is initially learning to use a transfer board, one to two healthcare workers may use a gait belt to assist. Eventually some patients are able to transfer independently from a wheelchair to bed using a transfer board.  *Figure 3.6 Slider board for transferring bed to chair and vice versa*
Data sources: HoverTech International, 2016; Perry et al., 2018.	

Special considerations:

- Use assistive devices only if properly trained in their safe use.
- Always tell patients what you are about to do, and how they should assist you in the procedure.
- Always perform a patient risk assessment or mobility assessment prior to using any assistive devices. The Assessing Risks web page from WorkSafeBC provides additional information regarding assessing risk and resources to help with decisions around safe patient handling.
- Use proper body mechanics when using assistive devices to reduce risk of injury.

Critical Thinking Exercise

1. A 100 kg patient with limited mobility requires transfer from his bed to stretcher. The nurse chooses to

use a HoverMatt© air transfer mattress for the transfer. Describe how this technology limits musculoskeletal strain, and give the steps for its use in this situation.

3.6 Types of Patient Transfers

Transfers involve moving a patient from one flat surface to another, such as from a bed to a stretcher (Perry et al., 2018). Types of hospital transfers include bed to stretcher, bed to wheelchair, wheelchair to chair, and wheelchair to toilet, and vice versa. Table 3.5 outlines types of transfers and patient factors that help to determine appropriateness of each.

Table 3.5 Types of Transfers

Type of Transfer	*Appropriateness*
One-person standing pivot	The patient: • can bear weight on one or both legs. • is cooperative and predictable. • can sit with minimal support on the side of the bed. **Note**: A gait belt may or may not be used.
Two-person standing pivot	• can assist with weight bearing, but may be inconsistent. • is cooperative and predictable. **Note**: Two-person transfer with a gait belt, a stander, or a two-person transfer with a slide board and a gait belt may be used.
One-person assist with transfer board	• is cooperative, follows directions, and has good trunk control. • can use their arms, but cannot bear weight on both legs.
Two-person assist with transfer board	• is cooperative and can follow directions. • can use their arms, but cannot bear weight on both legs. • does not have good trunk control. **Note**: If transferring out of a wheelchair, the chair must have removable arms.
Sit-to-stand	• can actively participate, with some ability to stand. • is reliable. • is predictable. • is a heavy two-person transfer. • does not have severe limb contractures or injuries where movement is medically contraindicated (e.g., spinal injury).
Mechanical / ceiling track	• cannot reliably stand. • is unpredictable. • is too heavy for a two-person transfer.

Data sources: WorkSafeBC, 2006; WRHA, 2008

Review this *Mobility Decision Support Tool* from Interior Health (n.d.).

Sections 3.7 and 3.8 offer more information about patient transfers with or without mechanical assistive devices.

3.7 Types of Patient Transfers: Transfers without Mechanical Assistive Devices

Patient Transfer from Bed to Stretcher

A bed to stretcher transfer requires a minimum of three to four people, depending on the size of the patient and the size and strength of the healthcare providers. Patients who require this type of transfer are generally immobile or acutely ill, so they may be unable to assist with the transfer. Checklist 25 shows the steps for moving patients laterally from one surface to another.

Checklist 25: Moving a Patient from Bed to Stretcher

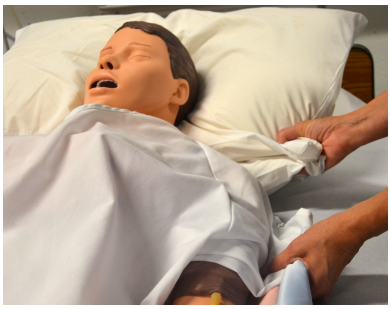
Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

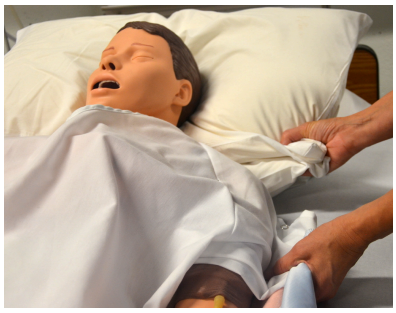
- Complete risk assessment for safer patient handling
- Complete QPA including safety.
- Inform the patient what is about to happen and how they can assist.
- Ensure tubes and attachments are properly placed prior to the procedure to prevent accidental removal.
- Ensure brakes are locked on the bed and stretcher.
- A slider board and full-size sheet or friction-reducing sheet are required for the transfer.

Steps	*Additional Information*
1. Always predetermine the number of staff required to safely transfer a patient horizontally.	Three to four healthcare providers are required for the transfer.

2. Explain what will happen and how the patient can help (tucked-in chin, keep hands on chest). Collect supplies.	This step provides the patient with an opportunity to ask questions and help with the transfer.  *Stretcher and slider board*  *Chin tucked-in and arms across chest*
3. Raise bed to safe working height. Flatten the head of bed and side rails. Position the patient closest to the side of the bed where the stretcher will be placed.	Safe working height is at waist level of the shortest healthcare provider. The patient must be positioned correctly prior to the transfer to avoid straining and reaching. May need additional healthcare providers to move patient to the side of the bed.

4. Position stretcher beside the bed on the side closest to the patient with stretcher slightly lower. Apply brakes. Caregiver #1 stands closest to the patient. Caregiver #2 and #3 stand on the other side of the bed: #2 is at the head and shoulders, and #3 is at the hips and legs. Caregiver #4 can be used to move feet or equipment, or help #2 and #3 with pulling.	The slider board will form a bridge between the bed and the stretcher. The sheet must be between the patient and the slider board to decrease friction between patient and board.  *Place slider board* Ensure all tubes and attachments are out of the way.
5. Caregiver #1 uses a front-to-back weight shift to roll patient onto their side using the sliding sheet. Meanwhile, caregivers #2 and #3 climb onto and kneel on the bed to place the slider board halfway under the patient. The patient is returned to the supine position. Patient's feet are positioned on the slider board.	Ensure proper body mechanics by keeping elbows close and backs tall. The position of the healthcare providers keeps the heaviest part of the patient near the healthcare providers' centre of gravity for stability.  *Caregiver at the head of the bed*
6. Caregivers #2 and #3 can remain on the stretcher. They grasp the draw sheet using a palms up technique, sitting-up tall, and keeping their elbows close to their body and backs straight. Caregiver #1 remains on the far side of the bed, between the chest and hips of the patient, with hands on hips and shoulders and forearms parallel to the bed.	Alternately, caregivers #2 and #3 can stand on the floor opposite to caregiver #1, grab the draw sheet using a palms up technique, and a front-to-back weight shift position.

7. The designated leader will count “1, 2, 3,” and start the move. Caregiver #1 will push patient just to arm’s length using a back-to-front weight shift. At the same time, caregivers #2 and #3 on the stretcher will move from a sitting-up-tall position to sitting on their heels, shifting their weight from the front leg to the back, bringing the patient with them using the sheet.	Coordinating the move between healthcare providers prevents injury while transferring patients. Using a weight shift from front-to-back uses the legs to minimize effort when moving a patient.

8. Caregivers #2 and #3 will climb off the stretcher and stand at the side, and grasp the sheet keeping elbows tucked-in. On the count of three, with backs straight and knees bent, they use a front-to-back weight shift and slide the patient into the middle of the bed.	The step allows the patient to be properly positioned in the bed and prevents back injury to healthcare providers.  *Caregiver at the head of the bed*  *Weight on front leg*  *Shift weight to back foot*
9. At the same time, caregiver #1 pulls the slider board out from under the patient.	This step allows the patient to lie flat on the bed.
10. Replace pillow under head, ensure patient is comfortable, and cover the patient with sheets.	This promotes comfort and prevents harm to patient.

11. Lower bed. Raise side rails as required, and ensure call bell is within reach. Perform hand hygiene.	Placing bed and side rails in a safe position reduces the likelihood of injury to patient. Proper placement of call bell facilitates patient's ability to ask for assistance.  *Bed in lowest position, side rail up, call bell within reach* Hand hygiene reduces the spread of microorganisms.
Data sources: Perry et al., 2018; PHSA, 2010	

Take PHSA's *Lateral Transfer Sliding Board* course for more information on sliding board transfer.

Transfer from Bed to Wheelchair

Patients often need assistance when moving from a bed to a wheelchair. A patient must be cooperative and predictable, and able to bear weight on both legs and take small steps. If any of these criteria are not met, a two-person transfer or mechanical lift is recommended. Always complete a patient risk assessment prior to all patient-handling activities. See Checklist 26 for the steps to transfer a patient from the bed to the wheelchair (PHSA, 2010).

Checklist 26: Bed to Wheelchair Transfer—One Person Assist

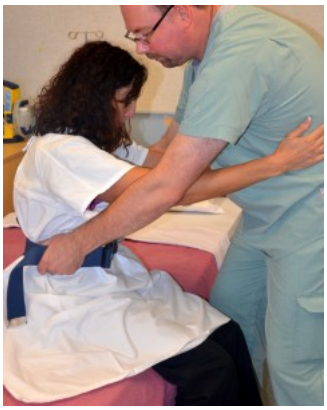
Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Complete risk assessment for safer patient handling
- Complete QPA including safety.
- Inform the patient what is about to happen and how they can assist.
- Ensure tubes and attachments are properly placed prior to the procedure to prevent accidental removal.
- Ensure brakes are locked on the bed and stretcher.
- A gait belt and wheelchair are required.

Steps	*Additional Information*
1. Perform hand hygiene. Explain what will happen during the transfer and how the patient can help.	This step provides the patient with an opportunity to ask questions and help with the positioning.  Explain procedure to patient

2. Apply proper footwear prior to ambulation.	 *Proper footwear*
3. Lower the bed and ensure that brakes are applied. Place the wheelchair next to the bed at a 45-degree angle and apply brakes. If a patient has weakness on one side, place the wheelchair on the stronger side.	Ensure brakes are applied on the wheelchair.  *Wheelchair with one leg rest removed*
4. Sit patient on the side of the bed with his or her feet on the floor. Apply the gait belt snugly around the waist (if required). Place hands on waist to assist into a standing position.	The patient's feet should be in between the healthcare provider's feet.

5. As the patient leans forward, grasp the gait belt (if required) on the side of the patient, with your arms outside the patient's arms. Position your legs on the outside of the patient's legs. The patient's feet should be flat on the floor.	 *Assist to a standing position using a gait belt*
6. Count to three and, using a rocking motion, help the patient stand by shifting weight from the front foot to the back foot, keeping elbows in and back straight.	 *Weight shift to back leg by healthcare provider*

7. Once standing, have the patient take a few steps to the side and back until they can feel the wheelchair on the back of their legs. Have patient grasp the arm of the wheelchair and lean forward slightly.	Ensure the patient can feel the wheelchair on the back of the legs prior to sitting down.  *Assist into the wheelchair*
8. As the patient sits down, shift your weight from back to front with bent knees, with trunk straight and elbows slightly bent. Allow patient to sit in wheelchair slowly, using armrests for support.	This allows the patient to be properly positioned in the chair and prevents back injury to healthcare providers.  *Transfer to wheelchair*
Data sources: Perry et al., 2018; PHSA, 2010	

Special considerations:

- Do not allow patients to place their arms around your neck. Have them place their arms around your hips.
- Avoid lifting patients. Let them stand using their own strength.

- Stay close to your patient during the transfer to keep the patient's weight close to your centre of gravity
- If the patient has weakness on one side of the body (e.g., due to a **cerebral vascular accident [CVA]** or stroke), place the wheelchair on the stronger side.

2019 Update: some health authorities are no longer recommending the care giver be positioned directly in front of the patient being transferred. Instead, the care giver should stand to the side of the patient and use a gait belt or transfer belt to guide the patient.

See Interior Health (nd). Patient handling procedure: One person manual transfer https://www.interiorhealth.ca/sites/Partners/WHSresources/Documents/Manual%20Transfers%20-%20One%20Person%20SWP.pdf

Watch the video *Assisting from Bed to Chair with a Gait Belt or Transfer Belt* (2018) by Kim Morris of Thompson Rivers University School of Nursing.

Take PHSA's *Standing Step Around Transfer* (2010) course to learn the method for a bed to wheelchair transfer.

Critical Thinking Exercises

1. Prior to moving the patient from bed to a wheelchair, where should the patient's feet be placed?

3.8 Types of Patient Transfers: Transfers Using Mechanical Aids

Depending on the risk assessment, the healthcare worker may choose to use a mechanical aid to assist with transferring a patient. The following videos provide some general direction to do this. It is the nurse's responsibility to be oriented to the equipment they are working with and always use it in a safe manner.

Watch the following videos (2018) by Kim Morris of Thompson Rivers University School of Nursing:

Sit to Stand Mechanical Assist

How to Use a Ceiling Lift

How to Use a Hammock Sling

How to Use a Hygiene Sling

Table 3.6 provides information about different kinds of slings used in the above videos.

Table 3.6: Choosing a Sling to Be Used with the Ceiling Lift	
Type of Sling	*Indications for Use*
Universal slings	• Can be applied while the client is sitting in a wheelchair. • Some universal slings are large enough to provide neck support. • Different loops allow the user to adjust the patient's position (i.e., head up, flat, etc.). • Follow the manufacturer's guidelines for use.
Hammock slings	• Provide more support than a universal sling. • Fit from just above the knees to the back of the head, thus giving some neck support. • Cannot be taken off while the patient is in a wheelchair. • Different loops allow for adjustments to the angle that the user will sit during the transfer.
Hygiene slings	• Intended to be used for transfers associated with toileting and cleaning. • Provide relatively little support, as they have less material than a universal or hammock sling. • Intended to provide patient support for a short time only.
Data source: Stewart, 2018	

Special considerations:

- All mechanical aids have weight restrictions. Check your agency equipment and guidelines.
- All equipment has specific manufacturer's guidelines for use. It is the agency's responsibility to provide resources for orientation to all equipment and the healthcare worker's responsibility to be oriented to the use of all equipment being used.

Critical Thinking Exercises

1. In the following situations, provide rationale for your choice of type of sling when using a ceiling lift: (a) transfer to a shower chair; (b) transfer to a wheelchair.

3.9 Positioning Patients in Bed

Positioning a patient in bed is important for maintaining alignment and for preventing pressure injury, foot drop, and contractures (Perry et al., 2018). Proper positioning is also vital for providing comfort for patients who are bedridden or who have decreased mobility related to a medical condition or treatment. When positioning a patient in bed, supportive devices such as pillows, rolls, wedges, and blankets, along with re-positioning, can aid in providing comfort and safety (Perry et al., 2018).

Positioning Patients in Bed

Positioning a patient in bed is a common procedure in the hospital. There are various positions possible for patients in bed, which may be determined by their condition, preference, or treatment related to an illness. Table 3.7 identifies patient positions in bed and a description for each.

Table 3.7 Patient Positions in Bed

Position	*Description*
Supine position	Patient lies flat on back. Additional supportive devices may be added for comfort, i.e., under lower legs, under head.  *Supine position*
Prone position	Patient lies on stomach with head turned to the side.  *Prone position*

Lateral position	Patient lies on the side of the body with the top leg over the bottom leg. This position helps relieve pressure on the coccyx.  *Lateral position*
Sims position	Patient lies between supine and prone with legs flexed in front of the patient. Arms should be comfortably placed beside the patient, not underneath.  *Sims position*

Fowler's position	Patient's head of bed is placed at a 45-degree angle. Hips may or may not be flexed. This is a common position to provide patient comfort and care.  *Fowler's position* • high Fowler's position is used to describe a patient's position where the upper body is positioned approximately 60 and 90 degrees in relation to the lower body.
Semi-Fowler's position	Patient's head of bed is placed at a 30-degree angle. This position is used for patients who have cardiac or respiratory conditions, and for patients with a nasogastric tube and who have enteral nutrition.  *Semi-Fowler's position*

Orthopneic or tripod position	Patient sits at the side of the bed with head resting on an over-bed table on top of several pillows. This position is used for patients with breathing difficulties.  *Figure 3.7 Tripod position – relieves restriction on rib cage and promotes lung expansion*
Trendelenburg position	Place the head of the bed lower than the feet. This position is used in situations such as hypotension and medical emergencies. It helps promote venous return to major organs such as the head and heart.  *Trendelenburg position*
Data sources: Perry et al., 2018; Potter et al., 2017	

Moving a Patient Up in Bed

When moving a patient in bed, perform a patient risk assessment prior to the procedure to determine the level of assistance needed for optimal patient care. If a patient is unable to assist with repositioning in bed, follow agency policy regarding “no patient lifts” and the use of

mechanical lifts for complex and bariatric patients. See Checklist 27 for the steps to move a patient up in bed.

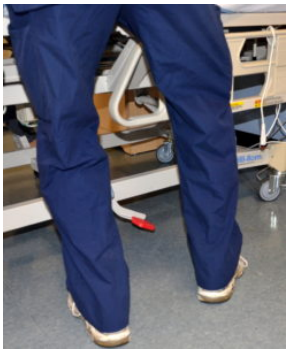
Checklist 27: Moving a Patient Up in Bed

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Perform hand hygiene.
- Check room for additional precautions.
- Introduce yourself to patient.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Complete risk assessment for safer patient handling
- Complete QPA including safety.
- Ensure tubes and attachments are properly placed prior to the procedure to prevent accidental removal.
- Ensure patient has a draw sheet and friction-reducing sheet on the bed prior to repositioning.

Steps	*Additional Information*
1. Make sure an additional healthcare provider is available to help with the move.	This procedure requires two healthcare providers.
2. Explain to the patient what will happen and how the patient can help.	Doing this provides the patient with an opportunity to ask questions and help with the positioning.
3. Complete risk assessment (Checklist 24) of patient's ability to help with the positioning.	This step prevents injury to patient and healthcare provider.

4. Raise bed to safe working height. The bed should be flat. Ensure brakes are applied. Healthcare providers stand on each side of the bed.	Principles of proper body mechanics help prevent MSI. Safe working height is at waist level of the shortest healthcare provider. Leaving the head of bed elevated increases effort required and increases risk of MSI.  *Bed at waist level*
5. Lay patient supine; place pillow at the head of the bed and against the headboard.	This step protects the head from accidentally hitting the headboard during repositioning.
6. Stand between shoulders and hips of patient with feet shoulder width apart. Weight will be shifted from back foot to front foot.	This keeps the heaviest part of the patient closest to the centre of gravity of the healthcare providers.  *Feet shoulder width apart*

7. Fan-fold the draw sheet toward the patient with palms facing up.	This provides a strong grip to move the patient up using the draw sheet.  *Fold sheet with fingers facing upward*
8. Ask patient to tilt head toward chest, fold arms across chest, and bend knees to assist with the movement. Let the patient know when the move will happen.	This step prevents injury from patient and prepares patient for the move.  *Chin tucked-in and arms across chest*
9. Tighten your gluteal and abdominal muscles, bend your knees, and keep back straight and neutral.	The principles of proper body mechanics help prevent injury.
10. On the count of three by the lead person, gently slide (not lift) the patient up the bed, shifting your weight from the back foot to the front, keeping back straight with knees slightly bent.	The principles of proper body mechanics help prevent injury.  *Facing direction of movement*
11. Replace pillow under head, position patient in bed, and cover with sheets.	This step promotes comfort and prevents harm to patient.

12. Lower bed, raise side rails as required, and ensure call bell is within reach. Perform hand hygiene.	Placing bed and side rails in safe positions reduces the likelihood of injury to patient. Proper placement of call bell facilitates patient's ability to ask for assistance.  *Bed in lowest position, side rail up, call bell within reach* Hand hygiene reduces the spread of microorganisms.
Data sources: Perry et al., 2018; PHSA, 2010	

Now complete the following online courses to learn more about how to move a patient up in bed.

Take the following PHSA courses:

Repositioning a Patient in Bed, Caregivers at Head teaches how to move a patient up in bed with caregivers at the head of the bed.

Repositioning a Patient in Bed, Caregivers Facing Each Other covers how to move a patient up in bed with the caregivers facing each other.

Repositioning a Patient in Bed, Diagonal Technique shows how to move a patient up in bed with the caregivers standing positioned diagonally.

Positioning a Patient to the Side of the Bed

Prior to ambulating, re-positioning, or transferring a patient from one surface to another (e.g., a stretcher to a bed), it may be necessary to move the patient to the side of the bed to avoid straining or excessive reaching by the healthcare provider. Positioning the patient to the side of the bed also allows the healthcare provider to have the patient as close as possible to the healthcare provider's centre of gravity for optimal balance during patient handling. Checklist 28 describes how to safely move a patient to the side of the bed.

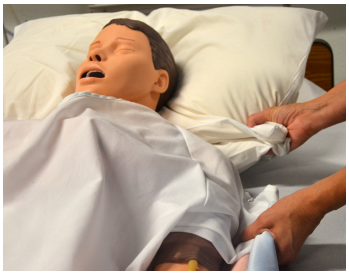
Checklist 28: Positioning a Patient to the Side of the Bed

Disclaimer: Always review and follow your agency policy regarding this specific skill.

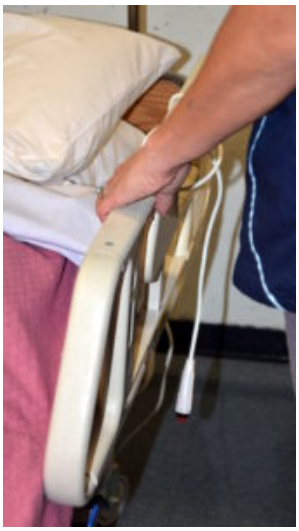
Safety considerations:

- Perform hand hygiene.
- Check room for additional precautions.
- Introduce yourself to patient.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Complete risk assessment for safer patient handling
- Complete QPA including safety.
- Ensure tubes and attachments are properly placed prior to the procedure to prevent accidental removal.
- Ensure patient has a draw sheet and a friction-reducing sheet on the bed prior to repositioning.

Steps	*Additional Information*
1. Make sure you have as many additional healthcare providers as needed to help with the move.	The procedure works best with two or more healthcare providers, depending on the size of the patient and the size of the healthcare professionals.
2. Explain to the patient what will happen and how the patient can help.	This provides the patient with an opportunity to ask questions and help with the positioning.
3. Raise bed to safe working height and ensure that brakes are applied. Lay patient supine.	Principles of proper body mechanics help prevent MSI. Safe working height is at waist level of the shortest healthcare provider.

4. Stand on the side of the bed the patient is moving toward. One person stands at the shoulder area and the other person stands near the hip area, with feet shoulder width apart.	This step keeps the heaviest part of the patient closest to the centre of gravity of the healthcare providers.  *Keep heaviest part of the patient closest to your centre of gravity*
5. Fan-fold the draw sheet toward the patient with palms facing up.	 *Fold sheet with fingers facing upward*
6. Have the healthcare provider at the head of the bed grasp the pillow with one hand and the draw sheet with the other hand.	This prevents injury to patient.  *Grasp the pillow with one hand and the draw sheet with the other*

7. Have patient place arms across chest.	This step prevents injury to patient.  *Chin tucked-in and arms across chest*
8. Tighten your gluteal and abdominal muscles, bend your knees, and keep back straight and neutral. Place one foot in front of the other. The weight will shift from the front foot to the back during the move.	Use of proper body mechanics helps prevent injury when handling patients.
9. On the count of three by the lead person, with arms tight and shoulders down, shift your weight from the front foot to the back foot. Use your large leg muscles to move the patient. Do not lift, but gently slide the patient.	 *Start move with weight on front foot*  *Shift weight to back foot* If the patient is bariatric, the move should be repeated to correctly position the patient, or use a mechanical lift.

10. Once patient is positioned toward the side of the bed, ensure pillow is comfortable under the head, and straighten sheets. Complete all other procedures related to safe patient handling.	This step promotes comfort and prevents harm to patient.  *Raise side rails*
11. Lower bed, raise side rails as required, and ensure call bell is within reach. Perform hand hygiene.	Placing bed and side rails in safe positions reduces the likelihood of injury to patient. Proper placement of call bell facilitates patient's ability to ask for assistance.  *Bed in lowest position, side rail up, call bell within reach* Hand hygiene reduces the spread of microorganisms.
Data sources: Perry et al., 2018; PHSA, 2010	

Take this PHSA *Repositioning a Patient to One Side of the Bed* course to learn how to position a patient to one side of the bed.

Critical Thinking Exercises

1. Your patient is experiencing shortness of breath related to heart failure. Which position in bed might best help people with this condition?
2. Consider how a mechanical assistive device might help with re-positioning a patient in bed.

Attribution

Figure 3.7 Tripod position by author is licensed under a Creative Commons Attribution 4.0 International License.

3.10 Assisting a Patient to Ambulate Using Assistive Devices

Immobility in hospitalized patients is known to cause functional decline and complications affecting the respiratory, cardiovascular, gastrointestinal, integumentary, musculoskeletal, and renal systems (Kalisch, Lee, & Dabney, 2013). For surgical patients, early ambulation is the most significant factor in preventing complications (Sanguinetti, Wild, & Fain, 2014). Lack of mobility and ambulation can be especially devastating to the older adult when the aging process causes a more rapid decline in function (Graf, 2006). Ambulation provides not only improved physical function, but also improves emotional and social well-being (Kalisch, Lee, & Dabney, 2013).

Prior to assisting a patient to ambulate, it is important to perform a patient risk assessment to determine how much assistance will be required. An assessment can evaluate a patient's muscle strength, activity tolerance, and ability to move, as well as the need to use assistive devices or find additional help. The amount of assistance will depend on the patient's condition, length of stay and procedure, and any previous mobility restrictions.

Before ambulating, the patient may need assistance getting to a sitting position.

Assisting Patient to the Sitting Position

Patients who have been immobile for a long period of time may experience **vertigo**, a sensation of dizziness, and **orthostatic hypotension**, a form of low blood pressure that occurs when changing position from lying down to sitting, making the patient feel dizzy, faint, or lightheaded (Potter et al., 2017). For this reason, always begin the ambulation process by sitting the patient on the side of the bed for a few minutes with legs dangling. Checklist 29 outlines the steps to positioning the patient on the side of a bed prior to ambulation (Perry et al., 2018).

Checklist 29: Assisting a Patient to a Sitting Position

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Complete risk assessment for safer patient handling
- Complete QPA including safety.
- Ensure tubes and attachments are properly placed prior to the procedure to prevent accidental removal.
- Follow the principles of proper body mechanics with all patient-handling procedures

Steps	*Additional Information*
1. Check prescriber's orders for any restrictions related to ambulation due to medical treatment or surgical procedure.	Equipment (proper footwear, gait belt, or assistive devices) must be gathered prior to ambulation. Do not leave patient sitting on the side of the bed unsupervised, as this poses a safety risk.
2. Explain what will happen and let the patient know how they can help.	This step provides the patient with an opportunity to ask questions and help with the positioning.
3. Lower bed and ensure brakes are applied.	This prepares the work environment.
4. Stand facing the head of the bed at a 45-degree angle with your feet apart, with one foot in front of the other. Stand next to the waist of the patient.	Proper positioning helps prevent back injuries and provides support and balance.

5. Have patient turn onto side, facing toward the caregiver. Assist patient to move close to the edge of the bed.	Turning, rolling, and leverage requires less work than lifting. This step prepares the patient to be moved.  *Positioning patient on the side of the bed*
6. Place one hand behind patient's shoulders, supporting the neck and vertebrae.	This provides support for the patient. If available, use the electric bed to elevate the patient's torso to a sitting position.
7. On the count of three, instruct the patient to use their elbows to push up on the bed and then grasp the side rails, as you support the shoulders as the patient sits up. Shift weight from the front foot to the back foot.	Do not allow the patient to place their arms around your shoulders. This action can lead to serious back injuries.

8. At the same time as you're shifting your weight, gently grasp the patient's outer thighs with your other hand and help the patient slide their feet off the bed to dangle or touch the floor.	This step helps the patient sit up and move legs off the bed at the same time.  *Assisting patient into a sitting position*
9. Bend your knees and keep back straight and neutral.	Use of proper body mechanics helps prevent injury when handling patients.
10. On the count of three, gently raise the patient to sitting position. Ask patient to push against bed with the arm closest to the bed, at the same time as you shift your weight from the front foot to the back foot.	This allows the patient to help with the process and prevents injury to the healthcare provider.  *Assist into a sitting position*

11. Assess patient for orthostatic hypotension or vertigo.	If patient is not dizzy or lightheaded, the patient is safe to ambulate. If patient becomes dizzy or faint, lay patient back down on bed.
12. Continue with mobilization procedures as required.	Mobilization helps prevent complications and improves physical function in hospitalized patients.
Data sources: Interior Health, 2013; Perry et al., 2018; PHSA, 2010	

Assisting a Patient to Ambulate

Ambulation is defined as moving a patient from one place to another (Potter et al., 2010). Once a patient is assessed as safe to ambulate, the nurse must determine if assistance from additional healthcare providers or assistive devices is required. The following checklists provide guidance in assisting to ambulate using a gait belt or transfer belt (see Checklist 30), walker (Checklist 31), crutches (Checklist 32), and a cane (Checklist 33).

Checklist 30: Assisting to Ambulate Using a Gait Belt / Transfer Belt

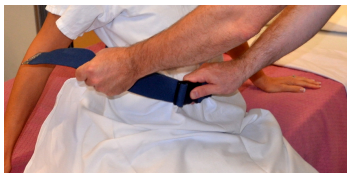
Disclaimer: Always review and follow your agency policy regarding this specific skill.

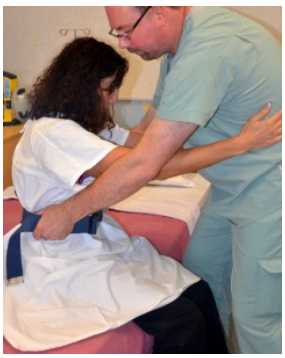
Safety considerations:

- Complete risk assessment for safer patient handling
- Complete QPA including safety.
- Ensure tubes and attachments are properly placed prior to the procedure to prevent accidental removal.
- The gait belt should fit snug and not tight around the patient's waist.

Steps	*Additional Information*

1. Ensure patient does not feel dizzy or lightheaded and is tolerating the upright position. Instruct the patient to sit on the side of the bed first, prior to ambulation. Ensure proper footwear is on patient, and let patient know how far you will be ambulating. Check physician's orders for any activity restrictions related to treatment or surgical procedures.	Proper footwear is non-slip or slip-resistant footwear. Socks are not considered proper footwear. Proper footwear is essential in preventing accidental falls.  *Footwear*

2. Explain to the patient what will happen and what they can do to help. Apply gait belt snugly around the patient's waist.	 *Assessment and instructions prior to ambulation*  *Gait belts are applied over clothing.*  *Gait belt should be snug, not tight*
3. Stand in front of the patient, grasping each side of the gait belt, keeping back straight and knees bent.	The patient must be cooperative and predictable, able to bear weight on own legs, and have good trunk control.

4. While holding the belt, gently rock back and forth three times. On the third time, assist the patient to rise into a standing position.	This action provides momentum to help patient into a standing position. Count out loud so the patient knows what to expect.  *Rock back and forth to provide momentum*  *Pulled to a standing position*
5. Once patient is standing and feels stable, move to the unaffected side and grasp the gait belt in the middle of the back. With the other hand, hold the patient's hand closest to you.	Standing to the side of the patient provides assistance without blocking the patient.
6. Before ambulating ask the patient if they feel dizzy or lightheaded. If they do, sit patient back down on the bed. If patient feels stable, begin walking, matching your steps to the patient's. Instruct patient to look ahead and lift each foot off the ground.	Risk assessment is ongoing. Walk only as far as the patient can tolerate without feeling dizzy or weak.
7. To help a patient back to bed, have patient stand with back of knees touching the bed. Grasp the gait belt and help patient into a sitting position, keeping your back straight and knees bent.	Allowing a patient to rest after ambulation helps prevent fatigue. Short frequent walks help to build stamina.

8. When patient is finished ambulating, remove gait belt, and settle patient into bed or a chair.	This provides a safe place for the patient to rest.  *Remove gait belt*
9. Leave the patient in a safe place. If in bed, place the bed in lowest position, raise side rails as required, and ensure call bell is within reach. Perform hand hygiene.	Placing bed and side rails in a safe position reduces the likelihood of injury to patient. Proper placement of call bell facilitates patient's ability to ask for assistance.  *Bed in the lowest position, call bell in reach, and side rail up* Hand hygiene reduces the spread of microorganisms.
10. Document patient's ability to tolerate ambulation and type of assistance required. Update the care plan as required.	This provides a baseline of patient's abilities and promotes clear communication between health care providers.
Data sources: Interior Health, 2013; Perry et al., 2018; PHSA, 2010	

Watch the video *How to Ambulate With or Without a Gait Belt or Transfer Belt* (2018) by Kim Morris of Thompson Rivers University School of Nursing.

Checklist 31: Ambulating with a Walker

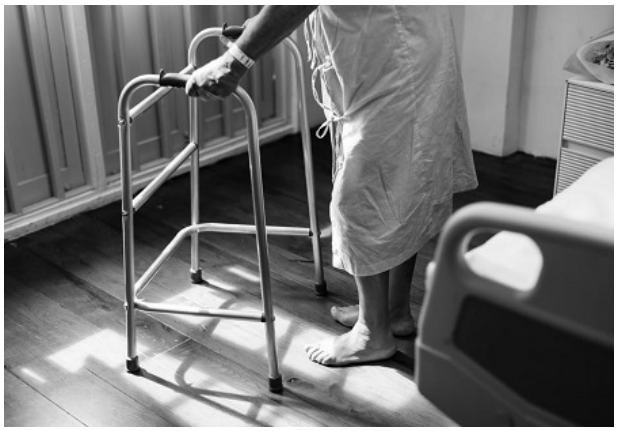


Figure 3.8 Walking with a walker

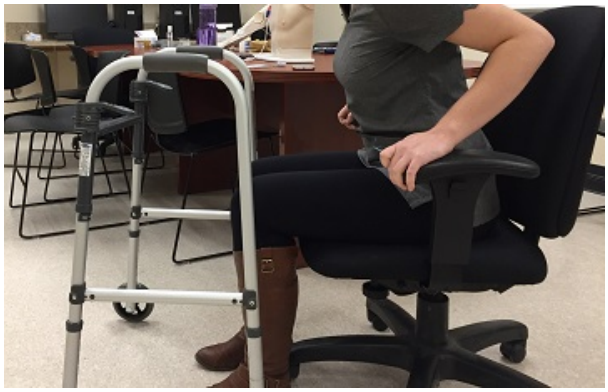
Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Complete risk assessment for safer patient handling
- Complete QPA including safety.
- Ensure proper fitting footwear is used.
- Use rubber tips to prevent the device from slipping.
- Avoid scatter rugs.
- Inspect rubber ends after being outside and remove any gravel.

Steps	*Additional Information*

1. Ensure proper footwear is on the patient, and let the patient know how far you will be ambulating. Proper footwear is non-slip or slip-resistant footwear. If in acute care, check prescriber's orders for any activity restrictions related to treatment or surgical procedures.	Proper footwear is essential to prevent accidental falls.  *Footwear*
2. Measure client for walker height.	 *Figure 3.9 Standing with the support of a walker* The top of the walker should line up with the crease on the inside of the wrists when one is standing. Elbows should flex 15-30 degrees when standing inside the walker with hands on the hand grips.
3. Explain and demonstrate how to walk with a walker.	 *Assessment and instructions prior to ambulation*

4. From a sitting position, instruct patient to push up from the chair's armrest to a standing position.	Do not use the walker to pull oneself up. It is not stable and could result in injury.  *Figure 3.10 Preparing to move from a chair to using a walker* Apply gait belt if required for additional support.
5. Firmly grip both sides of the walker. Move the walker forward a short distance.	The base of the walker provides a broad base of support. Once patient is standing and feels stable, move to the unaffected side. If using a gait belt, grasp the belt in the middle of the patient's back.
6. Step forward with the injured or weak leg first, taking weight through one's hands. Then step with the stronger leg.	Do not step forward if all four feet of the walker are not in contact with the floor. Walker – weak leg – strong leg. Keep feet within the walker's boundaries. Advise the patient to look forward not down at the floor.
7. To turn: Advise to take small steps, moving the walker and then the legs.	Avoid twisting the knee joint when turning. Walking in a large circle may be necessary.
Data sources: Cleveland Clinic, 2018a; Perry et al., 2018	

Checklist 32: Ambulating with Crutches

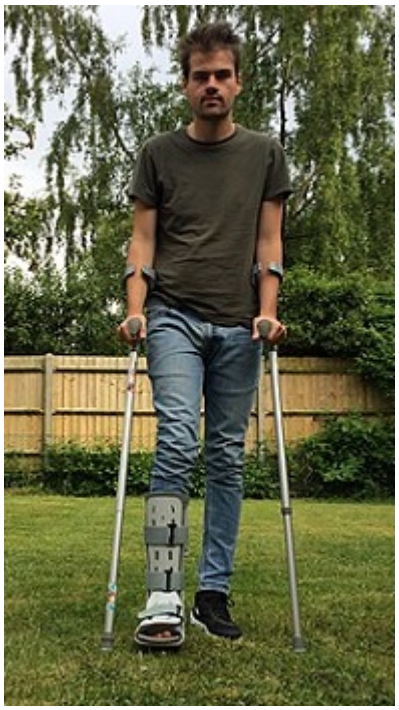


Figure 3.11 Walking with forearm crutches

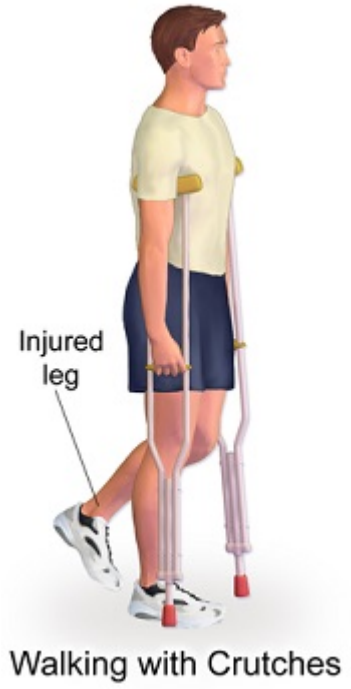


Figure 3.12 Walking with crutches (axilla height)

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Complete risk assessment for safer patient handling
- Complete QPA including safety.
- Ensure proper fitting footwear is used.
- Use rubber tips to prevent the device from slipping.
- Avoid scatter rugs.
- Inspect rubber ends after being outside, and remove any gravel.
- Ensure tubes and attachments are properly placed prior to the procedure to prevent accidental removal.

Steps	*Additional Information*
1. Ensure proper footwear is on the patient, and let the patient know how far you will be ambulating. Proper footwear is non-slip or slip-resistant footwear. If in acute care, check prescriber's orders for any activity restrictions related to treatment or surgical procedures.	Proper footwear is essential to prevent accidental falls. An informed patient is part of delivering safe patient care.  *Footwear*
2. Ensure crutch height is correct.	**Axilla height crutches**: When standing, the there should be two to three finger widths from the axilla to the top of the crutch. The height of the hand grip will be adjusted to allow the elbow to be flexed 15 to 30 degrees or to the wrist crease. There are different crutch walking techniques that depend on the patient's ability to bear weight. **Forearm crutches**: The elbows should be flexed 15 to 30 degrees when holding the hand grips. The forearms should be supported roughly mid-point between the wrist and elbow.
3. Explain and demonstrate how to walk with crutches.	An informed patient may result in reduced risk of falls.
4. From a sitting position, advise the patient to push up from the chair's armrest to a standing position. Stand to gain balance. Advise the patient to not lean on the underarm supports.	The patient should be cooperative and predictable, able to bear weight on own legs, and to have good trunk control. Apply gait belt if required for additional support. Pressure on the axilla can cause damage to tissues and nerves.

5 a. Advise patient accordingly: Ambulation method #1: • Establish balance. • Move both crutches forward slightly. • Move injured leg forward. • Push down on the crutch hand grips. • Step through the crutches with the good leg. • Ensure balance is maintained. • Repeat.	Bear in mind any weight bearing limitations.
5 b. Ambulation method #2: • Establish balance. • Move the crutches and the injured leg forward simultaneously. • Push down on the crutch hand grips. • Step through the crutches with the good leg. • Ensure balance is maintained. • Repeat.	Ambulation method #2 requires good balance and trunk strength.
6 a. Ascending stairs: • Stand close to and facing the bottom step. • Step up with the strong leg. • Ensure balance is maintained. • Move the weak / injured leg onto the step. • Move the crutches up. • Repeat.	Strong leg – weak leg – crutches. Use of the hand rail may be helpful.
6 b. Descending stairs: • Stand close to the top step and face the stairs. • Move crutches to the next step down keeping weight on the hand grips. • Step down with weak / injured leg. • Ensure balance is maintained. • Step down with good / strong leg. • Repeat.	Crutches – weak leg – strong leg. Use of the hand rail may be helpful.
Data sources: Cleveland Clinic, 2018b; Perry et al., 2018	

Watch the video *How to Ambulate With Crutches* (2018) by Kim Morris of Thompson Rivers University School of Nursing.

Checklist 33: Ambulating with a Cane

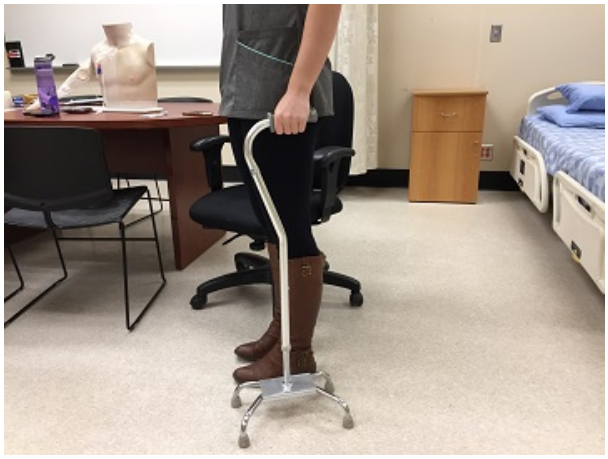
Figure 3.13 Different types of canes

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Complete risk assessment for safer patient handling
- Complete QPA including safety.
- Ensure proper fitting footwear is used.
- Use rubber tips to prevent the device from slipping.
- Avoid scatter rugs.
- Inspect rubber ends after being outside, and remove any gravel.
- Ensure tubes and attachments are properly placed prior to the procedure to prevent accidental removal.

Steps	*Additional Information*
1. Let patient know how far you plan to ambulate. Proper footwear is non-slip or slip-resistant footwear.	Proper footwear is essential to prevent accidental falls. An informed patient is part of delivering safe patient care.  *Footwear*
2. Ensure cane height is correct.	Cane height is the length from the greater trochanter to the floor. Allow 15 to 30 degree flexion at the elbow.
3. Explain and demonstrate how to walk with crutches.	An informed patient may result in reduced risk of falls.

4. Encourage the patient to get to a standing position.	**Quad cane**: Push up from the armrest of the chair to standing position. Grasp cane and establish balance.  *Figure 3.14 Cane height – from floor to greater trochanter. Elbow bent slightly* **Standard cane**: Hold the cane handle in one hand. Push up from the armrest to standing position. Establish balance.
5. Advise the patient to move the cane forward a short distance.	Cane position is forward and slightly to the side when ambulating.
6. Step forward with injured / weak leg. Put weight onto the cane handle. Then step with the strong leg.	Cane – weak leg – strong leg.

7 a. Ascending stairs: • Stand close to and facing the bottom step. • Step up with the strong leg. • Ensure balance is maintained. • Step up with the injured / weak leg. • Bring cane up. • Repeat.	Strong leg – weak leg – cane. Quad canes may have to be turned sideways to fit on a stair. Use of hand rail may help improve balance.
7 b. Descending stairs: • Stand close to the top step and face the stairs. • Place cane down onto the next step. • Step down with weak / injured leg. • Ensure balance is maintained. • Step down with good / strong leg. • Repeat.	
Data sources: Cleveland Clinic, 2018c; Perry et al., 2018	

Watch the video *How to Ambulate with a Cane* (2018) by Kim Morris of Thompson Rivers University School of Nursing.

Critical Thinking Exercises

1. A 90-year-old patient is required to ambulate. He had a total hip arthroplasty and is post-operative day 2 (POD 3). What risk factors should be considered prior to ambulating an elderly patient who has been immobile after hip surgery?
2. Does ambulation require an order from a prescriber?
3. What should you do if a patient feels dizzy or lightheaded before ambulation?

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Figure 3.10 Preparing to move from chair to walker by author is licensed under a Creative Commons Attribution 4.0 International License.

Figure 3.11 Teenage boy on crutches with walking boot by Pagemaker787 is used under a Creative Commons Attribution-Share Alike 4.0 International license.

Figure 3.12 An illustration depicting walking on crutches by BruceBlaus is used under a Creative Commons Attribution-Share Alike 4.0 International license.

Figure 3.13 An illustration depicting different cane types by BruceBlaus is used under a Creative Commons Attribution-Share Alike 4.0 International license.

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3.11 Fall Prevention

Patient falls are the most reported patient safety events in British Columbia and account for 40% of all adverse events (BCPSLS Central, 2015). Falls are a major priority in healthcare, and healthcare providers are responsible for identifying, managing, and eliminating potential hazards to patients. Older adults may be at increased risk for falls due to impaired mental status, decreased strength, impaired balance and mobility, and decreased sensory perception (Titler et al., 2011). Other patients may be at risk due to gait problems, cognitive ability, visual problems, urinary frequency, generalized weakness, and cognitive dysfunction. Specific treatments and medications may cause hypotension or drowsiness, which increases a patient's risk for falls (Hook & Winchel, 2006).

Fall Prevention Strategies

All clients should be assessed for risk factors, and necessary prevention measures should be implemented as per agency policy. Table 3.8 lists factors that affect patient safety and general measures to prevent falls in healthcare.

Table 3.8 Fall Prevention Strategies

Prior to ambulation consider the following risk factors:

- Age (elderly)
- Sensory-perception alteration
- Cognitive impairment (decreased LOC, confusion)
- Poly-pharmacology
- Urinary incontinence
- Ability to communicate (language barriers)
- Lack of safety awareness (height of bed, attachments and tubes)
- Environmental factors (dim light, tripping hazards, uneven floors)

Prevention Strategies	*Safety Measures*
Look for fall risk factors in all patients.	Identifying specific factors helps you implement specific preventive measures. Risk factors include age, weakness on one side, the use of a cane or walker, history of dizziness or lightheadedness, low blood pressure, and weakness.
Follow hospital guidelines for transfers.	Transfer guidelines provide a good baseline for further patient risk assessments.
Orient patient to surroundings.	Orient patients to bed, surroundings, location of bathroom and call bell, and tripping hazards in the surrounding environment.
Answer call bells promptly.	Long wait times may encourage unstable patients to ambulate independently.
Ensure basic elimination and personal needs are met.	Provide opportunities for patients to use the bathroom and to ask for water, pain medication, or a blanket.

Ensure patient has proper footwear and mobility aids.	Proper footwear prevents slips.  *Proper footwear*
Communicate with your patients.	Let patients know when you will be back, and how you will help them ambulate.
Keep bed in the lowest position for sedated, unconscious, or compromised patients.	This step prevents injury to patients should they attempt to get out of bed.
Avoid using side rails when a patient is confused.	Side rails may create a barrier that can be easily climbed and create a fall risk situation for confused patients.
Keep assistive devices and other commonly used items close by.	Allow patients to access assistive devices quickly and safely. Items such as the call bell, water, and Kleenex should be kept close by, to avoid any excessive reaching.
Data sources: Canadian Patient Safety Institute, 2015; Perry et al., 2018; Titler et al., 2011	

Lowering a Patient to the Floor

A patient may fall while ambulating or being transferred from one surface to another. If a patient begins to fall from a standing position, do not attempt to stop the fall or catch the patient. Instead, control the fall by lowering the patient to the floor. Checklist 34 lists the steps to assisting a patient to the floor to minimize injury to patient and healthcare provider (PHSA, 2010).

Checklist 34: Lowering a Patient to the Floor

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- There is always a potential fall risk during transfers and ambulation. Prevention is key.
- If a patient begins to feel dizzy, have them sit on a chair or the floor to avoid a fall.
- The head is the most important part of the body; always protect it as much as possible.
- In the event of a fall, stay with the patient until help arrives.
- After a fall, always assess a patient for injuries prior to moving them. If the patient remains weak or dizzy, do not attempt to ambulate them. Seek help.
- Document according to agency policy including the PSLS (patient safety learning system).

Steps	*Additional Information*
1. If a patient starts to fall and you are close by, move behind the patient and take one step back.	Look and be attentive to cues if a patient is feeling dizzy or weak.  *Stand behind patient*

2. Support the patient around the waist or hip area, or grab the gait belt. Bend your leg and place it in between the patient's legs.	Hand placement allows for a solid grip on the patient to guide the fall.  *Support patient by grabbing the hip area or gait belt*
3. Slowly slide the patient down your leg, lowering yourself at the same time. Always protect the head first.	Lowering yourself with the patient prevents back injury and allows you to protect the patient's head from hitting the floor or hard objects.  *Lower patient to the floor*
4. Once the patient is on the floor, assess the patient for injuries prior to moving.	Assesses patient's ability, or need for additional help, to get off the floor.  *Assess patient prior to moving*
5. Provide reassurance and seek assistance if required.	If required, stay with the patient and call out for help.

6. If patient is unable to get up off the floor, use a mechanical lift.	If patient still feels dizzy or weak, using a mechanical lift will prevent injury.
7. Complete an incident report according to agency policy.	An incident report helps identify and manage risks related to patient falls.
Data sources: Perry et al., 2018; PHSA, 2010; Titler et al., 2011	

Special considerations:

- Use a falls risk assessment tool for all patients according to agency policy.
- Younger patients may not be aware of the effects of medication and treatments leading to dizziness and orthostatic hypotension.
- Inform patients and family members about the potential risks for falls in the hospital. If informed, people are more likely to call for assistance.
- Always ensure call bell is in place. Many falls occur due to incontinence issues. The call bell allows patient and family to obtain assistance quickly.
- If appropriate, educate patient about home maintenance and safety to prevent falls when returning home.
- Fall prevention is interdisciplinary. Proper communication by the care team is required to prevent falls.

Take PHSA's *Lowering a Patient to the Floor* course for more information on lowering a falling patient to the floor.

Watch the video *Assisted Fall* (2018) by Kim Morris of Thompson Rivers University School of Nursing.

Critical Thinking Exercises

1. Name four fall prevention strategies that will help keep a patient safe when ambulating in the hospital.
2. A patient is ambulating for the first time after surgery. Is it safe to encourage the patient to ambulate independently?
3. Many physiological risk factors can be identified from a routine assessment to suggest risk for falls. Name three risk factors and three prevention strategies to manage these risks. For example, if a patient has frequent toileting needs, a preventive action is to offer assistance to the toilet every hour, and to ensure

the call bell is within reach at all times.

3.12 Summary

To use the principles of body mechanics effectively and safely, healthcare providers must have the required training to perform a risk assessment, knowledge about transfer assistive devices, and an understanding of the procedures for safe patient handling. In addition, knowing risk factors for positioning, transferring, and ambulation, along with understanding falls prevention, will help prevent injuries to staff and patients. The goal of this chapter has been to help reduce the incidence and severity of injuries related to patient-handling procedures.

Key Takeaways

- Patients' conditions and their ability to move will change over the course of their hospital stay. A patient risk assessment must be done prior to all patient-handling procedures.
- MSI can result from any type of handling procedure. The principles of proper body mechanics can be applied to all procedures related to positioning, transferring, and ambulation. Correct posture and keeping the patient close to your centre of gravity are essential to maintain balance during transfers, positioning, and ambulation.
- Educate yourself on standard procedures to protect yourself from injury. Retrain and keep current with new procedures and assistive devices.
- The use of assistive devices can help a patient transfer safely and effectively.
- Always seek additional assistance and help as required.
- Keep yourself healthy with exercise and a proper diet, along with suitable footwear, to help prevent injury. If a MSI is suspected, seek help immediately and report the incident.
- Avoid trying to catch a falling patient. If possible, follow the guidelines to lower a falling patient to the floor.
- Be proactive to implement safe strategies and prevent hazards in the workplace related to patient handling.

Suggested Online Resources

1. Agency for Healthcare Research and Quality: *Which Fall Prevention Practices Do You Want to Use?* (2013). These universal fall risk precautions review physiological, anticipated, unanticipated, and environmental hazards with a focus on identifying risk factors and prevention strategies.
2. BC Interior Health: *Safe Patient Handling* (n.d.). This website lists excellent resources, including brochures and videos, about topics related to body mechanics, transfers, positions,

and performing risk assessments.

3. BC Patient Safety & Quality Council: *Hospital Care for Seniors: 48/6 Approach* (2012). This resource offers a model of care for hospitalized seniors (aged 70 and older) in British Columbia. It is an integrated care initiative that addresses six care areas of functioning through patient screening and assessment (assessments are completed only where screening shows areas of concern) within the first 48 hours of hospital admission.
4. Canadian Fall Prevention Education Collaborative: *Canadian Fall Prevention Curriculum* (2017). This website provides information and tool kits for preventing falls in the community and acute care settings.
5. Centers for Disease Control and Prevention: *Safe Patient Handling Training for Schools of Nursing* (2009). This resource was developed by the World Health Organization to create global awareness. It provides up-to-date algorithms for patient transfers.
6. Provincial Health Services Authority: *Safe Patient Handling* (2010). These instructional video courses cover numerous topics including mechanical (ceiling) lifts, additional re-positioning techniques, transfers, and assisting a patient off the floor.

References

Berman, A., & Snyder, S. J. (2016). *Skills in clinical nursing* (8th ed.). Hoboken, NJ: Pearson.

British Columbia Patient Safety Learning System (BCPSLS) Central. (2015). Retrieved from http://bcpslscentral.ca/.

Canadian Patient Safety Institute. (2015). *Reducing falls and injury from falls: Getting started kit*. Retrieved from http://www.patientsafetyinstitute.ca/en/toolsResources/Documents/Interventions/Reducing%20Falls%20and%20Injury%20from%20Falls/Falls%20Getting%20Started%20Kit.pdf.

Cleveland Clinic. (2018a). *Walkers*. Retrieved from https://my.clevelandclinic.org/health/articles/15542-walkers.

Cleveland Clinic. (2018b). *Crutches*. Retrieved from https://my.clevelandclinic.org/health/articles/15543-crutches.

Cleveland Cinic. (2018c). *Canes*. Retrieved from https://my.clevelandclinic.org/health/articles/15541-canes.

Graf, C. (2006). Functional decline in hospitalized older adults. It's often a consequence of hospitalization, but it doesn't have to be. *American Journal of Nursing*, 101(1), 58-67. Retrieved

from http://www.researchgate.net/publication/232182376_Functional_Decline_in_Hospitalized_Older_Adults_Its_often_a_consequence_of_hospitalization_but_it_doesnt_have_to_be.

Handicare. (2018). How to choose the proper sling. Retrieved https://www.handicare.ca/blog/2018/08/24/how-to-choose-the-proper-sling/

Hook, M. L., & Winchel, S. (2006). Fall related injuries in acute care: Reducing the risk of harm. *Clinical Practice*, 15(6), 370-377.

HoverTech International. (2016). *HoverMatt air transfer system*. Retrieved from http://www.hovermatt.com/hovermatt.html.

Interior Health. (2012). *Point-of-care risk assessment*. Retrieved from https://www.interiorhealth.ca/sites/Partners/WHSresources/Documents/Point%20of%20Care%20Risk%20Assessment%20Tool.pdf.

Interior Health. (2013). *Manual transfer: One person assist with help*. Retrieved from https://www.interiorhealth.ca/sites/Partners/WHSresources/Documents/Manual%20Transfers%20-%20One%20Person%20Assist%20with%20Help%20SWP.pdf.

Kalisch, B. J., Lee, S., & Dabney, B. W. (2013). Outcomes of inpatient mobilization: A literature review. *Journal of Clinical Nursing*, 23(11-12), 1486-501. https://doi.org/10.1111/jocn.12315

National Institute for Occupational Safety and Health (NIOSH). (2010). *Safe patient handling training for schools of nursing*. Retrieved from http://www.cdc.gov/niosh/docs/2009-127/pdfs/2009-127.pdf.

Peninsula Health. (1999). *Falls risk assessment tool (FRAT)*. Retrieved from https://www2.health.vic.gov.au/about/publications/policiesandguidelines/falls-risk-assessment-tool.

Perry, A. G., Potter, P. A., & Ostendorf, W. R. (2018). *Clinical nursing skills and techniques* (9th ed.). St. Louis, MO: Elsevier-Mosby.

Potter, P. A., Perry, A. G., Stockert, P., Hall, A., Astle, B., & Duggleby, W. (2017). *Canadian fundamentals of nursing* (6th ed.). Milton, ON: Mosby.

Potter, P. A., Perry, A. G., Stockert, P. A., & Hall, A. (2011). *Basic nursing* (7th ed.). St. Louis, MO: Elsevier-Mosby.

Provincial Health Services Authority (PHSA). (2010). *Workplace health – Safe patient handling* [Online courses]. Retrieved from http://learn.phsa.ca/phsa/patienthandling/.

Registered Nursing. (n.d.). *Ergonomic principles*: NCLEX-RN. Retrieved from https://www.registerednursing.org/nclex/ergonomic-principles/.

Sanguineti, V. A., Wild, J. R., & Fain, M. J. (2014). Management of postoperative complications: A general approach. *Clinics in Geriatric Medicine*, 30(2), 261-270. https://doi.org/10.1016/j.cger.2014.01.005.

South Island Alliance. (n.d.). *Level of assistance definitions*. Retrieved from https://www.sialliance.health.nz/UserFiles/SouthIslandAlliance/File/LEVEL%20OF%20ASSISTANCE%20DEFINITIONS%202016.pdf.

Stewart, D. (2018). *Ceiling lift sling information*. Retrieved from https://mobilitybasics.ca/ceiling-lifts/slings.

Titler, M. G., Shever, L. L., Kanak, M. F., Picone, D. M., & Qin, R. (2011). Factors associated with falls during hospitalization in an older adult population. *Research and Theory for Nursing Practice: An International Journal*, 25(2), 127-152. https://doi.org/10.1891/1541-6577.25.2.127.

Winnipeg Regional Health Authority (WRHA). (2015). *Safe patient handling assessment form*. Retrieved from http://www.wrha.mb.ca/professionals/safety/files/SafePatientHandling/SafePatientHandlingAssessmentForm.pdf.

Winnipeg Regional Health Authority (WRHA). (2008). *Patient assessment procedures and screening tool*. Retrieved from http://www.wrha.mb.ca/professionals/safety/files/SafePatientHandling/PatientAssessmentProcedure.pdf.

WorkSafeBC. (2006). *Handle with care: Patient handling and the application of ergonomics (MSI) requirements*. Retrieved from https://www.worksafebc.com/en/resources/health-safety/books-guides/handle-with-care-patient-handling-application-ergonomics-musculoskeletal-msi-requirements?lang=en&origin=s&returnurl=https%3A%2F%2Fwww.worksafebc.com%2Fen%2Fsearch%23q%3Dtransfer%2520assist%2520devices%2520for%2520safer%26sort%3Drelevancy%26f%3Alanguage-facet%3D%5BEnglish%5D.

WorkSafeBC. (2008). *Understanding the risks of musculoskeletal injury (MSI): An educational guide for workers on sprains, strains, and other MSIs*. Retrieved from http://www.worksafebc.com/publications/Health_and_Safety/by_topic/assets/pdf/msi_workers.pdf.

WorkSafeBC. (2010). *Patient handling*. Retrieved from https://www.worksafebc.com/en/health-safety/industries/health-care-social-services/topics/patient-handling.

WorkSafeBC. (2013). *Preventing musculoskeletal injury* (MSI). Retrieved from http://www.worksafebc.com/publications/health_and_safety/by_topic/assets/pdf/msi_employers.pdf.

World Health Organization. (2018). *Assistive devices and technology*. Retrieved from https://www.who.int/disabilities/technology/en/.

CHAPTER 4. WOUND CARE

4.1 Introduction

Wound healing is a complex physiological process. It occurs after an injury in the cells and tissues of our bodies to restore function of the tissue. The healing process is affected by the severity of the wound, location, extent of injury, and other external and internal factors that will either inhibit or promote wound healing. A health care provider must understand how to assess a wound, assess external and internal factors, and determine treatment to optimize the healing process.

Learning Outcomes

- Describe six factors that affect wound healing, and possible strategies that the nurse can implement to promote wound healing.
- Describe four stages of (uncomplicated) wound healing.
- Describe 2 individual, 2 environmental and 2 wound factors that contribute to risk of infection and possible strategies that the nurse can implement to decrease that risk
- Perform a comprehensive wound assessment.
- Differentiate situations that require sterile versus clean technique when performing dressing changes.
- Perform the following skills following principles of asepsis:
    - Simple dressing change
    - Wound irrigation
    - Wound packing
    - Staple removal
    - Suture removal
    - Empty and remove JP and hemovac drains

4.2 Wound Healing and Assessment

Wound healing is a dynamic process of restoring the anatomic function of living tissue. Since damage to the body's tissue is common, the body is well adapted to utilizing mechanisms of repair and defence to elicit the healing process. Normal wound healing is profoundly influenced by the type of injury and by factors about the wound (intrinsic) and within the patient (extrinsic) (Perry et al., 2014).

Phases of Wound Healing

There are four distinct phases of wound healing. These four phases must occur in correct sequence and in a correct time frame to allow the layers of the skin to heal (see Figure 4.1).

Table 4.1 describes how a wound heals.

Table 4.1 Phases of Wound Healing for Full Thickness Wounds	
Phase	*Additional Information*
Hemostasis phase	Blood vessels constrict and clotting factors are activated. Clot formation blocks the bleeding and acts as a barrier to prevent bacterial contamination. Platelets release growth factors, which alert various cells to start the repair process at the wound location.
Inflammatory phase	Vasodilation occurs, allowing plasma and leukocytes (white blood cells) into the wound to start cleaning the wound bed. This process is seen as edema, erythema, and exudate. Macrophages (another type of white blood cell) work to regulate the cleanup.
Proliferative phase	Four important processes occur in this phase: 1. Epithelialization: New epidermis and granulation tissue are developed. 2. New capillaries: angiogenesis occurs to bring oxygen and nutrients to the wound. 3. Collagen formation: This provides strength and integrity to the wound. 4. Contraction: The wound begins to reduce in size.
Maturation (remodelling) phase	Collagen continues to strengthen the wound, and the wound becomes a scar.
Data sources: British Columbia Provincial Nursing Skin and Wound Committee, 2011; Perry et al., 2014	

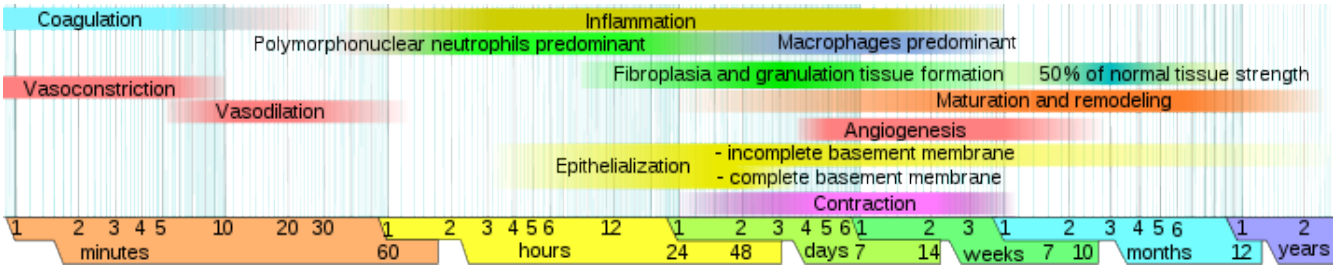


Figure 4.1 Phases of wound healing

Types of Wounds

To determine how to treat a wound, consider the etiology, amount of exudate, and available products to plan appropriate treatment. Wounds are classified as acute (healing occurs in a short time frame without complications) or chronic (healing occurs over weeks to years, and treatment is usually complex). Examples of acute wounds include a surgical incision or a traumatic wound (e.g., a gunshot wound). Examples of chronic wounds include venous and arterial ulcers, diabetic ulcers, and pressure ulcers. Table 4.2 lists the six main types of wounds.

Table 4.2 Types of Wounds	
Type	*Additional Information*
Surgical	Healing occurs by primary, secondary, or tertiary intention. **Primary intention** is where the edges are sutured or stapled closed, and the wound heals quickly with minimal tissue loss. The healing time for a surgical wound is usually short, depending on the surgery. A surgical wound left open to heal by scar formation is a wound healed by **secondary intention**. In this type of wound, there is a loss of skin, and granulation tissue fills the area left open. Healing is slow, which places the patient at risk for infection. Examples of wounds healing by secondary intention include severe lacerations or massive surgical interventions. Healing by **tertiary intention** is the intentional delay in closing a wound. On occasion, wounds are left open (covered by a sterile dressing) to allow an infection or inflammation to subside. Once the wound is closed with staples or sutures, the scarring in minimal.
Traumatic	Examples are gunshot wounds, stab wounds, or abrasions. These wounds may be acute or chronic.
Diabetic/neuropathic ulcer	This is a nerve disorder that results in the loss or impaired function of the tissues affecting nerve fibres. These wounds generally occur as a result of damage to the autonomic, sensory, or motor nerves and have an arterial perfusion deficit. They are usually located in the lower extremity on the foot. Diabetic/neuropathic ulcers are often small with a calloused edge. Pain may be absent or severe depending on the neuropathy.
Arterial ulcer	Arterial ulcers occur when tissue ischemia occurs due to arterial insufficiency from the narrowing of an artery by an obstruction (atherosclerosis). They are located on the distal aspects of the arterial circulation, and can be anywhere on the legs, including feet or toes, and sometimes the fingers and hands. Wound margins are well defined with a pale wound bed with little or no granulation. Necrotic tissue is often present. There is minimal to no exudate present. Peripheral pulses are usually absent or diminished. Pain occurs in limb at rest, at night, or when limb is elevated. Arterial ulcers account for 5% to 20% of all leg ulcers. Perfusion must be assessed prior to initiating treatment.

Venous ulcer	A venous ulcer is a lower extremity wound. Tissue ischemia occurs due to the failure of the venous valve function to return blood from the lower extremities to the heart. It is usually located in the ankle to mid-calf region, usually medial or lateral, and can be circumferential. Drainage can be moderate to heavy. A venous ulcer can be irregularly shaped, large, and shallow with generalized edema to lower limbs. Pulse may be difficult to palpate. Venous ulcers account for 70% to 90% of all leg ulcers. Perfusion must be assessed prior to initiating treatment.
Pressure injury	Also known as a pressure sore or decubiti wound, the pressure injury refers to a localized area of tissue damage that results from compression of soft tissue between a hard surface and a bony prominence (coccyx, ankle, shoulder blade, or hip). As blood supply decreases to the area of compression, tissue anoxia occurs, which can lead to eventual tissue death. Wounds are usually circular and may have viable or necrotic tissue, and exudate can vary from none to heavy. Pressure ulcers are classified depending on the level of tissue damage (stages 1 to 4). Treatment is based on stage, exudate, type of available dressing, and frequency of dressing changes.
Data sources: British Columbia Provincial Nursing Skin and Wound Committee, 2011, 2014; Perry et al., 2014	

Wound Healing

Wounds require different treatment throughout the phases of healing. There are multiple factors that affect how a wound heals as it moves through the phases of healing. It is important to look at the "whole patient" rather than the "hole in the patient" to identify the correct treatment and work efficiently and effectively from the beginning of the healing process.

Table 4.3 lists a number of factors that inhibit the ability of tissues and cells to regenerate, which can delay healing and contribute to wound infections.

Table 4.3 Patient Considerations for Wound Healing

Influencing Factors	*Additional Information*
Patient's age	Vascular changes occur with increasing age, skin is less pliable, and scar tissue is tighter. For example, an older adult's skin tears more easily from mechanical trauma such as tape removal.
Patient's nutritional status	Tissue repair and infection resistance are directly related to adequate nutrition. Patients who are malnourished are at increased risk for wound infections and wound infection-related sepsis.
Patient's size	Inadequate vascularization due to obesity will decrease the delivery of nutrients and cellular elements required for healing. An obese person is at greater risk for wound infection and dehiscence or evisceration.
Oxygenation	Factors such as decreased hemoglobin level, smoking, and underlying cardiopulmonary conditions will decrease oxygenation. Adequate oxygenation at the tissue level is essential for adequate tissue repair. Hemoglobin level and oxygen release to tissues is reduced in smokers.
Patient's medications	Steroids reduce the inflammatory response and slow collagen synthesis. Cortisone depresses fibroblast activity and capillary growth. Chemotherapy depresses bone marrow production of white blood cells and impairs immune function.
Chronic diseases or trauma	Chronic diseases and traumas such as diabetes mellitus or radiation decrease tissue perfusion and oxygen release to tissues. Chronic wounds may be colonized with microbes; wound beds may have reached a point of chronicity and require debridement to initiate the inflammatory process and (hopefully begin healing). Pressure, friction, and shear can contribute to the development of pressure injury.
Data source: Gallagher-Camden, 2012; Perry et al., 2014; Stotts, 2012	

Watch this 30-minute video about *How Wounds Heal* from Connecting Learners with Knowledge (CLWK), a provincial resource and is licensed under a CC BY-NC-ND 2.5 Canada licence.

Wound Assessment

Frequent wound assessment based on the type, cause, and characteristics of the wound is necessary to help determine the type of treatment required to manage the wound effectively and to promote maximal healing. The health care professional should always compare the wound to the previous assessment to determine progress toward healing. If there has been no improvement in the healing of the wound, alternative options or consulting a wound care specialist should be considered.

Table 4.4 outlines considerations when assessing a wound.

Table 4.4 : Wound Assessment

Considerations	*Additional Information*
1. Location	Note the anatomic position of the wound on the body.
2. Type of wound	Note the etiology (cause) of the wound (i.e., surgical, pressure, trauma). Common types are pressure, venous, arterial, or neuropathic/diabetic foot ulcers, or surgical or trauma wounds.
3. Extent of tissue involvement	A full-thickness wound involves both the dermis and epidermis. A partial-thickness wound involves only the epidermal layer. If the wound is a pressure ulcer, use the Braden Scale Interventions Algorithm.
4. Type and percentage of tissue in wound base	Describe the type of tissue (i.e., granulation, slough, eschar) and the approximate amount.
5. Wound size	Follow agency policy to measure wound dimensions, including width, depth, and length. Assess for a sinus tract, tunnelling, or induration.
6. Wound exudate	Describe the amount, colour, and consistency: • Serous drainage (plasma): clear or light yellowish • Sanguineous drainage (fresh bleeding): bright red • Serosanguineous drainage (a mix of blood and serous fluid): pink • Purulent drainage (infected): thick and yellow, pale green, or white
7. Presence of odour	Note the presence or absence of odour. The presence of odour may indicate infection.
8. Peri-wound area	Assess the temperature, colour, and integrity of the skin surrounding the wound.
9. Pain	Assess pain.
Data sources: British Columbia Provincial Nursing Skin and Wound Committee, 2014; Perry et al., 2014	

Watch this 30-minute *Wound Assessment* video, a provincial resource from CLWK, to learn how to improve

wound-assessment skills. It is licensed under a CC BY-NC-ND 2.5 Canada license.

Critical Thinking Exercises

1. A patient is 75 years old, smokes cigarettes, has renal disease, and is overweight. What additional factors should you consider prior to assessing the patient's wound? Provide rationale.
2. What indications might lead the nurse to suspect that a patient is malnourished and therefore at risk for delayed wound healing?
3. What phase of wound healing is indicated by the presence of epithelialization and wound contraction? Name three extrinsic factors that can contribute to the risk of pressure injury.

Attributions

Figure 4.1 Phases of wound healing by Mikael Häggström is in the public domain.

4.3 Wound Infection and Risk of Wound Infection

Wound Infection

Wounds are not sterile because normal flora is a part of human existence. Even intentional wounds contain microbes which may include bacteria and fungi. It is important for the nurse to recognize that presence of bacteria in a wound does not necessarily mean infection. It is also important for the nurse to recognize their role in reducing risk of infection through standard precautions and by working with the patient and interdisciplinary team to mitigate factors that might contribute to patient risk. The wound infection continuum is characterized by increasing numbers and virulence of microorganisms and the host's response to them.

Table 4.5 Wound Infection Continuum and S&S Associated with Each Stage

Contamination	All wounds may acquire micro-organisms. If the ideal microbe environment does not exist and host defenses are strong, microbes cannot multiply. They are present but don't affect wound healing.	
Local Infection	**Subtle signs of local infection:** • Hyper granulation (excessive "vascular" tissue) • Bleeding, friable granulation • Epithelial bridging and pocketing in granulation tissue • Wound breakdown and enlargement • Delayed wound healing beyond expectations • New or increasing pain • Increasing malodor	**Classic signs of local infection:** • Erythema • Local warmth • Swelling • Purulent discharge • Delayed wound healing beyond expectations • New or increasing pain • Increasing malodor
Spreading Infection	• Extending in duration • +/- erythema Lymphangitis Crepitus • Wound breakdown/dehiscence with or without satellite lesions • Malaise/lethargy or non-specific general deterioration • Loss of appetite • Inflammation, swelling of lymph glands	
Systemic	• Severe sepsis • Septic shock • Organ failure • Death	

Data source: ©Wounds International. Adapted for this textbook with permission.

Factors that Increase the Risk of Wound Infection

Table 4.6 Considerations for Increased Risk of Wound Infection

Individual Factors

- Poorly controlled diabetes
- Prior surgery
- Radiation therapy or chemotherapy
- Conditions associated with hypoxia and/or poor tissue perfusion (e.g., anemia, cardiac or respiratory disease, arterial or vascular disease, renal impairment, rheumatoid arthritis, shock)
- Immune system disorders (e.g., acquired immune deficiency syndrome, malignancy)
- Inappropriate antibiotic prophylaxis, particularly in acute wounds
- Protein-energy malnutrition
- Alcohol, smoking, and drug abuse
- +/- erythema Lymphangitis Crepitus
- Age

Wound Factors

Acute wounds:

- Contaminated or dirty wounds
- Trauma with delayed treatment
- Pre-existing infection or sepsis
- Spillage from gastro-intestinal tract
- Penetrating wounds over four hours
- Inappropriate hair removal
- Operative factors (e.g., long surgical procedure, hypothermia, blood transfusion)

Chronic wounds:

- Degree of chronicity/ duration of wound
- Large wound area
- Deep wound
- Anatomically located near a site of potential contamination (e.g., perineum or sacrum)

Both wound types:

- Foreign body (e.g., drains, sutures)
- Hematoma
- Necrotic wound tissue
- Impaired tissue perfusion
- Increased exudate or moisture

Environment Factors
• Hospitalization (increased risk of exposure to antibiotic resistant organisms) • Poor hand hygiene and aseptic technique • Unhygienic environment (e.g., dust, unclean surfaces, mold/mildew in bathrooms) • Inadequate management of moisture, exudate, and edema • Inadequate pressure off-loading • Repeated trauma (e.g., inappropriate dressing removal technique)
Data source: © Wounds International. Adapted for this textbook with permission.

Critical Thinking Exercises

1. Gerry is 58 years old. He has a history of smoking and hypertension, and has been in a motorcycle accident resulting in significant abrasions to his arms and legs. What factors increase Gerry's risk of wound infection?
2. JT is 38 years old. Has had paraplegia and a wound on the right ischium for 18 months. What factors increase JT's risk of wound infection?
3. What are the commonalities in relation to risk of wound infection and risk of impaired wound healing?

Attributions

Table 4.5 and 4.6 International Wound Infection Institute, 2016

4.4 Wound Management

The science of wound management has grown tremendously in recent years. As our understanding of wound healing has grown, so has the number of products used to manage wounds. For purposes of this textbook, brief discussions of different types of dressings are included. The reader is encouraged to further their understanding of wound healing through other sources and to seek the skills of wound care experts in practice.

Purposes of a dressing (Kerr et al, 2014):

- Protects from microorganisms entering the body
- Protects fragile wound bed
- Aids in hemostasis
- Absorbs drainage, and assists autolytic debridement
- Supports the wound and site (i.e., pressure dressing)
- Provides thermal insulation of the wound surface
- Provides wound bed with a moist environment

Wound management occurs on a continuum from what many nurses refer to as simple dressing changes (such as a surgical wound) to complex wound management involving things like wound irrigation, vacuum assisted closure, and use of manufactured products designed for specific wound needs. The bottom line is that dressings have different purposes, and the dressing chosen should be appropriate to the wound's needs.

Wound management follows the nursing process in terms of:

- Assessment and reassessment: Assess the whole patient not just the "hole in the patient." Assessment must include patient and other factors that are influencing wound healing. This often includes a multidisciplinary approach with the patient at the centre. Continual reassessment of the patient and the wound are essential
- Setting goals: Ideally the patient and healthcare team cooperate to determine and identify goals that take into account the patient's values and beliefs and a realistic vision of the wound's capabilities. For example, some wounds will not heal, in which case quality of life and symptom control might be the most reasonable expectations.
- Intervention and implementation: These are the strategies used to promote wound healing. Multiple strategies might be necessary including optimizing nutrition, oxygenation, and the appropriate selection and use of particular wound care products.

- Evaluation: Links back to assessment. Did the interventions work? If not, why? Review and reconsider interventions and implementation.

Terms that sometimes confuse people:

Aseptic technique: The purposeful prevention of the transfer of microorganisms from one person to another by keeping the microbe count to a minimum, and for assuring that cross-contamination does not occur. The technique chosen is based on dressing procedure, client setting, and agency policy. Principles of asepsis apply to all of them. There are three different applications of aseptic technique for the nurse to consider (British Columbia Provincial Nursing Skin & Wound Committee, 2011):

- Sterile technique: The use of sterile gloves, field, tray, instruments solutions, and dressings. This is similar to no touch technique, but you use sterile gloved hands to manipulate your equipment. Appropriate for surgical wounds, drain sites, wound irrigation, and wound packing.
- No touch technique: The use of clean gloves and sterile field, tray, instruments, solutions; sterile instruments are used for direct contact with the wound; dressings are to be sterile. This is the same as sterile technique, but you use instruments to manipulate your equipment.
- Clean technique: The use of sterile solutions, clean gloves, and clean dressings. Appropriate for chronic wounds (e.g., diabetic foot ulcers, pressure ulcers).

4.5 Simple Dressing Change

The healthcare provider chooses the appropriate sterile technique and necessary supplies based on the clinical condition of the patient, the cause of the wound, the type of dressing procedure, the goal of care, and agency policy.

Agency policy will determine the type of wound cleansing solution, but sterile normal saline and sterile water are the solutions of choice for cleansing wounds and should be at room temperature to support wound healing. The ideal cleansing agent and the optimal method of wound cleansing has not been established conclusively (International Wound Infection Institute, 2016). Some wound cleansing solutions include sterile water, sterile saline, tap water, chlorhexidine, and povidone/iodine. Each cleansing solution has characteristics that make it a good or poor choice in certain situations. The nurse should use the wound cleansing solution as directed by agency policy and/or wound specialists.

Surgical dressings should remain in place for at least 48 hours and should be reinforced if soiled. At the 48 hour point, the wound may be exposed to air, but this is dependent on a number of factors such as type of surgery, wound healing (wound edges must be approximated and the wound not leaking), comfort of the client with an exposed incision, and agency policy (BC Provincial Skin and Wound Committee, 2011).

Checklist 35 outlines the steps for performing a simple dressing change.

Checklist 35: Simple Dressing Change

Disclaimer: Always review and follow your agency policy regarding this specific skill.

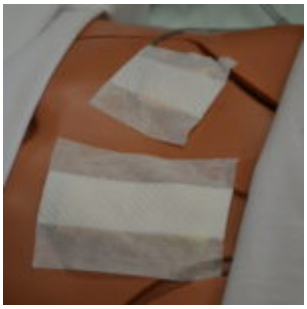
Safety considerations:

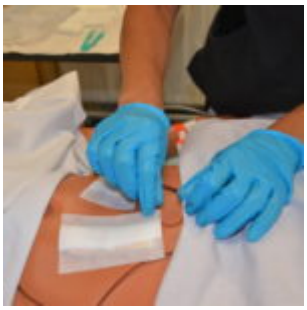
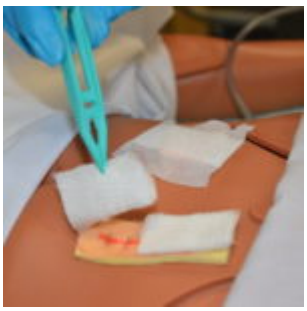
- Perform hand hygiene.
- Check room for additional precautions.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient; offer analgesia, bathroom, etc.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Complete QPA including safety.
- Perform point of care risk assessment for PPE
- Sanitize your working surface.

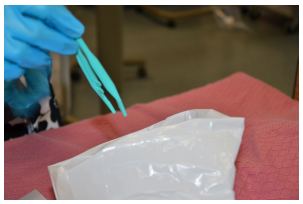
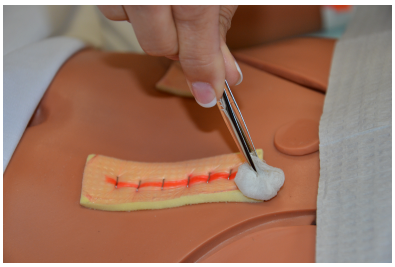
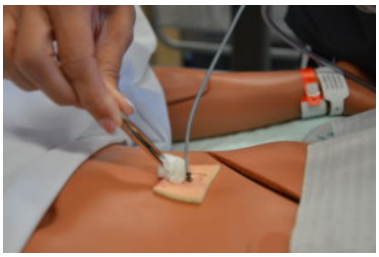
Steps	*Additional Information*

1. Assess current dressing.	If you plan to touch the dressing, donne non-sterile gloves to protect yourself from exposure to BBF. Assess dressing for signs of shadowing / bleeding, type and size of dressing used.  *Apply non-sterile gloves*
2. Perform hand hygiene.	Hand hygiene reduces risk of spread of microorganisms.  *Perform hand hygiene*
3. Gather necessary equipment.	Dressing supplies must be for single patient use only. Use the smallest size of dressing for the wound.  *Gather supplies* Take only the dressing supplies needed for the dressing change to the bedside. Equipment that is contaminated at the bedside cannot return to general circulation to be used with other patients.

4. Prepare environment; position patient; adjust height of bed; and turn on lights.	Ensure patient's comfort prior to and during the procedure. Proper lighting allows for good visibility to assess wound.
5. Perform hand hygiene.	Hand hygiene prevents spread of microorganisms.  *Hand hygiene with ABHR*
6. Prepare sterile field.	 *Prepare sterile field*

7. Add necessary sterile supplies.	 *Add necessary supplies*
8. Pour cleansing solution.	 *Pour sterile cleansing solution into sterile tray* Normal saline or sterile water containers must be used for only one client, and they must be dated and discarded within at least 24 hours of being opened.
9. Prepare patient and expose dressed wound.	 *Prepare patient and expose wound*

10. Apply non-sterile gloves.	Use non-sterile gloves to protect yourself from contamination.  *Apply non-sterile gloves*
11. Remove outer dressing with non-sterile gloves and discard as per agency policy.	 *Remove outer dressing with non-sterile gloves* The rationale for non sterile gloves is to protect you from exposure to BBF.
12. If necessary, remove inner dressing with transfer forceps.	 *Remove inner dressing with transfer forceps*

13. Discard transfer forceps & gloves	 *Discard transfer forceps*  *discard gloves*
14. Assess wound	Are the wound edges approximated? Are the staples / sutures intact? Is there evidence of complications?
14. Cleanse wound remembering principles of asepsis	Clean to dirty; one wipe one way discard; fluids flow in the direction of gravity. 
15. Cleanse around the drain if present	Using a circular motion, clean the area immediately next to the drain and work outward still following principles of asepsis 
16. Apply new sterile dressing.	The type of dressing applied will depend on the needs of the wound and the supplies available in the agency. Secure dressings and drains with tape. Write the date and time on the outside of the dressing as a way to inform others.

17. Ensure the patient is comfortable before leaving the bedside. Perform hand hygiene.	Discard used equipment according to agency policy.
18. Document according to agency policy. Consider the progression of wound healing. If concerned notify the prescriber.	Documentation example: *date / time: abdominal dressing changed. Moderate sanguinous drainage from distal end of incision. Wound well approximated. Staples intact. Cleansed with 0.9% NS. Dressed with medipore dressing. Patient tolerated well. ——- B. Dage RN*

Data source: BCIT, 2010a; Perry et al., 2018

If necessary review *Principles of Asepsis* developed by Renée Anderson & Wendy McKenzie Thompson Rivers University.

Watch the video *Simple Sterile Dressing Change* developed by Renée Anderson and Wendy McKenzie Thompson Rivers University School of Nursing (2014).

4.6 Advanced Wound Care: Wet to Moist Dressing, and Wound Irrigation and Packing

Traditionally, when wounds required debridement wet to dry dressings were used. This involved applying moist saline or other solution (i.e., Dakin's) to gauze, placing it into a wound bed, allowing it to dry, and then removing it. As the dressing is removed, so is the unhealthy tissue. The belief was that the removal of the dead tissue facilitated healing. As we have come to understand more about wound healing, we now know that this practice disrupts healthy tissue. Besides being detrimental to wound healing, it can also be painful for the patient. As such, this is not current best practice (Kerr et al., 2014).

We have come to understand that wound beds need a moist environment to heal. Wet to moist dressings provide a moist healing environment, but they can require several dressing changes each day to maintain that moisture. These frequent dressing changes come with personal cost to the patient, financial cost in terms of nursing time and supplies, risk of infection associated with frequent dressing changes, and potential damage to the wound bed if the dressing is allowed to dry out (Kerr et al., 2014).

A wet to moist dressing can be selected for a wound bed until further direction is given by someone with knowledge about wound products. The type of wound dressing used depends not only on the characteristics of the wound, but also on the goal of the wound treatment and ability to access products. Recalling factors that influence wound healing, the skill and knowledge of the healthcare professional (HCP) and their ability to diagnose, select appropriate treatments, and correctly implement treatments are important considerations in relation to wound care (Norton et al., 2018; Harris et al., 2018).

Wet to Moist Dressing

A wet to moist dressing involves a primary dressing that directly touches the wound bed, and a secondary dressing covering it.

Important: Ensure pain is well managed prior to a dressing change to maximize patient comfort.

Checklist 36 outlines the steps for performing a wet to moist dressing change.

Checklist 36: Wet to Moist Dressing Change

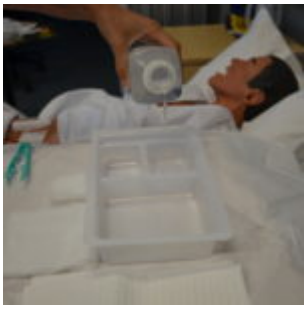
Disclaimer: Always review and follow your agency policy regarding this specific skill.

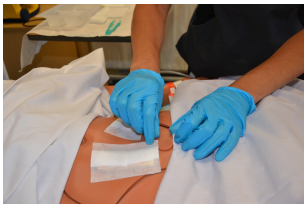
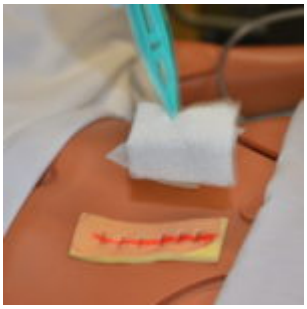
Safety considerations:

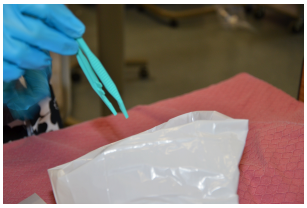
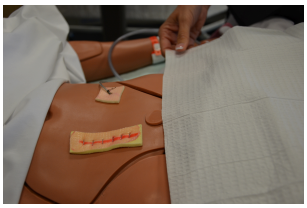
- Check room for additional precautions.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient and offer analgesia, bathroom, etc.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Complete QPA including safety.
- Perform a point of care risk assessment for PPE.
- Sanitize your working surface.

Steps	*Additional Information*
1. Check present dressing using non-sterile gloves if necessary.	This provides an opportunity for assessment and to determine required supplies for the procedure.

2. Perform hand hygiene.	Hand hygiene reduces the risk of infection.  *Perform hand hygiene*
3. Gather necessary equipment and supplies.	Being organized will help with efficiency and expedite the procedure, minimizing the length of time the patient experiences discomfort.
4. Prepare environment; position patient; adjust height of bed; turn on lights; and sanitize working surface.	This helps prepare patient and bedside for procedure.
5. Perform hand hygiene.	Hand hygiene reduces the risk of infection.  *Hand hygiene with ABHR*

6. Decide if this is a clean or sterile procedure. If a clean procedure, use non-sterile gloves. If a sterile procedure, use sterile gloves and follow principles of asepsis. Prepare field.	 *Sterile field* Whether this is a sterile or clean procedure, always reduce risk of transmitting microorganisms to patients
7. Add necessary sterile supplies. If this is a sterile procedure, use sterile saline. If you are irrigating the wound, you will need irrigation equipment (10 ml syringe and wound irrigation catheter).	 *Add supplies*
8. Pour cleansing solution into two separate compartments. Place gauze and saline to be used for wound packing in its own compartment.	 *Pour cleansing solution*

9. Apply non-sterile gloves.	This reduces the risk of contaminating your hands with the patient's blood and other body fluids. It also reduces the risk of germ transmission from you to the patient and vice versa, as well as from one patient to another.  *Apply non-sterile gloves*
10. Remove outer dressing with non-sterile gloves.	 *Remove outer dressing with non-sterile gloves*
11. Remove inner dressing with transfer forceps, and assess the old dressing and the wound.	 *Remove inner dressing with forceps* Inspect wound for evidence of healing or complications including the amount and type of drainage, odor, presence of staples / sutures, wound approximation, peri skin condition.

12. Discard transfer forceps and non-sterile gloves.	 *Discard transfer forceps*
13. Drape patient with underpad (optional).	 *Drape patient with underpad*
14. Clean the peri-wound skin and clean the wound bed either by irrigating or with sterile gauze and saline.	Irrigating with 10 pounds per square inch (PSI) and/or wiping gently with sterile gauze helps to lift slough and clean the wound bed.
15. Apply sterile or clean gloves (depending if the nature of the wound calls for a clean or sterile procedure). Wring-out excess solution from the gauze to be used for packing. "Not too wet and and not too dry … just like your eye" (author unknown)	Use enough saline to saturate gauze. Too much moisture can cause the peri-wound skin to become macerated.  *Saturate gauze*

16. Fluff up the moist gauze. Place into wound ensuring the wound bed is in contact with the moisture. Ensure gauze does not touch peri-wound skin.	Apply skin preparation to peri-wound skin if there is risk of skin breakdown.
17. Apply cover dressing. Secure with tape, stockinette, or kling.	Select a cover dressing that will help the gauze to remain moist until the next dressing change (i.e., one that won't wick away all of the moisture and cause the gauze to dry out).
18. Discard gloves according to agency policy, and perform hand hygiene.	Hand hygiene reduces the risk of infection.  *Discard gloves*
19. Next: • Assist patient to comfortable position. • Lower patient's bed. • Discard used equipment appropriately.	These steps ensure the patient's continued safety.

20. Document procedure and findings according to agency policy. Report any unusual findings or concerns to the appropriate healthcare professional.	Record dressing change: time, place of wound, wound characteristics, presence of staples or sutures, size, drainage type and amount, type of cleansing solution and dressing applied. Sample charting: *date / time. Right lateral ankle dressing changed. Large amount of sero purulent drainage. No odor. Wound approx 2 cm × 3 cm × 0.5 cm. Wound bed 90 % yellow slough 10% red. Irrigated with 30 ml normal saline. Packed with 4×4 gauze moist with saline. Covered with ABD pad and secured with stockinette. Peri-wound skin intact. Tolerated well. ————T Rex RN*
Data sources: Perry et al., 2018; WHO, 2009	

Wound Irrigation and Packing

Wound irrigation and packing refer to the application of fluid to a wound to remove exudate, slough, necrotic debris, bacterial contaminants, and dressing residue without adversely impacting cellular activity vital to the wound healing process (British Columbia Provincial Nursing Skin and Wound Committee, 2014, 2017).

Any wound that has a cavity, undermining, sinus, or a tract will require irrigation and packing. Open wounds require a specific environment for optimal healing from secondary intention. The purpose of irrigating and packing a wound is to remove debris and exudate from the wound, and encourage the growth of granulation tissue to prevent premature closure and abscess formation (Saskatoon Health Region, 2013). Depending on the severity of the wound, it can take weeks to months or years to complete the healing process. Packing should only be done by a trained healthcare professional and according to agency guidelines.

Contraindications to packing a wound include a fistula tract, a wound with an unknown endpoint to tunneling, a wound sinus tract or tunnel where irrigation solution cannot be retrieved, or a non-healing wound that requires a dry environment (Saskatoon Health Region, 2013).

The type of packing for the wound is based on a wound assessment, goal for the wound, and wound care management objectives. The packing material should fill the dead space and conform to the cavity to the base and sides. It is important to not over-pack or under-pack the wound. If the wound is over-packed, there may be excessive pressure placed on the tissue causing pain, impaired blood flow, and, potentially, tissue damage. If the wound is under-packed and the packing material is not touching the base and the sides of the cavity, undermining, sinus tract, or tunnel, there is a risk of the edges rolling and abscess formation (British Columbia Provincial Nursing Skin and Wound Committee, 2014).

The gauze used to pack a wound may be soaked with normal saline, ointment, or hydrogel, depending on the needs of the wound. Other types of packing material include gauze impregnated with polyhexaamethylene biguanide (PHMB), iodine (povidone and cadexomer), ribbon dressing, hydro-fiber dressing, alginate antimicrobial dressing, and a negative pressure foam or gauze dressing. Table 4.7 lists some wound care products and indications for each. If using ribbon gauze from a multi-use container, ensure each patient has their own container to avoid cross-contamination (British Columbia Provincial Nursing Skin and Wound Committee, 2014).

Additional guidelines to irrigating and packing a wound are listed in Table 4.8.

Wound Care Products

Table 4.7 Wound Care Products	
Type	*Indications*
Non-adherent contact layer (i.e., Telfa, silicone, petroleum-based woven dressings)	Allows the wound to drain with minimal disruption to the wound bed when the dressing is removed. Requires an outer dressing.
Hydrocolloid	• Minimal absorption capability (not for highly draining wounds) • Good for autolytic debridement • Maintains moist wound bed • Impermeable to external contamination • Self-adhesive and pliable, so conforms to the body • Duration approx. 5 to 7 days • All gel must be removed between dressing changes • Not for infected or necrotic wounds

Hydrogel	• Introduces moisture into the wound • Absorbs small amounts of exudate • Debrides wound by softening necrotic tissue • Does not adhere to wound base • Duration approx. 5 to 7 days • All gel must be removed between dressing changes
Calcium alginates	• Manufactured from seaweed • Highly absorbent • Becomes a gel in presence of moisture • Available as sheet or rope form • Requires an outer dressing • Must be fitted to the wound bed and not in contact with peri-wound skin
Foams	• Used for highly draining wounds • Autolytic debridement • Change frequency depends on wound drainage (1 to 3 days) • Not for infected wounds • Not for dry necrosis
Charcoal	• Charcoal imbedded in product and is odour absorbent • Requires an outer dressing

Anti-microbials	• Medical grade honey, silver, cadexomer iodine, alginates, foams, pastes
Negative Pressure Wound Therapy (NPWT)	• Also knows as VAC dressing, vacuum assisted closure • Manages large amounts of exudate • Sub-atmospheric pressure applied to a wound bed promotes and accelerates healing
BHMB	• Antimicrobial / antiseptic impregnated into guaze (strips or sheets) and foam dressings
Silver impregnated gauze / foams	• Silver is antimicrobial and promotes healing. Foam absorbs moisture
Combination products	• Can include more than one of the above (e.g., silver and charcoal)
Data sources: Alavi et al., 2015; Eberlein & Assadian, 2010; Kerr et al., 2014; Munteanu et al, 2016; Wiegand et al., 2015	

Table 4.8 General Guidelines for Irrigating and Packing a Complicated Wound

Guideline	*Additional Information*
Aseptic technique	Sterile technique or no-touch technique may be used for irrigating and packing a wound. The use of a specific technique is based on agency policy, condition of the client, heal-ability of the wound, invasiveness, and goal of the wound care. Sterile technique or no-touch technique must be used in all acute care settings. Clean technique may be used for chronic wounds in long-term-care and home settings.
Type of solution for irrigation	The most common solution used is normal saline at room temperature, unless otherwise ordered. Check prescriber's / wound care specialist's orders. Non-potable water should never be used for cleansing of post operative wounds. Boiled and cooled water is an acceptable alternative (Johanna Briggs Institute, 2006, as cited in Harris et al., 2018)
Wound irrigation	The wound is irrigated each time the dressing is changed. See specific wound guidelines about volume used to irrigate. The volume of irrigation solution is dependent on the size of wound and amount of exudate. Usually "irrigate until clear." The majority of irrigation fluid should be recovered. If not, stop and consult the prescriber or wound care specialist. Begin irrigation at one part of the wound and move methodically looking for tunnels whilst irrigating. Note the placement of the tunnel (using a clock face i.e. 12 o'clock) and note the depth of each tunnel.
Irrigation pressure	The pressure of irrigating must be strong enough to remove debris but not damage the new tissue. Generally, a 35 ml syringe with a 19 gauge blunt tip will provide sufficient PSI for irrigation.
Wound assessment	Wound assessment must be done with each dressing change to ensure the product is adequately meeting the needs of the wound.
Swabbing the wound	Swab for culture, if required. Always swab a wound after irrigation. See agency protocols for how to obtain a wound C&S.

Packing material	Packing material must be removed with each dressing change. Only one piece of gauze or dressing material should be used in wounds with sinus tracts or tunneling to avoid the risk of retaining dressing/packing material. If there is a concern that packing is retained in the wound, contact the wound specialist or physician for follow-up. Always leave a "tail" of the packing strip outside the wound. If more than one piece of packing is used, leave the tails outside the wound by securing the tails to the skin with a piece of Steri-Strip if needed.
Documentation	Wound assessment and dressing change must be documented each time. Each wound requires a separate wound care sheet. Type and quantity of packing material (length or pieces), along with the number of inner and outer dressings should be recorded as per agency policy. For any cavity, undermining, sinus tract, or tunnel with a depth greater than 1 cm (> 1 cm), count and document the number of packing pieces removed from the wound, and the number of packing pieces inserted into the wound.
Communication	A copy of the most recent wound care assessment and dressing change should be sent with patient upon transfer to another healthcare facility.
Use of sterile gloves for packing	Sterile gloves may be used if packing a large or complex wound.
Data sources: British Columbia Provincial Nursing Skin and Wound Committee, 2014; Harris, 2017; Saskatoon Health Region, 2013	

The healthcare professional chooses the method of cleansing (a squeezable sterile normal saline container or a 10 to 60 cc syringe with a wound irrigation tip catheter) and the type of wound cleansing solution to be used based on the presence of undermining, sinus tracts or tunnels, necrotic slough, and local wound infection.

Agency policy will determine the wound cleansing solution, and/or product to be used to impregnate the gauze to be packed into the wound. Generally sterile normal saline and sterile water are the solutions of choice. Warmed solutions may increase patient comfort (Harris et al., 2018)

Undermining, sinuses, and tunnels can only be irrigated when there is a known endpoint. Do not irrigate undermining, sinuses, or tunnels that extend beyond 15 cm unless directed by a physician or nurse practitioner (NP). If fluid is instilled into a sinus, tunnel, or undermined area and cannot be removed from the area, stop irrigating and refer to a wound specialist, physician, or NP.

Checklist 37 outlines the steps for irrigating and packing a wound.

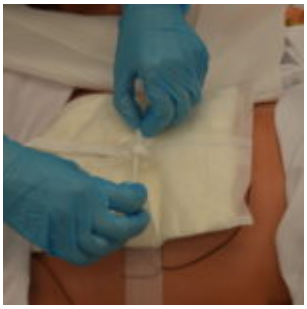
Checklist 37: Wound Irrigation and Packing

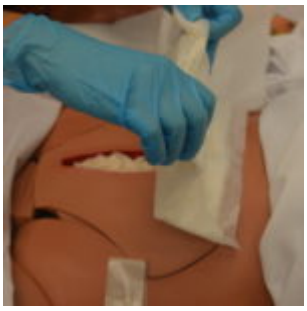
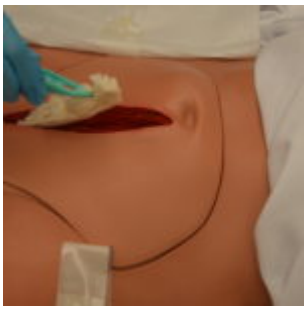
Disclaimer: Always review and follow your agency policy regarding this specific skill.

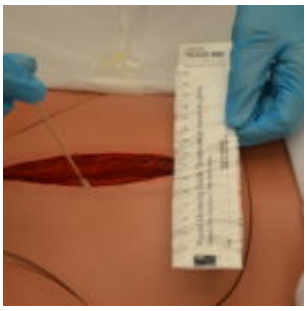
Safety considerations:

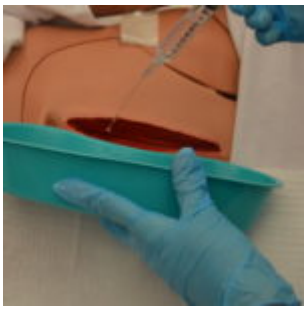
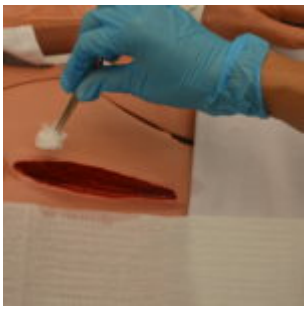
- Perform hand hygiene.
- Check room for additional precautions.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient and offer analgesia, bathroom, etc.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Complete QPA including safety.
- Containers with cleansing solution must be patient specific, and must be discarded after 24 hours.
- Sanitize working surface.
- Perform a point of care risk assessment for PPE.

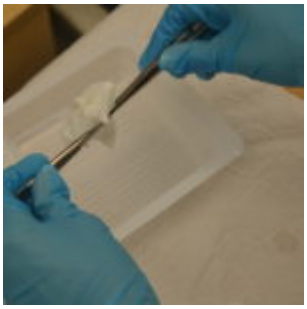
Steps	*Additional Information*
1. Review order for wound care.	Confirm that prescriber's orders are appropriate to wound assessment.
2. Perform hand hygiene.	Hand hygiene reduces the risk of infection.  *Hand hygiene with ABHR*

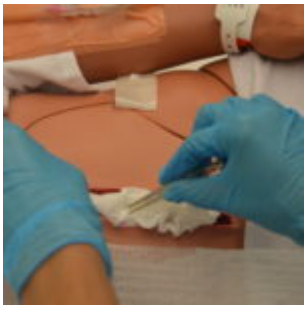
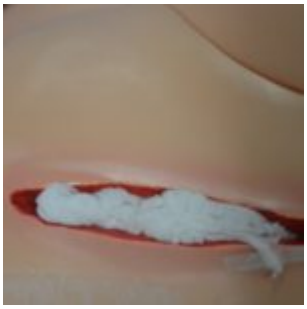
3. Gather necessary equipment and supplies: • Syringe (10 to 60 ml) • Cannula with needleless adaptor (a.k.a. irrigation catheter) • Irrigation fluid (usually saline) • Basin • Waterproof pad • Dressing tray • Scissors if wound packing materials must be cut • Skin barrier / protectant • Cotton tip applicators • Measuring guide • Outer sterile dressing • Packing gauze or packing as per physician's orders Some agencies provide a prepackaged sterile irrigation tray.	Being organized will help with efficiency and expedite the procedure, minimizing the length of time the patient experiences discomfort.  *Gather supplies and set up sterile tray*
4. Position patient to allow solution to flow off patient. Position patient so wound is vertical to the collection basin.	 *Position patient on side*
5. Place waterproof pad under patient. Set up sterile field and supplies.	Protect patient's clothing and bedding from irrigation fluid.

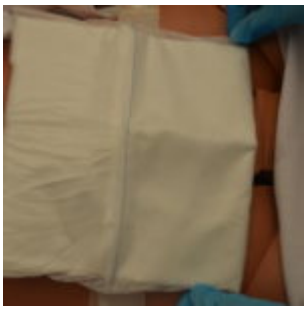
	 *Remove outer dressing*
6. Remove outer dressing with non-sterile glove. Using transfer forceps, remove inner dressing (packing) from the wound. If the packing sticks, gently soak the packing with normal saline or sterile water and gently lift off the packing. Confirm the quantity and type of packing is the same as recorded on previous dressing change.	Removing packing that adheres to the wound bed without soaking can cause trauma to the wound bed tissue. If packing material cannot be removed, contact the physician, NP, or wound clinician. If packing adheres to the wound, reassess the amount of wound exudate and consider a different packing material.  *Remove inner dressing* All packing must be removed with each dressing change.

7. Assess the wound. • Take measurements, including length, width, and depth. • For undermining or tunneling, note location and size. • Look for evidence of bone or tendon exposure. • Assess appearance of wound bed, noting percentage of tissue types. • Note presence of odor after cleansing. • Assess appearance of wound edge and peri-wound skin.	 *Assess the wound* Wound assessment helps identify if the wound care is effective. Always compare the current wound assessment with the previous assessment to determine if the wound is healing, delayed, worsening, or showing signs of infection.
8. Apply non-sterile gloves, gown, and goggles or face shield according to your point of care risk assessment.	The use of personal protective equipment (PPE) reduces the risk of your exposure to BBF  *Apply non-sterile gloves*
9. Fill 35 to 60 ml syringe with sterile water or irrigating solution, and attach an irrigation tip to the end of syringe.	 *Fill syringe with irrigating solution*

10. Hold the irrigation tip very close to the wound and flush wound using gently continuous pressure until returns run clear into the basin. If irrigating a deep wound with a very small opening, attach an irrigation tip catheter to the syringe. Insert the tip searching for undermining and tunnels, measuring and noting the location and depth of each. Use slow continuous pressure to flush wound. Repeat flushing procedure until returns run clear into the basin. If the majority of the irrigation fluid is not recovered stop and consult the prescriber.	 *Irrigate wound* Irrigation should be drained into basin. Retained irrigation fluid is a medium for bacterial growth and subsequent infection. Irrigation should not increase patient discomfort. The irrigation tip controls the pressure of the fluid, not the force of the plunger.
11. Clean and dry wound edges with sterile gauze using sterile forceps.	 *Clean & dry wound edges with sterile gauze* This step prevents maceration of surrounding tissue from excess moisture.
12. Remove goggles or face shield.	

13. Perform hand hygiene and apply sterile gloves (if not using sterile forceps) or non-sterile gloves.	Hand hygiene reduces the risk of infection.  *Hand hygiene with ABHR*
14. For normal saline gauze packing: • Moisten the gauze with sterile normal saline, and wring it out so it is damp but not wet. • Enclose any non-woven edges in the centre of the packing material to reduce the risk of loose threads in the wound. For other packing materials (e.g., hydrogel, iodine [povidone & cadexomer], PHMB), see the specific product information.	The wound must be moist, not wet, for optimal healing. Gauze packing that is too wet can cause tissue maceration, and it reduces the absorbency of the gauze.  *Moisten gauze* If using normal saline gauze packing, it needs to be changed often throughout the day to prevent the gauze from drying out. If it is necessary to use more than one ribbon packing piece, the pieces must be tied together using sterile gloves; ensure the knot(s) is secure.

15. Open gauze and gently pack it into wound using either forceps, the tip of a cotton swab stick, or sterile gloved hands. Begin with the deepest part of the wound and finish at the surface. Ensure the wound is not over-packed or under-packed as this may diminish the healing process. Apply skin protectant to peri-wound skin.	Continue to pack the wound until *all* wound surfaces are in contact with gauze.  *Apply packing to wound* Keep the moist dressing off of the peri-wound skin. Saturated packing materials and/or wound exudate may macerate or irritate unprotected peri-wound skin.
16. Always leave a "tail" of packing materials either clearly visible in the wound cavity or on the peri-wound skin. Use a Steri-Strip to secure the packing tail to the peri-wound skin. If two or more packing pieces have been knotted together, ensure that the knots are placed in the wound cavity, not in the undermining, sinus tract, or tunnel.	 *Leave a "tail" of packing materials* If the knot is visible in the wound, it is less likely that a packing piece will be lost if the knot comes undone. A knot exerting pressure on the wound surface may impair blood flow and potentially cause necrosis in the wound.

17. Apply an appropriate outer dry dressing, depending on the frequency of the dressing changes and the amount of exudate from the wound. Secure the dressing.	The dressing on the wound must remain dry on the outside until the next dressing change to reduce risk of introducing more microorganisms into the wound.  *Apply outer dressing*
18. Discard supplies and perform hand hygiene.	This prevents the transfer of microorganisms.  *Perform hand hygiene*
19. Help patient back into a comfortable position, and lower the bed.	This step optimizes patient safety.
20. Document wound assessment, irrigation solution, dressings used for packing, and patient response to the procedure. Documentation should include date and time of procedure. Report any unusual findings or concerns to the appropriate healthcare professional.	This allows for effective communication between healthcare providers. Notify required healthcare providers if wound appears infected or is not healing as expected. Sample charting: *date / time. Abdominal wound dressing changed. Large amount foul smelling purulent drainage present. wound irrigated with 60 ml NS using irrigation tip catheter and syringe. 2 cm tunnel at 12 o'clock and 4 cm tunnel at 5 o'clock. Wound bed approx 1.5 cm × 2 cm × 0.5 cm. Wound bed 50 % red 50% yellow slough. Tunnels and wound bed packed with hydrogel soaked ribbon gauze approx 20 cm in total. Peri-wound skin macerated extending approx. 3 cm. Skin prep applied to same. Covered with ABD pad. Tolerated with some voiced discomfort.————————YIkes RN*
Data sources: BCIT, 2010b; Perry et al., 2018	

Watch the video *Wound Irrigation and Packing* by Renée Anderson and Wendy McKenzie Thompson Rivers University.

The following links provide additional information about wound packing and wound measuring.

Read British Columbia Provincial Nursing Skin & Wound Committee's *Procedure: Wound Packing* (2017) to learn more about wound packing procedure.

Take Vancouver Coastal Health Authority's *Wound Assessment* course (2009) to learn more about wound measuring and assessment.

Critical Thinking Exercises

1. Provide a rationale for selecting PPE when performing wound irrigation (eye protection; gown; non-sterile gloves; sterile gloves).
2. Which elements are important to consider when assessing a closed surgical incision?
3. What elements are important to consider when assessing an open wound?

4.7 Suture Removal

Sutures are tiny threads, wire, or other material used to sew body tissue and skin together. They may be placed deep in the tissue and/or superficially to close a wound. A variety of suture techniques are used to close a wound, and deciding on a specific technique depends on the location of the wound, thickness of the skin, degree of tensions, and desired cosmetic effect (Perry et al., 2014).

There are different types of sutures techniques. Some of these are illustrated in Figure 4.2. The most commonly seen suture is the intermittent or interrupted suture.

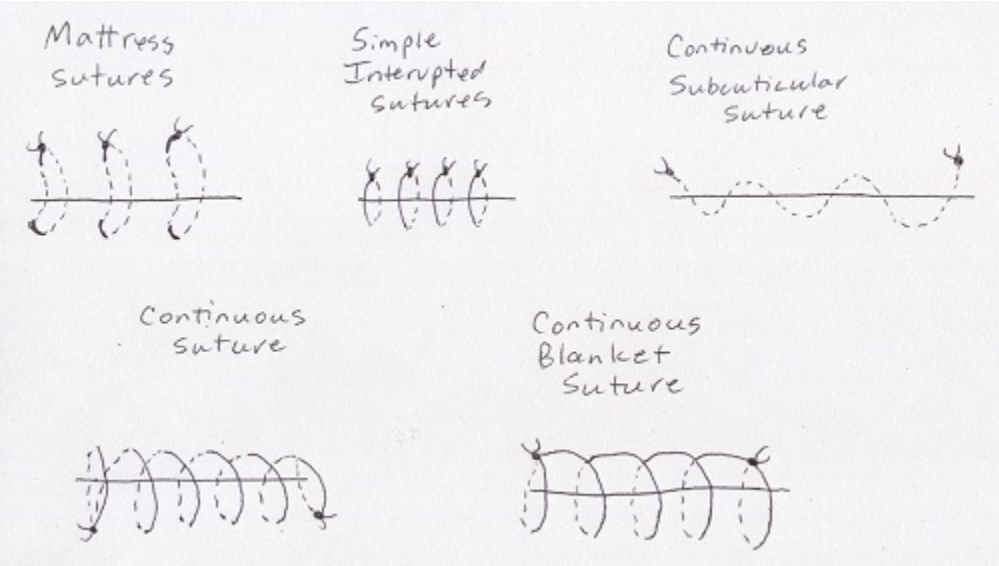


Figure 4.2 Suture techniques

Figure 4.3 Simple interrupted sutures

Sutures may be absorbent (dissolvable) or non-absorbent (must be removed). Non-absorbent sutures are usually removed within 7 to 14 days. Suture removal is determined by how well the wound has healed and the extent of the surgery. Sutures must be left in place long enough to establish wound closure with enough strength to support internal tissues and organs.

The healthcare provider must assess the wound to determine whether or not to remove the sutures. The wound line must also be observed for separations during the process of suture removal. Removal of sutures must be ordered by the primary healthcare provider (physician or nurse practitioner). An order to remove sutures must be obtained prior to the procedure, and a comprehensive assessment of the wound site must be performed prior to the removal of the sutures by the healthcare provider.

Alternate sutures (every second suture) are typically removed first, and the remaining sutures are removed once adequate approximation of the skin tissue is determined. If the wound is well healed, all the sutures would be removed at the same time. Alternately, the removal of the remaining sutures may be days or weeks later (Perry et al., 2014). Checklist 38 provides the steps for intermittent suture removal.

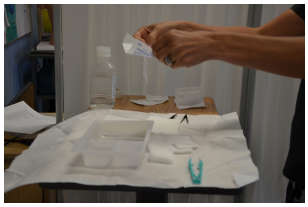
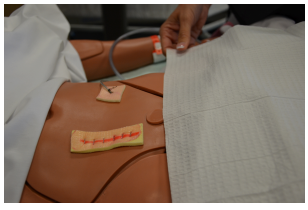
Checklist 38: Intermittent Suture Removal

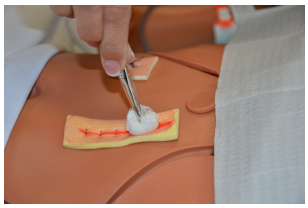
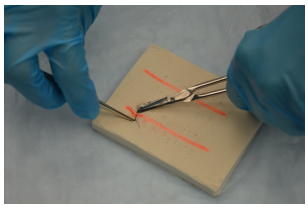
Disclaimer: Always review and follow your agency policy regarding this specific skill.

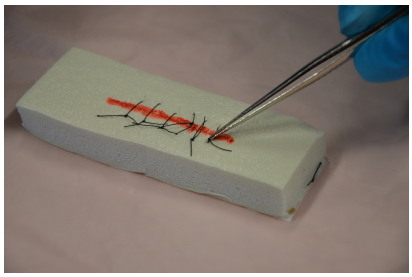
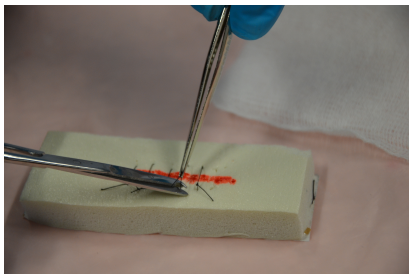
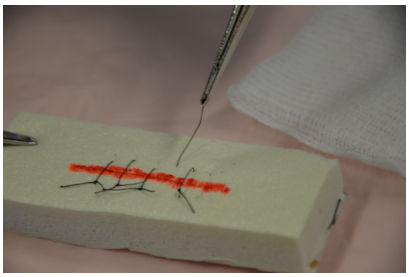
Safety considerations:

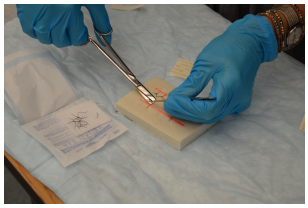
- Perform hand hygiene.
- Check room for additional precautions.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient and offer analgesia, bathroom, etc.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Complete QPA including safety.
- Assess the patient risk of delayed healing and risk of wound dehiscence.
- Perform a point of care risk assessment for necessary PPE.

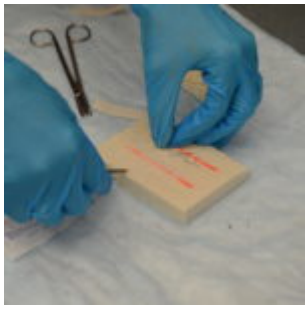
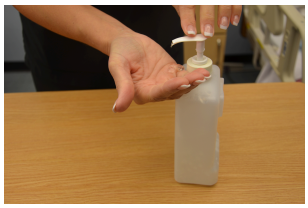
Steps	*Additional Information*
1. Confirm prescriber's orders, and explain procedure to patient. Offer analgesic.	Explaining the procedure will help prevent anxiety and increase compliance with the procedure. Inform patient that the procedure is not painful, but the patent may feel some pulling of the skin during suture removal.
2. Gather appropriate supplies after deciding if this is a clean or sterile procedure. Clean techniques suffice if wounds have been exposed to the air and the wound is approximated and healing.	You will need suture scissors or suture blade, forceps, receptacle for suture material (gauze, tissue, garbage bag), antiseptic swabs can be used for clean procedure, sterile dressing tray if this is a sterile procedure. Steri-Strips and outer dressing, if indicated.
3. Position patient appropriately and create privacy for procedure.	Ensure proper body mechanics for yourself, and create a comfortable position for the patient.

4. Perform hand hygiene.	Hand hygiene reduces the risk of infection.  *Perform hand hygiene*
5. If this is a sterile procedure, prepare the sterile field and add necessary supplies in an organized manner. Note: If this is a clean procedure, you simply need a clean surface for your supplies. Some of your equipment will come in its own sterile package. Think about how you can reduce waste but still ensure safety for the patient.	This allows easy access to required supplies for the procedure.  *Prepare sterile field*
6. If present, remove dressing using non-sterile gloves and inspect the wound.	Visually assess the wound for uniform closure of the wound edges, absence of drainage, redness, and swelling. Pain should be minimal. After assessing the wound, decide if the wound is sufficiently healed to have the sutures removed. If there are concerns, question the order and seek advice from the appropriate healthcare provider.  *Assess wound*

7. Remove non-sterile gloves and perform hand hygiene.	This prevents the transmission of microorganisms.  *Hand hygiene with* ABHR
8. If necessary, clean and dry the incision site according to agency policy. Consider the purpose and need for cleaning a wound that has been exposed to air for an extended period.	This step reduces risk of infection from microorganisms on the wound site or surrounding skin.  *Clean incision* Cleaning also loosens and removes any dried blood or crusted exudate from the sutures and wound bed.
9. Perform a point of care risk assessment. Apply clean non-sterile gloves if indicated. Alternatively you can use no touch technique To remove intermittent sutures, hold scissors / blade in dominant hand and forceps in non-dominant hand.	This allows for dexterity with suture removal.  *Hold scissors in dominant hand and forceps in non-dominant hand*

10. Grasp knot of suture with forceps and gently pull up knot. Note the entry / exit points of the suture material. Slip the tip of the scissors under suture near the skin.	
11. Cut under the knot as close as possible to the skin at the distal end of the knot. If using a blade to cut the suture, point the blade away from you and your patient.	 *Cut under the knot* Key points: • Cut the suture at the surface of the skin. • Never leave suture material below the surface. • Do not pull the contaminated suture (suture on top of the skin) below the surface of the skin.
12. Grasp knotted end with forceps, and in one continuous action pull suture out of the tissue and place removed sutures into the receptacle	 *Grasp knotted end with forceps*
13. Remove every second suture until the end of the incision line.	Assess wound healing after removal of each suture to determine if each remaining suture will be removed.
If wound edges open, stop the procedure, apply Steri-Strips (using tension to pull wound edges together), cover the wound, and notify appropriate healthcare providers. It is within the RN's independent scope of practice to apply Steri-Strips to a wound without an order (BCCNP, 2019).	

14. Using the principles of asepsis, place Steri-Strips perpendicular along the incision line with gaps of approximately 2 to 3 mm between each	 *Apply Steri-Strips*
15. Apply appropriate sized Steri-Strips to provide support on either side of the incision, generally 2.5 to 5 cm.	Steri-Strips support wound tension across wound and help to eliminate scarring.  *Steri-Strips*
16. Remove remaining sutures.	Only remove remaining sutures if wound is well approximated.  *Remove remaining sutures*

17. Place Steri-Strips on remaining areas of each removed suture along incision line.	The Steri-Strips will help keep the skin edges together.  *Apply Steri-Strips*
18. Complete patient teaching.	Instruct patient regarding: • Take showers rather than bathe. • Pat dry, do not scrub or rub the incision. • Do not pull off Steri-Strips. Allow the Steri-Strips to fall off naturally and gradually (usually takes one to three weeks). • Importance of avoiding strain on the wound (i.e., if this is an abdominal wound, no straining during defecation; if this is a knee wound avoid kneeling). • Importance of adequate rest, fluids, nutrition, and ambulation for optional wound healing. • Observe the wound for signs and symptoms of infection and notify a healthcare professional if any concerns.
19. Perform hand hygiene.	Hand hygiene reduces risk of infection.  *Hand hygiene with ABHR*

20. Document procedures and findings according to agency policy.	Report any unusual findings or concerns to the appropriate healthcare professional. Sample charting: *date/ time. Right hip sutures removed. Wound well approximated. No redness. No swelling. Steri-Strips applied. Aware of S&S of infection and to observe wound for same and report any concerns to the healthcare provider. Discussed showering, eventual removal of Steri-Strips, activity limitations for next 4 weeks. ————GNhome RN*
Data source: BCIT, 2010c; BCCNP 2019; Healthwise Staff, 2017; Perry et al., 2018	

Watch the videos *Intermittent Suture Removal* by Renée Anderson and Wendy McKenzie (2018) of Thompson Rivers University School of Nursing.

Critical Thinking Exercises

1. Jasbir is going home with a lower abdominal surgical incision following a c-section. What patient teaching is important in relation to the wound?
2. Acki is discharged from the clinic following removal of sutures in his knee following a mountain biking accident. What patient teaching is important in relation to the wound?
3. What situations warrant staple / suture removal to be a sterile procedure? What situations warrant staple / suture removal to be a clean procedure?

Checklist 39 outlines the steps to remove continuous and blanket stitch sutures.

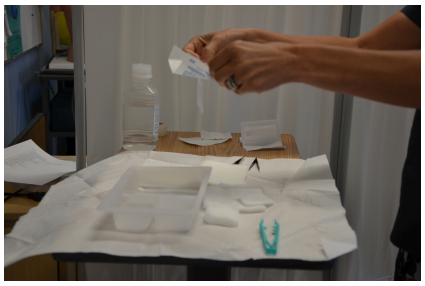
Checklist 39: Continuous and Blanket Stitch Suture Removal

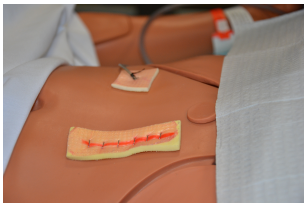
Disclaimer: Always review and follow your agency policy regarding this specific skill.

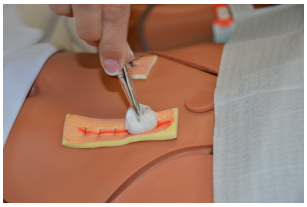
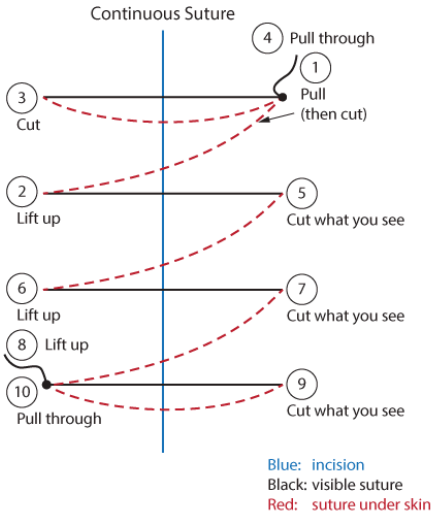
Safety considerations:

- Perform hand hygiene.
- Check room for additional precautions.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient and offer analgesia, bathroom etc.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Complete QPA including safety.
- Assess the patient risk of delayed healing and risk of wound dehiscence.
- Perform a point of care risk assessment for necessary PPE.

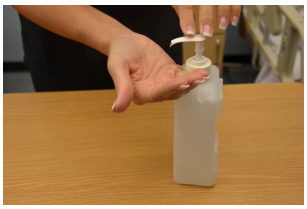
Steps	*Additional Information*
1. Confirm prescriber's order and explain procedure to patient.	Explaining the procedure will help prevent anxiety and increase compliance with the procedure. Inform patient that the procedure is not painful, but the patent may feel some pulling of the skin during suture removal.

2. Gather appropriate supplies after deciding if this is a clean or sterile procedure. Clean techniques suffice if wounds have been exposed to the air and the wound is approximated and healing.	You will need suture scissors or suture blade, forceps, receptacle for suture material (gauze, tissue, garbage bag), antiseptic swabs can be used for clean procedure, sterile dressing tray if this is a sterile procedure, Steri-Strips and outer dressing, if indicated.
3. Position patient appropriately and create privacy for procedure. Offer analgesic.	Ensure proper body mechanics for yourself, and create a comfortable position for the patient.
4. Perform hand hygiene.	Hand hygiene reduces the risk of infection.  *Perform hand hygiene*
5. If this is a sterile procedure, prepare the sterile field and add necessary supplies in an organized manner. Note: If this is a clean procedure you simply need a clean surface for your supplies. Some of your equipment will come in its own sterile package. Think about how you can reduce waste but still ensure safety for the patient.	This step allows for easy access to required supplies for the procedure.  *Prepare sterile field*

6. If present, remove dressing with non-sterile gloves and inspect the wound.	Visually assess the wound for uniform closure of the wound edges, absence of drainage, redness, and swelling. Pain should be minimal.  *Assess wound* After assessing the wound, decide if the wound is sufficiently healed to have the sutures removed. If there are concerns, question the order and seek advice from the appropriate healthcare provider.
7. Remove non-sterile gloves and perform hand hygiene.	This step prevents the transmission of microorganisms.  *Remove non-sterile gloves*

8. If necessary, clean and dry the incision site according to agency policy.	This step reduces the risk of infection from microorganisms on the wound site or surrounding skin. Cleaning also loosens and removes any dried blood or crusted exudate from the sutures and wound bed.  *Clean incision site*
9. Place receptacle close to suture line; grasp scissors in dominant hand and forceps in non-dominant hand.	This allows for dexterity with suture removal.
10. Grasp the knot of the suture with forceps and gently pull up. Note the entry and exit points of the suture material. Cut one of the suture strings. Gently pull on the knot to remove the suture. If suture isn't removed, gently pull on suture material to determine the next entry / exit point.	 *Continuous suture removal guide*
11. Snip second suture on the same side. Grasp knotted end and gently pull out suture. Place suture into receptacle.	This action prevents the suture from being left under the skin.
12. Continue cutting in the same manner until the entire suture is removed, inspecting the incision line during the procedure.	Inspection of incision line reduces the risk of separation of incision during procedure.

If separation occurs: Stop procedure, apply Steri-Strips and sterile dressing, and notify physician.	
13. Apply Steri-Strips to suture line, then apply sterile dressing or leave open to air.	This step reduces the risk of infection.  *Apply Steri-Strips*
14. Position patient and lower bed to safe height; ensure patient is comfortable and free from pain.	This ensures patient safety.
15. Complete patient teaching.	Instruct patient regarding: • Take showers rather than bathe. • Pat dry, do not scrub or rub the incision. • Do not pull off Steri-Strips. Allow the Steri-Strips to fall off naturally and gradually (usually takes one to three weeks). • Importance of avoiding strain on the wound (i.e., if this is an abdominal wound, no straining during defecation; if this is a knee wound avoid kneeling). • Importance of adequate rest, fluids, nutrition, and ambulation for optional wound healing. • Observe the wound for signs and symptoms of infection and notify a healthcare professional if any concerns.
16. Discard supplies according to agency policies for sharp disposal and biohazard waste.	In some agencies scissors and forceps may be disposed, in others they are sent for sterilization.

17. Perform hand hygiene.	Hand hygiene reduces risk of infection.  *Hand hygiene with ABHR*
18. Document procedures and findings according to agency policy.	Report any unusual findings or concerns to the appropriate healthcare professional.
Data source: BCIT, 2010c; Perry et al., 2014	

Watch the video *Continuous / Blanket Stitch Suture Removal* developed by Renée Anderson and Wendy McKenzie (2018) Thompson Rivers University School of Nursing.

Complications related to suture removal, including wound dehiscence, may occur if wound is not well healed, if the sutures are removed too early, or if excessive force (pressure) is applied to the wound. In addition, if the sutures are left in for an extended period of time, the wound may heal around the sutures, making extraction of the sutures difficult and painful. Table 4.9 lists additional complications related to wounds closed with sutures.

Table 4.9 Complications of Suture Removal

Complication	*Solution*
Unable to remove suture from tissue	Contact physician for further instructions.
Wound dehiscence: Incision edges separate during suture removal; wound opens up	Stop removing sutures. Apply Steri-Strips across open area and perpendicular to the wound. Notify physician.
Patient experiences pain when sutures are removed	Allow small rest breaks during removal of sutures. Use distraction techniques (wiggle toes / slow deep breaths). Offer analgesic. Provide opportunity for the patient to deep breathe and relax during the procedure.
Wound becomes red, painful, with increasing pain, fever, drainage from wound	These changes may indicate the wound is infected. Report findings to the primary healthcare provider for additional treatment and assessments.
Scarring related to sutures	All wounds form a scar and will take months to one year to completely heal. Scarring may be more prominent if sutures are left in too long.
Keloid formation	A **keloid formation** is a firm scar-like mass of tissue that occurs at the wound site. The scarring tends to extend past the wound and is darker in appearance.
Hypertrophic scars	Hypertrophic scars are scars that are bulky but remain within the boundaries of the wound. These scars can be minimized by applying firm pressure to the wound during the healing process using sterile Steri-Strips or a dry sterile bandage.
Data sources: BCIT, 2010c; Perry et al., 2014	

Critical Thinking Exercises

5. What is the purpose of applying Steri-Strips to the incision after removing sutures?
6. Which healthcare provider is responsible for assessing the wound prior to removing sutures?

7. What factors increase risk of delayed wound healing?
8. What patient teaching points should be included as ways to support wound healing?

Attributions

Figure 4.2 Suture techniques. Adapted from World Health Organization. Emergency & Essential Surgical Care Programme. [2018]. *Emergency and Trauma Care Module 2: Basic surgical skills: Practical suture techniques*. Used under the CC BY-NC-SA 3.0 IGO license.

Figure 4.3 Intermittent plain sutures by Jones, S. is used under the CC BY-SA 2.0 license.

4.8 Staple Removal

Staples are made of stainless steel wire and provide strength for wound closure. Staples are strong, quick to insert, and simple to remove.

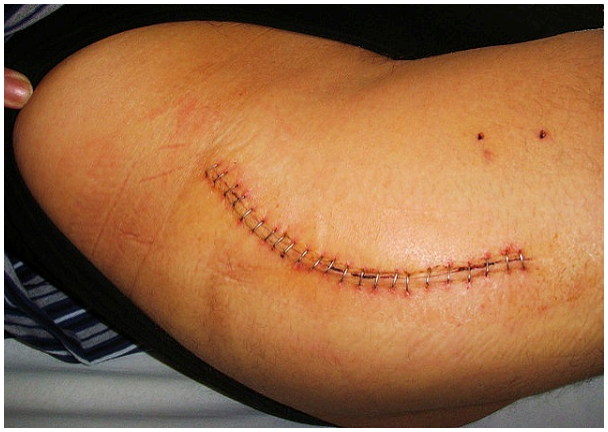


Figure 4.4 Surgical staples

Removal of staples requires aseptic considerations and a staple extractor. An order to remove the staples, and any specific directions for removal (i.e., remove alternate staples only), must be obtained prior to the procedure. The healthcare professional performing the removal must also inspect the wound prior to the procedure to ensure the wound is adequately healed to have the staples removed. Usually every second staple is removed initially; then the remainder are removed at a later time (Perry et al., 2014). In general, staples are removed within 7 to 14 days.

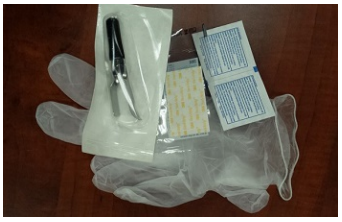
Checklist 39 outlines the steps for removing staples from a wound.

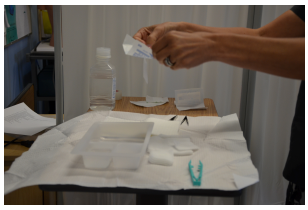
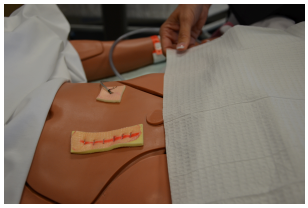
Checklist 39: Staple Removal

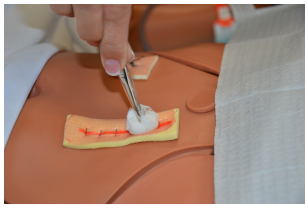
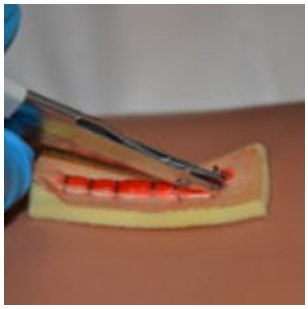
Disclaimer: Always review and follow your agency policy regarding this specific skill.

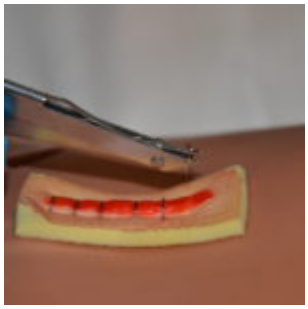
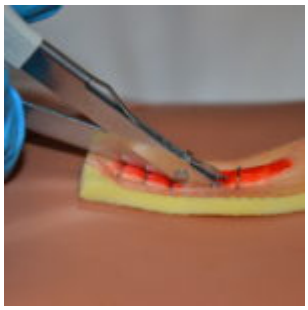
Safety considerations:

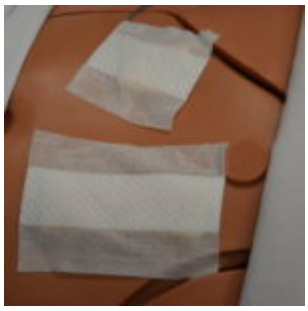
- Perform hand hygiene.
- Check room for additional precautions.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient and offer analgesia, bathroom, etc.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Complete QPA including safety.
- Assess patient risk for delayed wound healing and potential dehiscence.
- perform a point of care risk assessment for PPE

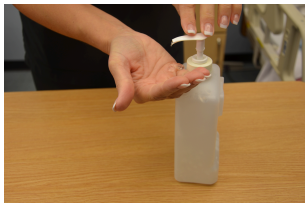
Steps	*Additional Information*
1. Confirm prescriber's orders, and explain procedure to patient.	Explanation helps prevent anxiety and increases compliance with the procedure. Inform patient the procedure is not painful, but the patent may feel some pulling or pinching of the skin during staple removal.
2. Gather appropriate supplies after deciding if this is a clean or sterile procedure. Clean techniques suffice if wounds have been exposed to the air and the wound is approximated and healing.	You will need staple remover, receptacle for suture material (gauze, tissue, garbage bag), antiseptic swabs can be used for clean procedure, sterile dressing tray if this is a sterile procedure. Steri-Strips and outer dressing, if indicated.  *Figure 4.5 staple removal equipment*

3. Position patient appropriately and create privacy for procedure.	Ensure proper body mechanics for yourself, and create a comfortable position for the patient.
4. Perform hand hygiene.	This reduces the risk of infection.  *Perform hand hygiene*
5. If necessary prepare the sterile field and add necessary supplies (staple extractor). Note: If this is a clean procedure you simply need a clean surface for your supplies. Some of your equipment will come in its own sterile package. Think about how you can reduce waste but still consider safety for the patient.	This step allows easy access to required supplies for the procedure.  *Add sterile items to sterile field*
6 Apply non-sterile gloves. If present, remove dressing and inspect the wound.	Visually assess the wound for uniform closure of the edges, absence of drainage, redness, and inflammation.  *Remove dressing and inspect the wound* After assessing the wound, determine if the wound is sufficiently healed to have the staples removed. If concerns are present, question the order and seek advice from the appropriate healthcare provider.

7. If necessary, clean incision site according to agency policy.	This reduces the risk of infection from microorganisms on the wound site or surrounding skin.  *Clean incision site* Cleaning also loosens and removes any dried blood or crusted exudate from the staples and wound bed.
When removing staples, remove every other one first.	
8. With the staple remover at an angle of less than 30° to the skin, place lower tip of staple extractor beneath the staple. Do not pull up while depressing handle on staple remover or change the angle of your wrist or hand. Close the handle, observe the staple ends lifting out of the skin. If necessary, gently move the staple side to side to remove.	The closed handle depresses the middle of the staple causing the two ends to bend outward and out of the top layer of skin.  *Close the handle, then gently move the staple from side to side to remove*

9. When both ends of the staple are visible, move the staple extractor away from the skin and place the staple on a receptacle by releasing the handles on the staple extractor.	This avoids pulling the staple out prematurely and avoids putting pressure on the wound. It also prevents scratching the skin with the sharp staple.  *Keep the handle closed and move the staple extractor away from the skin*
10. Continue to remove every second staple to the end of the incision line.	Alternating removal of staples provides strength to incision line while removing staples and prevents accidental separation of incision line.  *Continue to remove every second staple to the end of the incision line*

11. If necessary, apply Steri-Strips. Apply appropriate sized Steri-Strips to provide support on either side of the incision, generally 1 to 2 in long. Using the principles of asepsis, place Steri-Strips perpendicular along the incision line with gaps of approximately 2 to 3 mm between each.	Steri-Strips support wound tension across wound and eliminate scarring. This allows wound to heal by primary intention.  *Cut Steri-Strips to allow them to extend 1.5 to 2 cm on each side of incision*
12. Remove remaining staples, followed by applying Steri-Strips along the incision line.	Steri-Strips support wound tension across wound
13. If necessary, apply dry, sterile dressing on incision site or leave exposed to air if wound is not irritated by clothing, or according to physician orders.	This reduces risk of infection.  *Apply dry, sterile dressing if required*
14. Position patient, lower bed to safe height, and ensure patient is comfortable and free from pain.	This provides patient with a safe, comfortable place, and attends to pain needs as required.

15. Complete patient teaching.	Instruct patient regarding: • Take showers rather than bathe. • Pat dry, not scrub or rub the incision. • Do not pull off Steri-Strips. Allow the Steri-Strips to fall off naturally and gradually (usually takes one to three weeks). • Importance of avoiding strain on the wound (i.e., if this is an abdominal wound, no straining during defecation; if this is a knee wound, avoid kneeling; etc.). • Importance of adequate rest, fluids, nutrition, and ambulation for optional wound healing. • Observe the wound for signs and symptoms of infection and notify a healthcare professional if any concerns.
16. Discard supplies according to agency policies for sharps disposal and biohazard waste.	Staple extractor may be disposed of or sent for sterilization.
17. Perform hand hygiene and document procedure and findings according to agency policy. Report any unusual findings or concerns to the appropriate healthcare professional.	Hand hygiene reduces the risk of infection.  *Hand hygiene with ABHR*
Data source: BCIT, 2010c; Perry et al., 2014	

Watch the video *Staple Removal* developed by Renée Anderson and Wendy McKenzie (2018) of TRU School of Nursing.

Staple removal may lead to complications for the patient. When removing staples, consider the length of time the staples have been in situ. **Wound dehiscence**, a mechanical failure of wound healing, remains a problem and can be affected by multiple factors (Spiliotis et al., 2009). Obese patients (greater than 30 kg/m^2) have a higher risk of dehiscence than patients with a normal BMI. Additional risk factors for dehiscence include age over 75 years, COPD, diagnosis of cancer, use of steroids, malnutrition, anemia, sepsis, obesity, diabetes, tobacco use, and previous administration of chemotherapy or radiotherapy (Spiliotis et al., 2009).

Table 4.10 lists other complications of removing staples.

Table 4.10 Potential Complications of Staple Removal	
Complication	*Solution*
Unable to remove staple from tissue	Contact physician for further instructions.
Dehiscence: Incision edges separate during staple removal	Stop removing staples. Apply Steri-Strips across open area. Notify physician.
Patient experiences pain when staples are removed	Allow small breaks during removal of staples. Use distraction techniques. Provide opportunity for the patient to deep breathe and relax during the procedure.
Data source: BCIT, 2010c; Perry et al., 2018	

Critical Thinking Exercises

1. You are about to remove your patient's abdominal incision staples according to the prescriber's orders. As you start to remove the staples, you notice that the skin edges of the incision line are separating. What would be your next steps?
2. Your patient informs you that he is feeling significant pain as you begin to remove his staples. What would you do next?

Attributions

Figure 4.4 Surgical staples after total hip replacement by Karl-Heinz Wellmann, Wikipedia is used under the CC BY 3.0 license.

4.9 Drain Management and Removal

Drain Management

Drain systems are a common feature of post-operative surgical management and are used to remove drainage from a wound bed to prevent infection and the delay of wound healing. A drain may be superficial to the skin or deep in the tissue, duct, or cavity. The number of drains depends on the extent and type of surgery. Active drains are closed systems that use vacuum action to withdraw fluids from the site into a collection reservoir. The drainage tube is a silastic tube with perforations to allow fluid to be sucked away from the site. Closed systems should be emptied when they are 1/3 to 1/2 full to allow the drain to function optimally. At minimum they should be emptied and measured at least once every shift, and the ports cleaned according to agency policy. These drains are very common and are referred to as Hemovac or Jackson Pratt (Perry et al., 2018).

Hemovac drains (see Figure 4.5) can hold up to 500 ml of drainage. A Jackson Pratt (JP) (see Figure 4.6) is used for wounds anticipated to have smaller amounts of drainage. Drains are often sutured to the skin to prevent accidental removal. The drain insertion site is covered with a sterile dressing. Assessment of drain functioning periodically throughout the day is important. These types of drains are referred to as active drains because of the suction action used to remove drainage. They are also referred to as closed wound drains because the drain system is closed.

Passive drains, also known as capillary drains, work by providing an opening from the area of concern to the outside of the body. Gravity and body movement allow excess fluid to simply escape through the opening. Penrose drains are pieces of surgical tubing inserted into a surgical site, secured with a suture on the skin surface, and they drain into a sterile dressing (Perry et al., 2018). Care and maintenance includes frequent dressing changes and attention to the peri-wound skin, which is at risk for breakdown in the presence of ++ moisture. Removal of capillary drains requires attention to avoid losing the drain into the patient's body when the securing suture is released.

Pigtail drains (see Figure 4.7) are another type of passive drain. They are a type of tubing inserted into the site, held in place by the tube's curl at the end. These can also be sutured on the skin surface. Pigtail drains are attached to a drainage bag and are often used to manage the treatment of abscesses (RSNA, 2018).

Figure 4.5 Hemovac drain

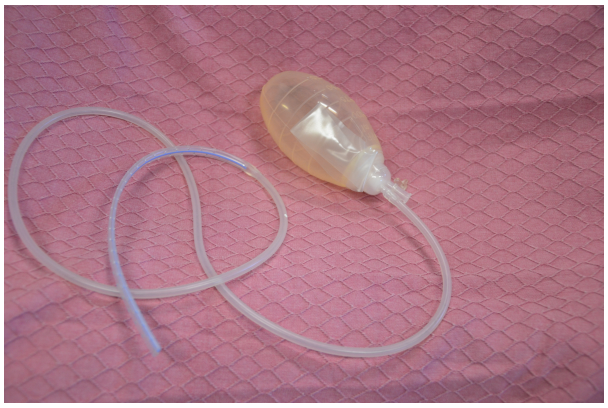


Figure 4.6 Jackson Pratt drain

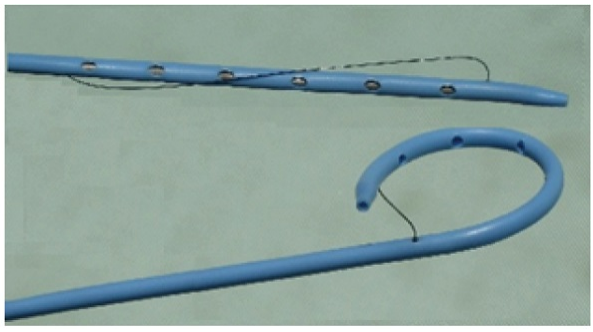


Figure 4.7 Pigtail drain

Checklist 40 outlines the steps to take when emptying a closed wound drainage system.

Checklist 40: Emptying a Closed Wound Drainage System

Disclaimer: *Always review and follow your agency policy regarding this specific skill.*

Safety considerations:

- Perform hand hygiene.
- Point of care risk assessment for PPE.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Complete QPA including safety.
- Explain process to patient and offer analgesia, bathroom, etc.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.

Steps	*Additional Information*
1. Perform hand hygiene.	Hand hygiene reduces the risk of infection  *Perform hand hygiene*
2. Collect necessary supplies.	For example: drainage measurement container, non-sterile gloves, waterproof pad, alcohol swab

3. Apply non-sterile gloves and goggles or face shield according to agency protocols and/or point of care risk assessment.

PPE reduces the transmission of microorganisms and protects against accidental body fluid exposure.

Apply non-sterile gloves

4. Maintaining principles of asepsis, remove plug from pouring spout as indicated on drain.

Open plug while pointing away from your face to avoid an accidental splash of body fluid.

Maintain asepsis in relation to the plug.

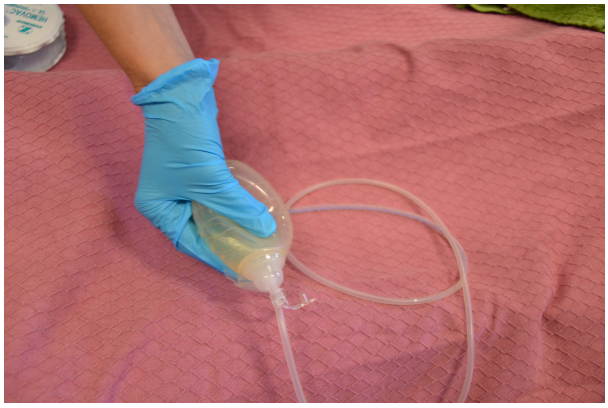
The vacuum will be broken and the reservoir (drainage collection system) will expand.

Open drain with opening facing away from you

5. Gently tilt the opening of the reservoir toward the measuring container and pour out contents. Note character of drainage: colour, consistency, odour, and amount.

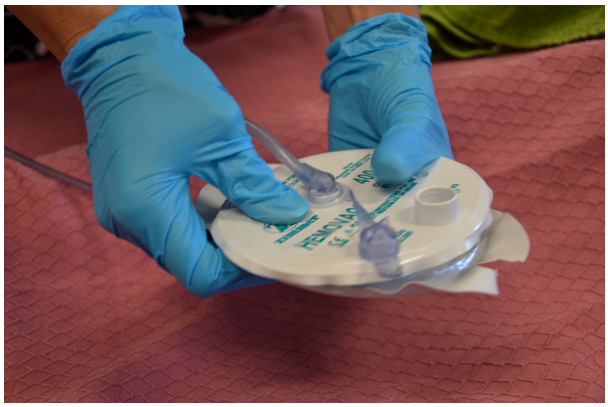
Pour away from yourself to prevent exposure to body fluids. Drainage counts as patient fluid output and must be documented on the patient chart as per hospital protocol.

Monitor drains frequently in the post operative period to reduce the weight of the reservoir and to monitor drainage. A recommendation is to empty when 1/3 to 1/2 full because they get heavy.



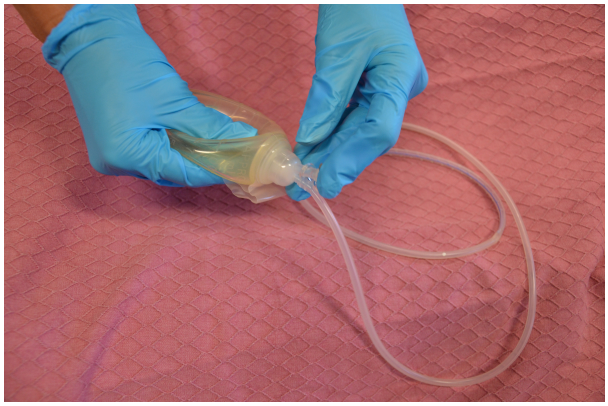
Expel air from JP drain and flatten it before closing

6. Swab the surface of the pouring spout and plug with an alcohol swab. Place drainage container on bed or hard surface, tilt away from your face, and compress the drain to flatten it with one hand.



Expel air from Hemovac drain and flatten it before closing

This establishes vaccum suction for drainage system



Place the plug into the pour spout of the JP drain maintaining principles of asepsi

7. Place the plug back into the pour spout of the drainage system, maintaining asepsis.

Place the plug back into the pour spout of the Hemovac drain maintaining principles of asepsis

8. Secure device onto patient's gown using a safety pin; ensure drain is functioning; ensure that enough slack is present on tubing.

Securing drain decreases risk of inadvertent removal. Providing enough slack to accommodate patient movement prevents tension at the drain insertion site.

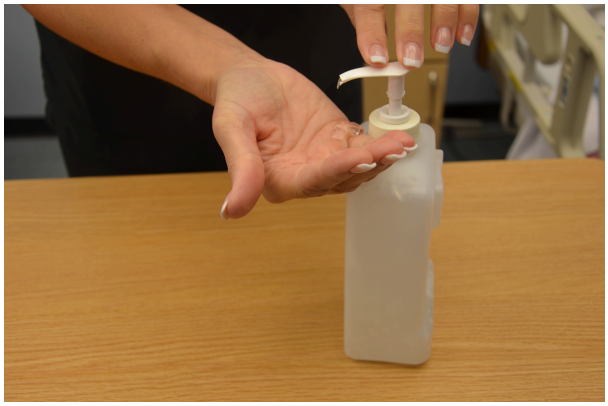
9. Discard drainage according to agency policy.

Protection of HCWs against exposure to BBF.

Hand hygiene must be performed after removing gloves. Gloves are not puncture-proof or leak-proof, and hands may become contaminated when gloves are removed.

Remove gloves

10. Remove gloves and perform hand hygiene.



Hand hygiene with ABHR

This allows for accurate recording of drainage.

If more than one drain is present, number them, note their location in the chart. Chart each one separately.

11. Document procedure and findings according to agency policy. Report any unusual findings or concerns to the appropriate healthcare professional.

If the amount of drainage increases or changes, notify the appropriate healthcare provider according to agency policy.

If the amount of drainage significantly decreases, the drain may be ready to be removed.

Data sources: BCIT, 2010b; Perry et al., 2018

Removal of a drain must be ordered by the prescriber. A drain is usually in place for 24 to 48 hours, and removal depends on the amount of drainage over the previous 24 hours.

Drain Removal

Checklist 41 outlines the steps for removing a wound drainage system (hemovac and JP) ** this is not the guidelines for removal of pigtail drains. Refer to your agency policy.

Checklist 41: Drain Removal

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Perform hand hygiene.
- Point of care risk assessment and selection of PPE.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient and offer analgesia, bathroom, etc.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Complete QPA including safety.
- Sanitize your working surface.

Steps	*Additional Information*
1. Confirm that the prescriber order correlates with the amount of drainage in the past 24 hours.	The prescriber should specify an amount for acceptable drainage for the drain to be removed. When in doubt, ask.
2. Explain procedure to patient; offer analgesia and bathroom as required.	Taking this step decreases the patient's anxiety about the procedure. Explain to the patient that a puling sensation may be felt but will stop after the procedure is complete. Analgesia provides comfort and achieves the goal of an acceptable pain level for the procedure.
3. Assemble supplies at patient's bedside: dressing tray, sterile suture scissors or sterile blade, cleansing solution, tape, garbage bag, outer dressing.	Organizing supplies helps the procedure occur as efficiently as possible for the patient.
4. Apply a waterproof drape or pad for setting the drain onto once it has been removed.	This provides a place to put the drain once it is removed.

Reduces risk of introducing microorganisms from elsewhere to the patient.

5. Perform hand hygiene.

Hand hygiene with ABHR

6. Apply non-sterile gloves and PPE according to Point of Care Risk Assessment.

Apply non-sterile gloves

7. Release suction on reservoir and empty; measure and record volumes greater than 10 ml.

Remove dressing.

Release suction on the reservoir

8. Clean and dry the incision and drain site following principles of asepsis.

Prepares the wound and surrounding tissue, may reduce microorganism counts.

9. Carefully cut and remove the securing suture following principles of asepsis.

If you forget to cut the suture, the drain will be stuck.

10. While holding two to three 4 × 4 sterile gauze in non-dominant hand, stabilize skin.

Sometimes additional drainage oozes out during drain removal. Sterile gauze provides a barrier to decrease risk of introducing microorganisms into the wound. Counter-pressure to the skin near the drain decreases discomfort to the patient.

Consider the use of sterile gloves if there is risk of introducing bacteria into the wound during drain removal.

11. Ask patient to take a deep breath and exhale slowly; remove the drain as the patient exhales.

Firmly grasp the drainage tube close to the skin with dominant hand, and with a swift and steady motion withdraw the drain.

Distraction helps the patient prepare for drain removal. Slight resistance may be felt. If there is strong resistance, hold your pull and ask the patient to take a deep breath. Sometimes the muscles need a little encouragement to relax. If you still can't remove it, stop and call the prescriber.

Gather up the drain tubing in your hand as it is being removed.

When removed, ensure the drain tubing and the tip are intact.

12. Place drain and tubing onto waterproof pad or into garbage bag. Remove gloves.

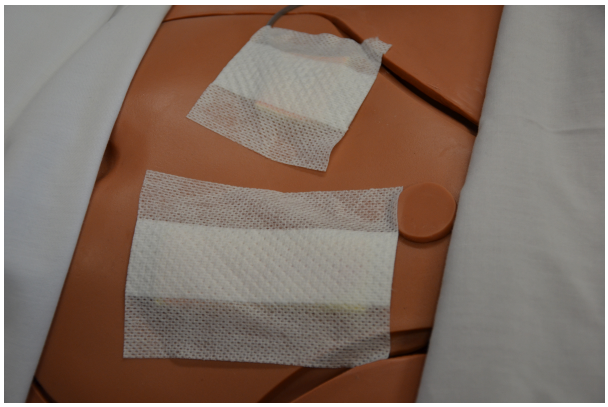
Prevents the drain and tubing from contaminating the bed or floor.

13. At this point some nurses will clean and dry the wound.

The nurse can decide depending on the situation.

Drain sites often drain for a few days after. Consider adding some gauze under the cover dressing for extra absorbency.

14. Dress the wound with sterile dressing.

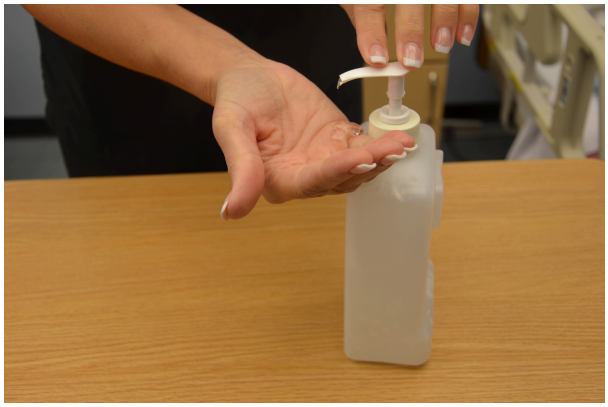


Dress the wound with a sterile dressing

15. Discard drain and garbage as per agency policy.

Decreases risk of BBF exposure to others.

16. Perform hand hygiene



Hand hygiene with ABHR

17. Assess dressing 30 minutes after drain removal. Likewise, ask the patient to call if they notice any increased drainage from the site.

Monitor for excessive drainage from the drain site.

	Accurate and timely documentation and reporting promotes patient safety.
18. Document procedure (including drain removal, drain output and characteristics, how the patient tolerated the procedure, dressings applied) or according to agency policy. Report any unusual findings or concerns to the appropriate healthcare professional.	Sample charting: date / time: *JP drain to RLQ site cleansed with NS. 5 ml sanguinous drainage in past 24 hours. Securing suture removed. Drain removed. Tip intact. Site free of complications. Site dressed with 4- 2×2 guaze and Medipore™. Patient tolerated well.——————————R.Barns RN*

Data sources: BCIT, 2010b; Interior Health, n.d.; Perry et al., 2018; Saskatoon Health Region, 2012

Watch the video JP Drain Removal developed by Renée Anderson & Wendy McKenzie Thompson Rivers University School of Nursing (2014).

Critical Thinking Exercises

1. When you start to remove your patient's Jackson Pratt drain, you notice there is 100 ml of fresh blood in the drainage bulb. What would be your next steps?
2. Describe ways in which you can help relieve the discomfort felt by a patient while removing a wound drain.

Attributions

Figure 4.7 Pigtail drain by Agency for Clinical Innovation is used under a CC BY 4.0 license.

4.10 Summary

Wound healing is a complex process. To ensure optimal wound healing, it is essential to identify and control underlying issues that may prevent a wound from healing. Controlling blood sugar levels, limiting smoking, and observing proper nutrition all have a significant impact on the healing process. It is important to educate patients on these modifiable risk factors to promote wound healing. Understanding the process of wound healing, the use of a comprehensive assessment, and the appropriate selection of wound care products can maximize the wound healing process.

Key Takeaways

- Wound care requires a complete assessment prior to initiating wound treatment. Always compare assessments with previous findings to assess whether wound is healing and if wound treatment is effective.
- Treat the patient (modifiable external and internal factors) and the wound to optimize the healing process.
- Select the appropriate wound treatment based on the wound characteristics, type of wound.
- Understand the differences between types of wounds and causes, and follow procedures for best practice in the acute and clinical setting.

Suggested Online Resources

1. Canadian Association of Wound Care (CAWC): Education. This website offers an education section for health care professionals using various methods to provide flexible, interprofessional education that supports the learning needs and professional career growth in the areas of skin health, wound prevention, and management.
2. Connecting Learners with Knowledge (CLWK). This website started as a pilot project in 2010 and was created by nurses to explore innovative ways to meet their education needs. Membership grew considerably, and it soon became a permanent, living resource. In February 2014 it merged with QExchange.ca, which was home to communities for British Columbia health care providers. CLWK is now a growing group of communities that support health care providers as they network and improve care.
3. Connecting Learners with Knowledge (CLWK): Skin & wound care. These interactive e-learning modules cover skin and wound care and each take about 25 to 30 minutes to

complete.

4. Provincial Infection Control Network of British Columbia (PICNET). This is the website for PICNET, a program of the Provincial Health Services Authority. Its mission is to reduce health care-associated infections by improving infection prevention control practices.
5. Vancouver Coastal Health: How wounds heal. This 30-minute video is designed for health care professionals who wish to improve their understanding of wound and skin care. Information includes the definition of a wound, the three classifications of wound healing or closure, the trajectory of wound healing, and reasons for delayed wound healing.
6. Vancouver Coastal Health: Wound assessment. This 30-minute video is designed for health care professionals who wish to improve their understanding of wound and skin care. Information includes basic wound etiology, wound location, and wound assessment parameters.

References

Agency for Clinical Innovation. (n.d.). *Pigtail drain with thread formation of pigtail shape* [Photo]. Retrieved from https://www.aci.health.nsw.gov.au/resources/respiratory/pleural-drains/pleural-drains-in-adults/section-1-pre-insertion/tube-selection.

Alavi, A., Archibald, G., Botros, M., Brassard, A., Coutts, P. M., Cross, K., … Woo, K. (2015). Summary of An Overview of Advanced Therapies in the Management of Diabetic Neuropathic Foot Ulcers. *Wound Care Canada*, 13(2), 10-17. Retrieved from https://www.woundscanada.ca/docman/public/wound-care-canada-magazine/2015-vol-13-no-2/546-wcc-fall-2015-v13n2-advanced-therapies/file.

British Columbia College of Nursing Professionals. (2019). *RN scope of practice standards | Autonomous scope and client-specific orders*. Retrieved from https://crnbc.ca/Standards/Lists/StandardResources/804ScopeStandards.pdf.

British Columbia Institute of Technology (BCIT). (2010a). Simple dressing change. Skills checklists.

British Columbia Institute of Technology (BCIT). (2010b). Drain removal. Skills checklists.

British Columbia Institute of Technology (BCIT). (2010c). Removal of sutures and staples. Skills checklists.

British Columbia Provincial Nursing Skin and Wound Committee. (2011). *Guideline: Assessment and treatment of surgical wounds healing by primary and secondary intention in adults & children.*

Retrieved from https://www.clwk.ca/buddydrive/file/guideline-surgical-wounds-primary-secondary-intention/.

British Columbia Provincial Nursing Skin and Wound Committee. (2014). *Guidelines: Braden scale for predicting pressure ulcer risks in adults and children/infants.* Retrieved from https://www.clwk.ca/buddydrive/file/guideline-braden-risk-assessment/.

British Columbia Provincial Nursing Skin and Wound Committee. (2017). *Procedure: Wound packing*. Retrieved from https://www.clwk.ca/buddydrive/file/procedure-wound-packing/.

Gallagher-Camden, S. (2012). Skin care needs of the obese patient. In R. A. Bryant & D. P. Nix (Eds.), *Acute and chronic wounds: Current management concepts* (4th ed.). St. Louis, MO: Mosby.

Häggström, M. (2010). Phases of wound healing. Limits vary within faded intervals, mainly by wound severity [Infographic]. *Wikimedia Commons*. Retrieved from https://commons.wikimedia.org/wiki/File:Wound_healing_phases.svg.

Harris, C., Kuhnke, J., Haley, J., Cross, K., Somayaji, R., Dubois, J., … Lewis, K. (2018). Best practice recommendations for the prevention and management of surgical wound complications. *Canadian Association of Wound Care*. Retrieved from https://www.woundscanada.ca/docman/public/health-care-professional/bpr-workshop/555-bpr-prevention-and-management-of-surgical-wound-complications-v2/file.

Healthwise Staff. (2017, May 16). *Incision care after surgery*. Retrieved from Government of British Columbia, HealthLinkBC website: https://www.healthlinkbc.ca/health-topics/tc4128spec.

Interior Health. (2016). *Infection prevention and control manual.* Retrieved from https://www.interiorhealth.ca/AboutUs/QualityCare/IPCManual/Entire%20Infection%20Control%20Manual.pdf.

International Wound Infection Institute (IWII). (2016). Wound infection in clinical practice. *Wounds International*. Retrieved from http://www.woundinfection-institute.com/wp-content/uploads/2017/07/IWII-Consensus_Final-2017.pdf.

Jones, S. (2007). 5 stitches on the finger [Photo]. *Wikimedia Commons*. Retrieved from https://commons.wikimedia.org/wiki/File:Stitches_2.jpg.

Kerr, J. R., Wood, M., Astle, B., & Duggleby, W. (2014). *Canadian fundamentals of nursing* (5th ed.). Toronto, ON: Elsevier.

Munteanu, A., Florescu, I., Nitescu, C. (2016). A modern method of treatment: The role of silver dressings in promoting healing and preventing pathological scarring in patients with burn wounds. Journal of Medicine and Life, 9(3). Pp 306-315. PMID: 27974941

Norton, L., Parslow, N., Johnston, D., Ho, C., Afalavi, A., Mark, M., … Moffat, S. (2018). Best practice recommendations for the prevention and management of pressure injuries. *Canadian Association of Wound Care.* Retrieved from https://www.woundscanada.ca/docman/public/health-care-professional/bpr-workshop/172-bpr-prevention-and-management-of-pressure-injuries-2/file.

Perry, A., Potter, P., & Ostendorf, W. (2014). *Clinical skills and nursing techniques* (8th ed.). St. Louis, MO: Elsevier-Mosby.

Perry, A., Potter, P., & Ostendorf, W. (2018). *Clinical skills and nursing techniques* (9th ed.). St. Louis: Elsevier-Mosby.

Radiology Society of North America (RSNA). (2018). *Percutaneous abscess drainage. Information for patients*. Retrieved from https://www.radiologyinfo.org/en/info.cfm?pg=percabscessdrn.

Saskatoon Health Region. (2013). *Drains: Emptying, shortening and removal. Policies and procedures*. Retrieved from https://www.saskatoonhealthregion.ca/about/NursingManual/1100.pdf.

Spiliotis, J., Tsiveriotis, K., Datsis, A. D., Vaxevanidou, A., Zacharis, G., Giafis, K., … Rogdakis, A. (2009). *Wound dehiscence: Is still a problem in the 21st century: A retrospective study*. Retrieved from http://www.wjes.org/content/4/1/12.

Stotts, N. A. (2012). Nutritional assessment and support. In R. A. Bryant & D. P. Nix (Eds.), *Acute and chronic wounds: Current management concepts* (4th ed.). St. Louis, MO: Mosby.

Vancouver Coastal Health Authority. (2009). *Wound assessment course*. Retrieved from http://ccrs.vch.ca/onlinecourses/wound_management/woundassessment_v4/index.html.

Wellmann, K.-H. (2013). Surgical staples after totel hip replacement (right thigh), 13th day after surgery [Photo]. *Wikimedia Commons*. Retrieved from https://commons.wikimedia.org/wiki/File:Hip_replacement,_surgical_staples_01.JPG.

Wiegand, C., Tittelbach, J., Hipler, U., & Elsner, P. (2015). Clinical efficacy of dressings for treatment of heavily exuding chronic wounds. *Chronic Wound Care Management and Research*, (2), 101-111. https://doi.org/10.2147/CWCMR.S60315.

World Health Organization. (2009). *Glove use information leaflet*. Retrieved from http://www.who.int/gpsc/5may/Glove_Use_Information_Leaflet.pdf.

World Health Organization. (n.d.). *Practical suture techniques*. Retrieved from http://www.who.int/surgery/publications/s16383e.pdf.

CHAPTER 5. OXYGEN THERAPY

5.1 Introduction

Oxygen is essential for sustaining life. The cardiovascular and the respiratory systems are responsible for supplying the body's oxygen demands. Blood is oxygenated through the mechanisms of ventilation, perfusion, and the transport of respiratory gases (Potter, Perry, Ross-Kerr, & Wood, 2010).

Respiration is optimal when sufficient oxygenation occurs at the cellular level and when cellular waste and carbon dioxide are adequately removed via the bloodstream and lungs. If this system is interrupted — for example by lung tissue damage, inflammation or excess mucus in the airways, or impairment of ventilation — intervention is required to support the client and prevent the condition from worsening or, potentially, to prevent death from occurring (Perry, Potter, & Ostendorf, 2018).

Oxygen is the most frequently used medication in emergency medicine, and when used appropriately in the treatment of hypoxemia (an inadequate supply of oxygen in the arterial blood), it potentially saves lives (Kane, Decalmer, & O'Driscoll, 2013). This chapter describes the principles of oxygen therapy, the causes and management of hypoxia (the reduction of oxygen supply at the tissue level), and the optimal use of oxygen therapy and treatment modalities.

Learning Outcomes

- Describe four functional components of the respiratory system.
- Identify health conditions that pose a risk to adequate oxygenation.
- Describe the functions and limitations of pulse oximetry.
- Differentiate hypoxemia and hypoxia.
- List hazards, precautions, and complications of oxygen therapy.
- Recognize signs and symptoms of hypoxia and safely administer oxygen within one's professional scope of practice.
- Identify benefits and risks associated with oral and oropharyngeal suctioning.
- Recognize signs and symptoms that suggest need for suctioning.
- Demonstrate competence in relation to:
    - Oral suctioning
    - Oropharyngeal suctioning

5.2 Oxygenation

In order for the nurse to understand the need to administer supplemental oxygen to a patient, a brief review of how we breathe and factors that affect oxygenation might be helpful. Supplemental oxygen is considered a medication and therefore requires continuous monitoring of the dose, concentration, and side effects to ensure its safe and effective use (Alberta Health Services, 2015). Oxygen therapy may be indicated for hypoxemia and hypoxia.

The air we breathe is made up of various gases, 21% of which is oxygen (Alberta Health Services, 2015). Therefore, a patient who is receiving no supplemental oxygen therapy is still receiving oxygen from the air. This amount of oxygen is adequate provided that the patient's airway is not compromised and there is sufficient hemoglobin in the blood. The cardiovascular system must also be intact and able to circulate blood to all body tissues. If any of these systems fail, the patient will require supplemental oxygen to increase the likelihood that adequate levels of oxygen will reach all vital body tissues necessary to sustain life.

McCance, Huether, Brashers, and Rote (2014) describe four functional components of the respiratory system, all of which work in a concerted effort with the circulatory system to help our bodies maintain oxygenation. Table 5.1 outlines the four components and provides some explanation and health conditions that might present challenges with each.

Table 5.1 Four Functional Components of the Respiratory System & Health Conditions that Might Present Challenges in Terms of Increasing Risk of Impaired Oxygenation

Neurochemical control of ventilation (respiratory center, chemoreceptors)	Ventilation is the movement of gases into and out of the lungs (Astle & Duggleby, 2019). The central nervous system controls ventilation by responding to signals from different neurochemicals (blood pH, $PaCO_2$, PaO_2 and others) at chemoreceptor sites located in different blood vessels. Some patients rely on the CO_2 drive to breathe, and as such too much supplemental oxygen can cause them to stop breathing (Abdo & Heunks, 2012).
Mechanics of breathing (accessory muscles, lung elasticity, airway resistance, surface tension in alveoli, work of breathing)	Breathing is often effortless. Many people don't realize that muscles like our diaphragm and intercostals muscles play a role in our ability to adequately oxygenate. Anything that can affect chest wall movement has the potential to affect ventilation. Some examples include pregnancy, obesity and chest wall trauma. Neuromuscular disorders can affect the diaphragm and intercostals muscle function as can medications like anesthetics (Astle & Duggleby, 2019). Certain lung diseases result in lost lung elasticity, and as such the work of breathing is increased as the lungs expand during inspiration and try to return to resting volume during expiration. Airway resistance might be caused by airway swelling, obstruction, and bronchospasm. Surfactant, a type of protein in our alveoli, prevents the alveoli from collapsing when we exhale. When surfactant is inadequate, the work of breathing is increased as the body tries to open the alveoli during inspiration to achieve adequate oxygenation. (McCance et al., 2014). Such is the case with many premature babies. If the mechanics of breathing is challenged, so is the work of breathing.
Gas transport (distribution of ventilation and perfusion, O_2 and CO_2 transport)	Oxygen is delivered to the cells and CO_2 taken away. When caring for individuals nurses must consider if ventilation (exchange of air from the environment to the lungs) and perfusion (the amount of oxygen getting to the lungs) are adequate to meet the oxygen demands. O_2 and CO_2 exchange are impeded when the alveolar capillary membranes are thickened from conditions like pulmonary edema, pulmonary infiltrates, emphysema, and pneumothorax (McCance et al., 2014). Likewise persons with low Hgb may be challenged to meet their oxygen requirements (Astle & Duggleby, 2019). Some persons with chronic lung disease have abnormally high Hgb levels as a compensatory mechanism to help them achieve normal oxygen levels (McCance et al., 2014).
Control of pulmonary circulation (distribution of pulmonary blood flow)	Vasoconstriction of the vessels in pulmonary circulation can be the result of alveolar hypoxia. Possible causes of this hypoxia include obstruction, metabolic and respiratory acidosis, and other biochemical factors (histamine, prostaglandins, bradykinin, and others) (McCance et al., 2014).

Data sources: Abdo & Heunks, 2012; Astle & Duggleby, 2019

Hemoglobin

We rely on hemoglobin (Hgb) for gas transport. It holds oxygen in reserve until the metabolic demands of the body require more oxygen. The Hgb then moves the oxygen to the plasma for transport to the tissues. The body's demand for oxygen is affected by activity, metabolic status, temperature, and level of anxiety. The ability of Hgb to move the oxygen to the tissues depends on a number of factors, such as oxygen supply, ventilatory effectiveness, nutrition, cardiac output, hemoglobin level, smoking, drug use, and underlying disease. Any one of these factors can potentially impede the supply and transport of oxygen to the tissues.

Measurement of Oxygen in the Blood

The vast majority of oxygen carried in the blood is attached to hemoglobin and can be assessed by monitoring the oxygen saturation through **pulse oximetry** (SpO_2).The target range for oxygen saturation as measured by blood analysis (SaO_2), such as arterial blood gas, is 92% to 98% for a normal adult. **Arterial blood gas** (ABG) is the analysis of an arterial blood sample to evaluate the adequacy of ventilation, oxygen delivery to the tissues, and acid-base balance status and is measured as SaO_2 (Simpson, 2004). For patients with COPD, the target SaO_2 range is 88% to 92% (Alberta Health Services, 2015; O'Driscoll, Howard, & Davison, 2008; Kane et al., 2013). Only about 3% of the oxygen carried in the blood is dissolved in the plasma, which can be assessed by looking at the partial pressure of oxygen in the blood through blood gas analysis (PaO_2). The normal PaO_2 of a healthy adult is 80 to 100 mmHg. The SpO_2 is more clinically significant than the PaO_2 in determining the oxygen content of the blood.

Oxygen is considered a medication and therefore requires continuous monitoring of the dose, concentration, and side effects to ensure its safe and effective use (Alberta Health Services, 2015). Oxygen therapy may be indicated for hypoxemia and hypoxia.

Understanding Hypoxemia and Hypoxia

Although the terms *hypoxemia* and *hypoxia* are often used interchangeably, they do not mean the same thing. **Hypoxemia** is a condition where arterial oxygen tension or partial pressure of oxygen (PaO_2) is below normal (<80 mmHg). Hypoxemia is the inadequate supply of oxygen in the arterial blood. **Hypoxia** is the reduction of oxygen supply at the tissue level, which is not measured directly by a laboratory value (Meštrović, 2014), but by pulse oximetry (SpO_2) (O'Driscoll et al., 2008).

Generally, the presence of hypoxemia suggests that hypoxia exists. However, hypoxia may not be present in a patient with hypoxemia if the patient is able to compensate for a low PaO_2 by increasing oxygen supply. This is usually achieved by increasing cardiac output (by raising the heart rate) or by decreasing tissue oxygen consumption. Conversely, patients who do not show signs of hypoxemia may be hypoxic if oxygen delivery to the tissues is diminished or if the tissues are unable to adequately use the oxygen.

Hypoxemia is the most common cause of tissue hypoxia, and if the correct diagnosis is made, it is readily treatable. Hypoxemia has a number of causes including:

- Breathing air at pressures less than atmospheric pressure, such as at high altitudes or in an enclosed space with inadequate ventilation (Karius, nd).
- Hypoventilation such as happens with brain stem injury, neuromuscular impairment, atelectasis, and opioid overdose (Henderson & Bonsall, 2014).
- When the ventilation / perfusion ratios are mismatched. In other words the ratio of air coming in and going out does not match perfusion in the lungs (Mestrovic, 2014).

Examples of medical conditions that have the potential to cause hypoxemia include:

- Asthma
- COPD
- Heart failure
- Pleural effusions
- Pneumonia
- Pneumothorax
- Pulmonary edema
- Pulmonary emboli

With hypoxia, there is inadequate transport of oxygen to the cells or tissues, either because of obstruction, secretions, or tumours in the lungs; hypoventilation due to disease, injury to the respiratory system, or medications; or poor blood flow due to a compromised circulatory system (O'Driscoll et al., 2008). Hypoxia related to anemia or circulatory system compromise, such as decreased cardiac output, will respond poorly to oxygen therapy, and other appropriate interventions should be considered.

Oxygen Therapy Will:

- Decrease the work of breathing in patients with respiratory or cardiovascular conditions,

which may prevent respiratory and muscle fatigue (Jardins & Burton, 2011).
- Decrease cardiopulmonary workload by reducing high cardiopulmonary demand (Perry et al., 2014). For example, patients with left ventricular failure benefit from additional oxygen to the tissues because the heart cannot provide enough oxygen to the tissues due to decreased cardiac output.
- Support post-operative recovery, and may be ordered for a specific time frame at a specific rate while the patient recovers from the surgical procedure.

It is important for the nurse to recognize early signs of respiratory compromise which might include shortness of breath, changes in mental status, anxiety, tachypnea (increase respiratory rate), and decreasing SpO_2 despite increasing amounts of supplemental oxygen (Fournier, 2014). Hypoxia is a medical emergency (Alberta Health Services, 2015). Untreated hypoxia can result in anaerobic metabolism, acidosis, cell death, and organ failure (Considine, 2007). It is important for the nurse to build competence in recognizing hypoxia and to work within their scope of practice and agency policies and guidelines to provide treatment.

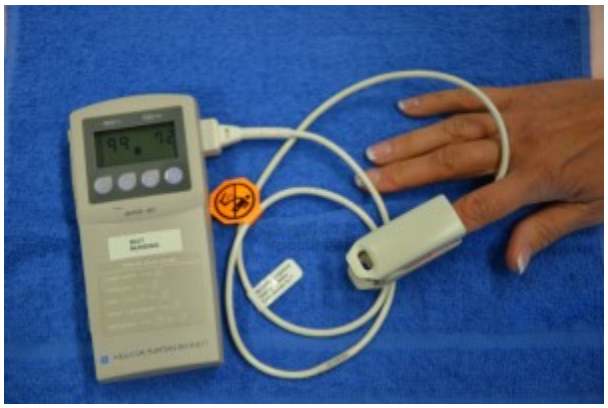
Critical Thinking Exercises

1. Explain how you might know if your patient is hypoxic or hypoxemic?
2. Why might a post-surgical patient require supplemental oxygen?

5.3 Pulse Oximetry

Oxygen saturation, sometimes referred to as "the fifth vital sign," should be checked by pulse oximetry in all breathless and acutely ill patients (O'Driscoll et al., 2008). SpO_2 and the inspired oxygen concentration should be recorded on the observation chart together with the oximetry result. The other vital signs of pulse, blood pressure, temperature, and respiratory rate should also be recorded in situations where supplemental oxygen is required.

Pulse oximetry is a painless, non-invasive method to monitor SpO_2 intermittently and continuously. The use of a pulse oximeter is indicated in patients who have, or are at risk for, impaired gaseous exchange or an unstable oxygen status.



Pulse oximeter

The pulse oximeter is a probe with a light-emitting diode (LED) that is attached to the patient's finger, forehead, or ear. Beams of red and infrared light are emitted from the LED, and the light wavelengths are absorbed differently by the oxygenated and the deoxygenated hemoglobin (Hgb) molecules. The receiving sensor measures the amount of light absorbed by the oxygenated and deoxygenated Hgb in the arterial (pulsatile) blood. The more Hgb that is saturated with oxygen, the higher the SpO_2, which should normally measure above 95%.

Pulse oximeters have an indicator of signal strength (such as a bar graph, audible tone, waveform, or flashing light) to show how strong the receiving signal is. Measurements should be considered inaccurate if the signal strength is poor.

Pulse oximeters will also indicate heart rate by counting the number of pulsatile signals. To ensure accuracy, count the patient's pulse rate by taking the pulse and comparing it to the pulse rate shown on the pulse oximeter.

Limitations

The most common cause of inaccuracy with pulse oximeters is motion artifact. Patient movement can cause pulsatile venous flow to be incorrectly measured as arterial pulsations, thus producing an inaccurate oximetry and pulse-rate reading.

Other causes for inaccuracy include some nail varnishes (nail polish), pigments (henna), bright lights (fluorescents), and poor peripheral perfusion. Poor peripheral perfusion can be caused by conditions such as hypothermia, peripheral vascular disease, vasoconstriction, hypotension, or peripheral edema (Perry et al., 2014; World Health Organization, 2011). A forehead probe can be used for patients with decreased peripheral perfusion.

Conditions such as jaundice, as well as intravascular dyes and carbon monoxide in the blood, can also influence oximetry readings. Anemic patients with low Hgb may have a normal SpO_2 reading, even though the available oxygen is not enough to meet the metabolic demands of the body. Patients with elevated bilirubin concentrations may also have falsely low SpO_2 readings (Howell, 2002).

Application of Pulse Oximetry

If measuring SpO_2 by attaching the probe to a finger or toe, check the radial or pedal pulse and capillary refill of the finger or toe you plan to use. If the patient's extremities are cold, you could try to warm his or her hands in yours, or apply warm towels to improve perfusion.

The patient's finger or toe should be clean and dry. Check that the patient does not have artificial nails or nail polish, as both will influence the light transmission and should, therefore, be removed before applying pulse oximetry.

Check that the probe is positioned properly so that optical shunting (when light from the transmitter passes directly into the receiver without going through the finger) does not occur.

Bright ambient light may also affect the accuracy of pulse oximetry readings.

Hazards of Pulse Oximetry

Pulse oximetry is generally considered to be a safe procedure. However, tissue injury may occur

at the measuring site as a result of probe misuse. Pressure sores or burns are possible effects of prolonged application (>2 hours). As such the nurse should consider anyone who is at risk of poor tissue integrity to be at risk (elderly, cardiovascular disease,malnutrition).

Critical Thinking Exercises

1. You are checking your patient's SpO_2 but the signal strength on the pulse oximeter is poor. What would be your next steps?
2. Your patient has been admitted with a diagnosis of carbon monoxide poisoning with an SpO_2 of 98%. What does this reading tell you?

5.4 Signs and Symptoms of Hypoxia

Assessment for hypoxia can be done by completing a medical history, determining current medical condition, and performing a respiratory assessment. If a patient is experiencing any of the signs and symptoms listed in Table 5.2, hypoxia may be present.

Hypoxia must be treated immediately by the health care provider, as a lack of oxygen to tissues and organs can create serious complications (Alberta Health Services, 2015).

Table 5.2 Signs and Symptoms of Hypoxia

Safety considerations:

- Presence of symptoms depends on the patient's age, presence of disease process, level of health, and presence of chronic illness.
- Consider any underlying causes of hypoxia, such as COPD, heart failure, anemia, and pneumonia, which need to be corrected to prevent and manage hypoxia (Perry et al., 2007).
- Early signs of hypoxia are anxiety, confusion, and restlessness; if hypoxia is not corrected, hypotension will develop.
- As hypoxia worsens, the patient's vital signs, activity tolerance, and level of consciousness will decrease.
- Late signs of hypoxia include bluish discoloration of the skin and mucous membranes, where vasoconstriction of the peripheral blood vessels or decreased hemoglobin causes **cyanosis**. Cyanosis is most easily seen around the lips and in the oral mucosa. Never assume the absence of cyanosis means adequate oxygenation.

Signs and Symptoms	*Indications*
Tachypnea	Increased respiration rate is an indication of respiratory distress.
Dyspnea	Shortness of breath (SOB) is an indication of respiratory distress.
Use of accessory muscles	Use of neck or intercostal muscles when breathing is an indication of respiratory distress.
Noisy breathing	Audible noises with breathing, or wheezes and crackles, are an indication of respiratory conditions. Assess lung sounds for adventitious sounds such as wheezing or crackles. Secretions can plug the airway, thereby decreasing the amount of oxygen available for gas exchange in the lung.
Decreased oxygen saturation levels	Oxygen saturation levels should be between 92% and 98% for an adult without an underlying respiratory condition. Lower than 92% is considered hypoxic. For patients with COPD, oxygen saturation levels may range from 88% to 92%. Lower than 88% is considered hypoxic.
Flaring of nostrils or pursed lips	Patients who are hypoxic may breathe differently, which may signal the need for supplemental oxygen.
Skin colour of patient	Changes in skin colour to bluish or gray are a late sign of hypoxia.
Position of patient	Patients in respiratory distress may voluntarily sit up or lean over by resting arms on their legs to enhance lung expansion. Patients who are hypoxic may not be able to lie flat in bed.

Ability of patient to speak in full sentences	Patients in respiratory distress may be unable to speak in full sentences, or may need to catch their breath between sentences.
Change in mental status or loss of consciousness (LOC)	This is a worsening and a late sign of hypoxia.
Restlessness or anxiety	This is an early sign of hypoxia.
Data source: O'Driscoll et al., 2008; Perry et al., 2018	

Critical Thinking Exercises

1. Your patient is tachypneic and dyspneic. What is the first step you should take to ensure maximal lung expansion?
2. Your patient is sitting up in high fowler's position, but is still showing signs of hypoxia. What would be your best steps?

5.5 Oxygen Therapy Systems

Tissue oxygenation is dependent on optimal or adequate delivery of oxygen to the tissues. Increasing the concentration of inhaled oxygen is an effective method of increasing the partial pressure of oxygen in the blood and correcting hypoxemia. Simply stated, **oxygen therapy** is a means to provide oxygen according to target saturation rates (as per physician orders or hospital protocol) to achieve normal or near normal oxygen saturation levels for acute and chronically ill patients (O'Driscoll et al., 2008). Those administering oxygen must monitor the patient to keep the saturation levels within the required target range. Oxygen should be reduced or discontinued in stable patients with satisfactory oxygen saturation levels (Perry et al., 2014).

Hypoxemia or hypoxia is a medical emergency and should be treated promptly. Failure to initiate oxygen therapy can result in serious harm to the patient. The essence of oxygen therapy is to provide oxygen according to target saturation rates, and to monitor the saturation rate to keep it within target range. The target range (SpO_2) for a normal adult is 92% to 98%. For patients with COPD, the target SpO_2 range is 88% to 92% (Alberta Health Services, 2015; Kane et al., 2013; O'Driscoll et al., 2008).

Although all medications given in the hospital require a prescription, oxygen therapy may be initiated without a physician order in emergency situations (BCCNP, 2019). Most hospitals will have a protocol in place to allow health care providers to apply oxygen in emergency situations. The health care provider administering oxygen is responsible for monitoring the patient response and keeping the oxygen saturation levels within the target range.

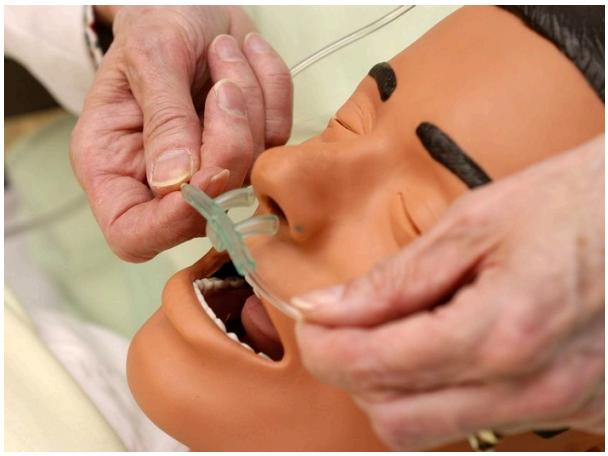
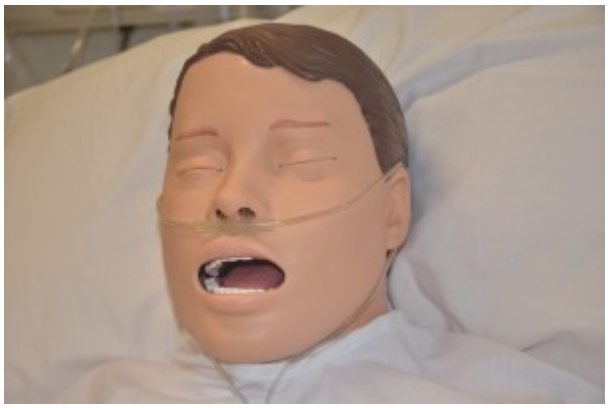
The most common reasons for initiating oxygen therapy include acute hypoxemia related to pneumonia, shock, asthma, heart failure, pulmonary embolus, myocardial infarction resulting in hypoxemia, post-operative states, pneumothorax, and abnormalities in the quality and quantity of hemoglobin. There are no contraindications to oxygen therapy if indications for therapy are present (Kane et al., 2013).

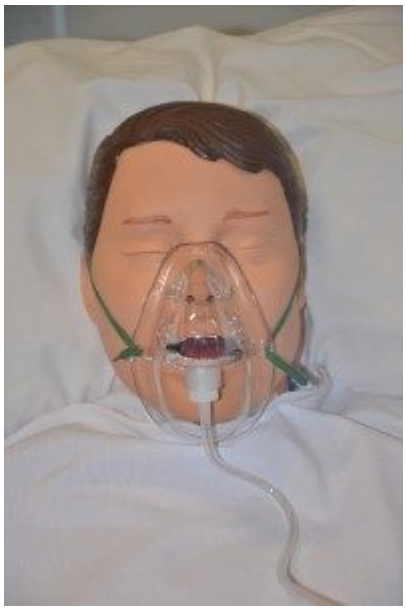
Oxygen Delivery Systems

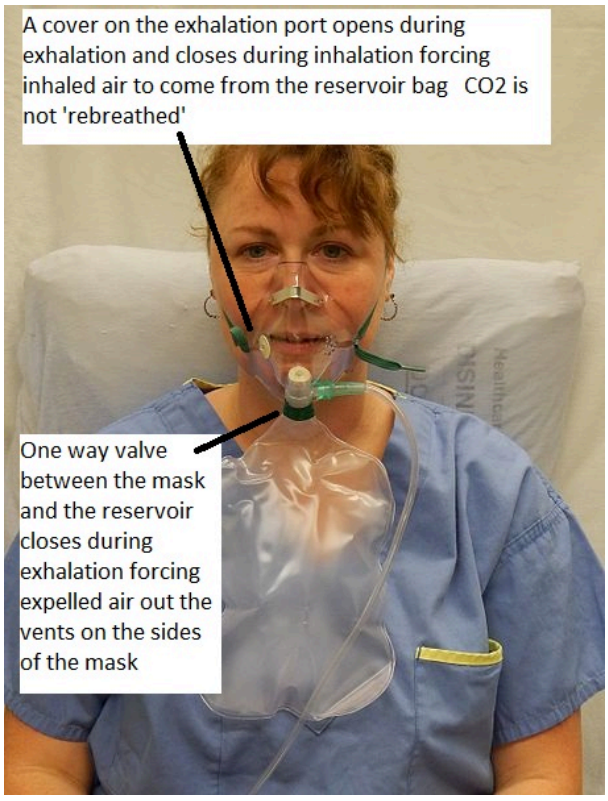
There is a wide variety of devices available to provide oxygen support. Delivery systems are classified as low-flow or high-flow equipment, which provide an uncontrolled or controlled amount of supplemental oxygen to the patient (O'Driscoll et al., 2008). Selection should be based on preventing and treating hypoxemia and preventing complications of hyper-oxygenation. Factors such as how much oxygen is required, the presence of underlying respiratory disease, age,

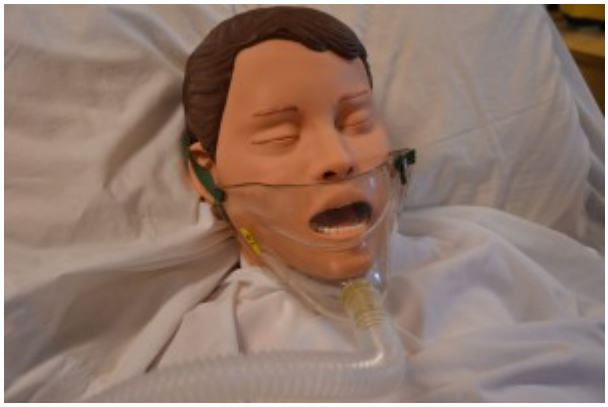
the environment (at home or in the hospital), the presence of an artificial airway, the need for humidity, a tolerance or a compliance problem, or a need for consistent and accurate oxygen must be considered to select the correct oxygen delivery device (O'Driscoll et al., 2008). Table 5.3 lists types of oxygen equipment.

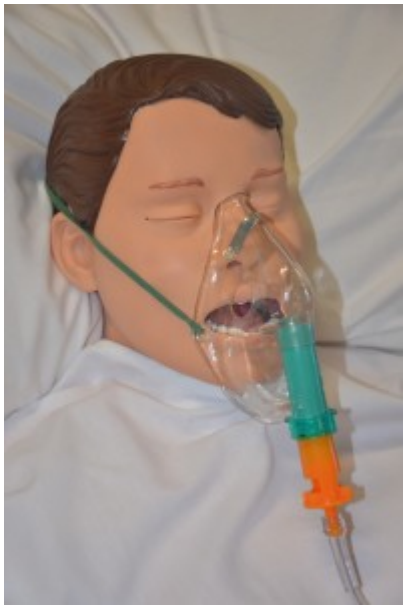
Table 5.3 Types of Oxygen Equipment	
Types of Oxygen Equipment	*Additional Information*

Nasal-cannula (low-flow system)	Nasal cannula consists of a small bore tube connected to two short prongs that are inserted into the nares to supply oxygen directly from a flow meter or through humidified air to the patient. It is used for short- or long-term therapy (i.e., COPD patients), and is best used with stable patients who require low amounts of oxygen. Advantages: Can provide 24% to 40% O_2 (oxygen) concentration. Most common type of oxygen equipment. Can deliver O_2 at 1 to 6 litres per minute (L/min). It is convenient as patient can talk and eat while receiving oxygen. May be drying to nares if level is above 4 L/min. Easy to use, low cost, and disposable. Limitations: Easily dislodged, not as effective is a patient is a mouth breather or has blocked nostrils or a deviated septum or polyps. Nasal dryness can occur  *Applying a nasal cannula*  *Nasal cannula*

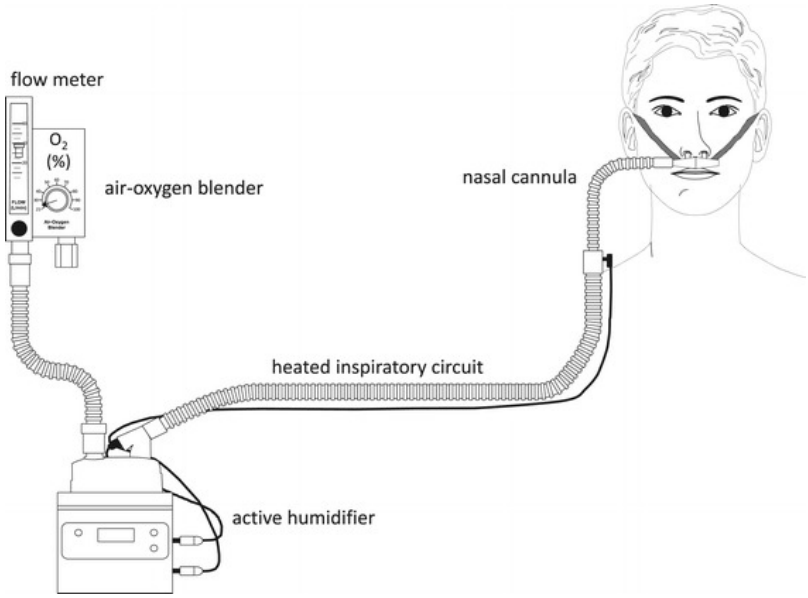
Simple face mask (low-flow system)	A mask fits over the mouth and nose of the patient and consists of exhalation ports (holes on the side of the mask) through which the patient exhales CO_2 (carbon dioxide). These holes should always remain open. The mask is held in place by an elastic around the back of the head, and it has a metal piece to shape over the nose to allow for a better mask fit for the patient. Humidified air may be attached if concentrations are drying for the patient. Advantages: Can provide 40% to 60% O_2 concentration. Flow meter should be set to deliver O_2 at 6 to 10 L/min. Used to provide moderate oxygen concentrations. Efficiency depends on how well mask fits and the patient's respiratory demands. Readily available on most hospital units. Provides higher oxygen for patients. Disadvantages: Difficult to eat with mask on. Mask may be confining for some patients, who may feel claustrophobic with the mask on. Note: exhalation ports / holes/ vents on the sides of the mask must be open to allow for gas exchange  *Simple face mask*

Non re-breather mask (high-flow system)	Consists of a simple mask and a small reservoir bag attached to the oxygen tubing connecting to the flow meter. With a re-breather mask, there is **no re-breathing of exhaled air**. It has a series of one-way valves between the mask and the bag and the covers on the exhalation ports. On inspiration, the patient only breathes in from the reservoir bag; on exhalation, gases are prevented from flowing into the reservoir bag and are directed out through the exhalation ports. Advantages: With a good fit, the mask can deliver between 60% and 80% **FiO_2 (fraction of inspired oxygen)**. The flow meter should be set to deliver O_2 at 10 to 15 L/min. Flow rate must be high enough to ensure that the reservoir bag remains partially inflated during inspiration.  *Figure 5.1 non rebreather mask* Disadvantages: These masks have a risk of suffocation if the gas flow is interrupted. The bag should never totally deflate. The patient should never be left alone unless the one-way valves on the exhalation ports are removed. This equipment is used by respiratory therapists for specific short-term, high oxygen requirements such as pre-intubation and patient transport. They are not available on general wards due to: 1. the risk of suffocation, 2. the chance of hyper-oxygenation, and 3. their possible lack of humidity. The mask also requires a tight seal and may be hot and confining for the patient. The mask will interfere with talking and eating.

Face tent (low-flow system)	The mask covers the nose and mouth and does not create a seal around the nose. Advantages: Can provide 28% to 100% O_2 Flow meter should be set to deliver O_2 at a minimum of 15 L/min. Face tents are used to provide a controlled concentration of oxygen and increase moisture for patients who have facial burn or a broken nose, or who are are claustrophobic. Disadvantages: It is difficult to achieve high levels of oxygenation with this mask…but sometimes this is the only option  *Face tent*

Venturi mask (high-flow system)	High-flow system consisting of a bottle of sterile water, corrugated tubing, a drainage bag, air/oxygen ratio nebulizer system, and a mask that works with the corrugated tubing. The mask may be an aerosol face mask, tracheostomy mask, a T-piece, or a face tent. The key is that the flow of oxygen exceeds the peak inspiratory flow rate of the patient, and there is little possibility for the patient to breathe in air from the room Advantages: The system can provide 24% to 60% O_2 at 4 to 12 L/min. Delivers a more precise level of oxygen by controlling the specific amounts of oxygen delivered. The port on the corrugated tubing (base of the mask) sets the oxygen concentration. Delivers humidified oxygen for patient comfort. It does not dry mucous membranes. Disadvantages: The mask may be hot and confining for some patients, and it interferes with talking and eating. Need a properly fitting mask. Nurses may be asked to set up a high-flow system. In other instances, respiratory therapists may be responsible for regulating and monitoring the high-flow systems.  *Venturi mask*

Oxygen concentrator aka nebulizer / humidifier (high flow system)	Concentrates oxygen from the wall source up to 100%. Delivers humidified oxygen for patient comfort and to reduce risk of drying out mucous membranes.  *Figure 5.2 Oxygen concentrator / nebulizer / humidifier*

High flow oxygen therapy (HFT)	Oxygen delivery system that has the ability to deliver: • high flows of oxygen -up to 60 L/min. • concentrated up to 100%. • oxygen that is warmed to body temperature. • Humidity to promote mucociliary clearance. • continuous flow and positive airway pressure delivery.  *Figure 5.3 High flow nasal cannula*
Data source: Perry et al., 2018; Vancouver Coastal Health Authority, 2015; Fisher & Paykel, 2018	

Special considerations:

- Review the protocol in your agency prior to initiating any high-flow oxygen systems, and consult your respiratory therapist.
- In general, nasal prongs and a simple face mask (low-flow oxygen equipment) may be applied by a health care provider. All other oxygen equipment (high-flow systems) must be set up and applied by a respiratory therapist.
- For patients with asthma, medicated nebulizer treatments should use oxygen at a rate greater than 6 L/min. The patient should be changed back to previous oxygen equipment when treatment is complete.
- Oxygenation is reduced in the supine position. Hypoxic patients should be placed in an upright position unless contraindicated (e.g., if they have spinal injuries or loss of consciousness).
- In general, for most patients with COPD, target saturation is 88% to 92%. Although the risk is

extremely low, it is important to recognize COPD patients are at risk for hypercapnic respiratory failure.
- Check the function of the equipment and complete a respiratory assessment at least once each shift for low-flow oxygen and more often for high-flow oxygen.
- In acutely ill patients, oxygen saturation levels may require additional ABGs to regulate and manage oxygen therapy.
- Oxygen saturation levels and delivery equipment should be documented on the patient's chart.

Increasing Oxygen in the Lungs

The use of oxygen delivery systems is only one component to increasing oxygen to the alveolar capillary bed to allow for optimal oxygenation to the tissues. Additional methods to increase oxygen saturation levels in the body include (Perry et al., 2014):

- Maintaining satisfactory airway
- Optimizing oxygen-carrying capacities (hemoglobin levels)
- Reversing any respiratory depressants
- Using invasive or non-invasive ventilation when necessary
- Treating airflow obstruction with bronchodilators and sputum-clearing techniques
- Treating pulmonary edema as required

Critical Thinking Exercises

1. Explain the difference between low- and high-flow oxygen delivery systems.
2. The reservoir bag on a non re-breather mask must always be kept partially inflated. Why?
3. Why are non re-breather masks not available on the general nursing units?

Attributions

Figure 5.1 A non rebreather by James Heilman, MD is used under a Creative Commons Attribution-Share Alike 4.0 International license.

Figure 5.3 Principle setup of high-flow nasal cannula oxygen therapy by Nishimura, Masaji is used under a CC-BY 4.0 license

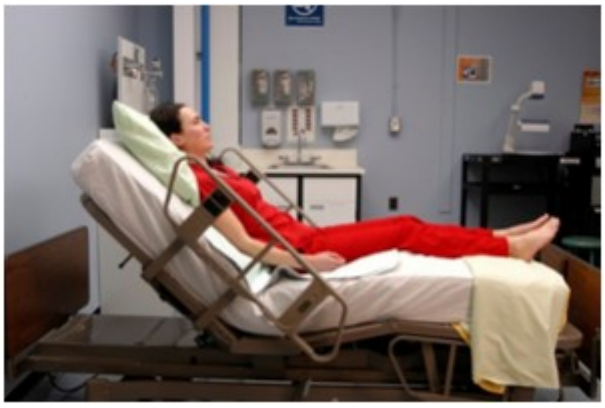
5.6 Management of Hypoxia

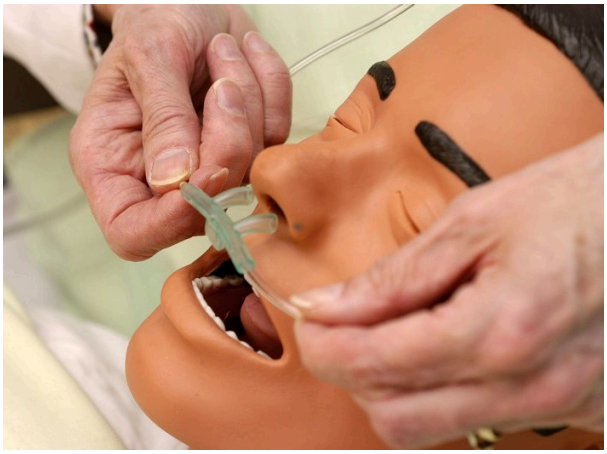
Hypoxemia or hypoxia is a medical emergency and should be treated promptly. Failure to initiate oxygen therapy can result in serious harm to the patient. The essence of oxygen therapy is to provide oxygen according to target saturation rate, and to monitor the saturation rate to keep it within target range. The target range (SpO_2) for a normal adult is 92% to 98%. For patients with COPD, the target SpO_2 range is 88% to 92% (Alberta Health Services, 2015; Kane et al., 2013; Perry et al., 2018).

Although all medications require a prescription, oxygen therapy may be initiated without a physician's order in emergency situations. Hypoxia is considered an emergency situation. Most hospitals have a protocol in place allowing health care providers to apply oxygen in emergency situations. The health care provider administering oxygen is responsible for monitoring the patient response and keeping the oxygen saturation levels within the target range. The most common reasons for initiating oxygen therapy include acute hypoxemia related to pneumonia, shock, asthma, heart failure, pulmonary embolus, myocardial infarction resulting in hypoxemia, post operative states, pneumonthorax, and abnormalities in the quality and quantity of hemoglobin. There are no contradictions to oxygen therapy if indications for therapy are present (Kane et al., 2013).

Hypoxic patients must be assessed for the causes and underlying reasons for their hypoxia. Hypoxia must be managed not only with supplemental oxygen but in conjunction with the interventions outlined in Table 5.4.

Table 5.4 Interventions to Treat and Prevent Hypoxia

Interventions	*Additional Information*
Raise the head of the bed	Raising the head of the bed promotes effective breathing and diaphragmatic descent, maximizes inhalation, and decreases the work of breathing. Positioning enhances airway patency in all patients. A Fowler's or semi-Fowler's position promotes a patient's chest expansion with the least amount of effort. Patients with COPD who are short of breath may gain relief by sitting with their back against a chair and rolling their head and shoulders forward or leaning over a bedside table while in bed.  *High Fowler's position*
Deep breathing and coughing techniques	Deep breathing and coughing techniques help patients effectively clear their airway while maintaining their oxygen levels. Teach patients "controlled coughing" by having them take a deep breath in and cough deeply with the mouth slightly open. If they have difficulty coughing, teach the huffing technique. This involves taking a medium breath and then making a sound like "ha" to push the air out fast with the mouth slightly open. This is done three or four times, and then they are instructed to cough. If secretions are thick and tenacious, the patient may be dehydrated and require additional fluids (if medical condition does not contraindicate additional fluids).

Oxygen therapy and equipment	If patient is already on supplemental oxygen, ensure equipment is turned on and set at the required flow rate and is connected to an oxygen supply source. If a portable tank is being used, check the oxygen level in the tank. Ensure the connecting oxygen tubing is not kinked, which could obstruct the flow of oxygen. Feel for the flow of oxygen from the exit ports on the oxygen equipment. In hospitals where medical air and oxygen are used, ensure patient is connected to the oxygen flow port.  *Applying nasal prongs*

Assess need for bronchodilators	Figure 5.6 Baby with rescue inhaler and spacerPharmacological management is essential for patients with respiratory disease. Medications such as bronchodilators effectively relax smooth muscles and open airways in certain disease processes such as COPD. Glucocorticoids relieve inflammation and also assist in opening air passages. Mucolytics and adequate hydration decrease the thickness of pulmonary secretions so that they can be expectorated more easily.  *Assess need for bronchodilation*  *Figure 5.5 Baby with spacer and rescue inhaler*

Oral suctioning	Some patients may have a weakened cough that inhibits their ability to clear secretions from the mouth and throat. Patients with muscle disorders or who have experienced a cerebral vascular accident (CVA) are at risk for aspiration related to ineffective cough reflex, which could lead to hypoxia. Provide oral suction if patient is unable to clear secretions, foreign debris, or mucous from the mouth and pharynx. See Checklist 43 for further directions.  *Oral suctioning may be necessary*
Pain relief	Provide adequate pain relief. Pain is known to increase the metabolic demands on the body, which in turn increases the need for more oxygen supply.
Devices to enhance secretion clearance	Many devices assist with secretion clearance, such as vests that inflate with large volumes of air and vibrate the chest wall, and handheld devices that help provide positive expiratory pressure to prevent airway collapse in exhalation. Usefulness of these therapies is decided based on the individual patient's situation and the preference of both the patient and care provider.
Frequent rests in between activities	Patients experiencing hypoxia often feel short of breath (SOB) and fatigue easily. Allow patient to rest frequently, and space out interventions to decrease oxygen demand in patients whose reserves are likely limited. Has the patient just returned from a walk down the hall or to the bathroom? Assess for underlying causes of the hypoxia. Is the potential problem respiratory or cardiovascular? What underlying respiratory or cardiovascular conditions exist? Complete respiratory and cardiovascular assessments may reveal potential abnormalities in these systems.
Obstructive sleep apnea	Patients with obstructive sleep apnea (OSA) may be unable to maintain a patent airway. In OSA, nasopharyngeal abnormalities that cause narrowing of the upper airway produce repetitive airway obstruction during sleep, with the potential for periods of apnea and hypoxemia. Pressure can be delivered during the inspiratory and expiratory phases of the respiratory cycle by using a mask to maintain airway patency during sleep. The process requires consideration of each individual's needs in order to to obtain compliance.

Anxiety and depression	The most common co-morbidities of COPD are anxiety and depression. Anxiety is related to chronic shortness of breath and an inability to breathe effectively. Anxiety and depression are chronically undertreated and may be relieved with breathing retraining, counselling, relaxation techniques, or anti-anxiety medications if appropriate.
Data source: Cigna & Turner-Cigna, 2005; Kane et al., 2013; Maurer et al., 2008; Perry et al., 2007; Perry et al., 2018; Shackell & Gillespie, 2009	

Applying and Titrating Oxygen Therapy

When providing oxygen therapy, remember the following (Kane et al., 2013; BCCNP, 2018):

- Consider the standards limits and conditions of your professional regulator in relation to administration of oxygen (BCCNP, 2018).
- Initiate oxygen according to hospital protocols when patients with respiratory or cardiovascular conditions warrant its use. Sometimes these are called decision support tools (DST).
- Always assess for underlying respiratory diseases. Patients with COPD are at risk for acute hypoventilation and carbon dioxide retention. Elevated CO_2 levels increase risk for respiratory failure or hyperventilation. With persons with COPD, always check the physician orders for the required amount of oxygen and acceptable SpO_2 range and/or proceed with caution if you are working within your independent scope of practice (BCCNP, 2018).
- Regardless of underlying conditions, your first priority should be to prevent or treat hypoxia. Never withhold oxygen for COPD patients while waiting for additional medical interventions (Alberta Health Services, 2015; O'Driscoll et al., 2008).
- Check all equipment for safety and function at least once per shift. Check oxygen equipment more frequently if using a high-flow system, which requires higher oxygen concentration.
- Avoid interruption of oxygen therapy during patient transport.
- When patient has a tracheostomy or a high-flow oxygen system and is being transported out of your care, contact respiratory therapy for assistance.

Oxygen is available in hospitals through bulk liquid oxygen systems that dispense oxygen as a gas through outlets in rooms. It can also be provided in cylinders (large or small) for easy transport for patient use while mobile or when moving around the hospital. An oxygen flow meter regulates the flow in litres per minute. Oxygen therapy may be short- or long-term depending on the SaO_2 requirements of the patients and underlying diseases processes (Perry et al., 2018).

Checklist 42 reviews the steps for applying and titrating oxygen therapy (see Figure 5.5).

Checklist 42: Applying and Titrating Oxygen Therapy

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Perform hand hygiene.
- Check room for additional precautions.
- Introduce yourself to patient.
- Check patient's name band to confirm identification.
- Complete QPA including safety.
- Explain process to patient.
- Use appropriate listening and questioning skills.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Apply principles of asepsis

Steps	*Additional Information*
1. Complete respiratory assessment for hypoxia. SpO_2 should be greater than 95% unless otherwise stated by the prescriber.	Assess need for O_2: check SpO_2 level with a pulse oximetry device. Assess for underlying medical conditions or alternate causes of hypoxia (cardiovascular). The goal is to use the least amount of oxygen to maintain levels between 92% and 98%.
2. If a patient requires oxygen therapy, choose an oxygen delivery system based on: • your patient's requirements, • your competency, • your scope of practice, and • your agency's policies and guidelines.	Oxygen is initially started at a low concentration (2 L/min) using nasal prongs. Then the flow is titrated up to maintain oxygen saturation of 92% or greater. Selection of delivery system is based on the level of oxygen support required (controlled or non-controlled), the severity of hypoxia, and the disease process. Other factors include age, presence of underlying disease (COPD), level of health, presence of an artificial airway, and environment (home or hospital). Significant decreases to O_2 saturation levels or large increases to maintain O_2 saturation should be reported promptly to responsible health care provider.

3. Once oxygen is applied, reassess your patient in 5 minutes to determine the effects on the body.	Hypoxia should be reduced or prevented. O_2 levels should be between 92% and 98%. Assess vital signs, respiratory and cardiovascular systems, and level of consciousness. Assess and implement additional treatments for hypoxia if appropriate. Reassess your patient if signs and symptoms of hypoxia return.
4. If required, adjust O_2 levels.	Changes in O_2 percentages should be in 5% to 10% increments. Patients should be reassessed (respiratory assessment including O_2 saturations) at miminum after 5 minutes following any changes to oxygenation levels. Changes in litre flow should be in 1 to 2 L increments. Consider changing O_2 delivery device if O_2 saturation levels are not maintained in target range. Slow, laboured breathing is a sign of respiratory failure.
5. If hypoxia continues, contact respiratory therapist or prescriber for further orders according to agency protocol.	Patient may require further interventions from the respiratory therapist or most responsible health care provider. Signs and symptoms of respiratory deterioration include increased respiratory rate, increased requirement of supplemental oxygen, inability to maintain target saturation level, drowsiness, decrease in level of consciousness, headache, or tremors.
6. Document according to agency protocol	Sample Charting: *Date/ time*: *Patient found sitting high Fowlers. Slight nasal flaring and use of neck accessory muscles noted with labored breathing. Chest auscultated course crackles throughout. Inspiratory expiratory wheezing throughout. T 37.3 HR 98 RR 27 BP 156/93. SpO_2 90% room air. O_2 @ 3l/ prongs initiated. Salbutamol / ipratropium given. ——- IBrth RN.* *Date / time. Respirations easy @ 18 / minute. No nasal flaring / use of accessory muscles noted. Describes breathing as more comfortable. SpO_2 96 %. O_2 reduced to 2l/ prongs. ———MBtr RN.*
Data source: O'Driscoll et al., 2008; Perry et al., 2018; BCCNP, 2019	

Special considerations:

- The underlying condition causing hypoxia must be treated to manage and improve patient outcomes. For example, if hypoxia is caused by pneumonia, additional treatment for hypoxia may include antibiotics, increased fluid intake, oral suctioning, position changes, and deep breathing and coughing exercises.
- If a patient has COPD, check physician order for the amount of required oxygen and the expected saturation level. The target range for persons with COPD is often lower than for persons with healthy lungs, i.e., 88% to 92% (British Thoracic Society, 2017).
- Once oxygen saturation levels are within normal range, perform a respiratory assessment frequently (i.e., every hour or more) if stable.
- When using oxygen therapy, assess the patient's skin where the oxygen device comes into contact with the patient. The nose, chin, and ears may have skin breakdown due to the irritation of the tubing on the skin. Oxygen therapy tends to cause drying effects to the nares and mouth. To prevent the drying effect, consider increasing fluid intake (if not contraindicated). Perform frequent mouth care and apply humidification if the patient is receiving more than 4 L/min (Perry et al., 2018).

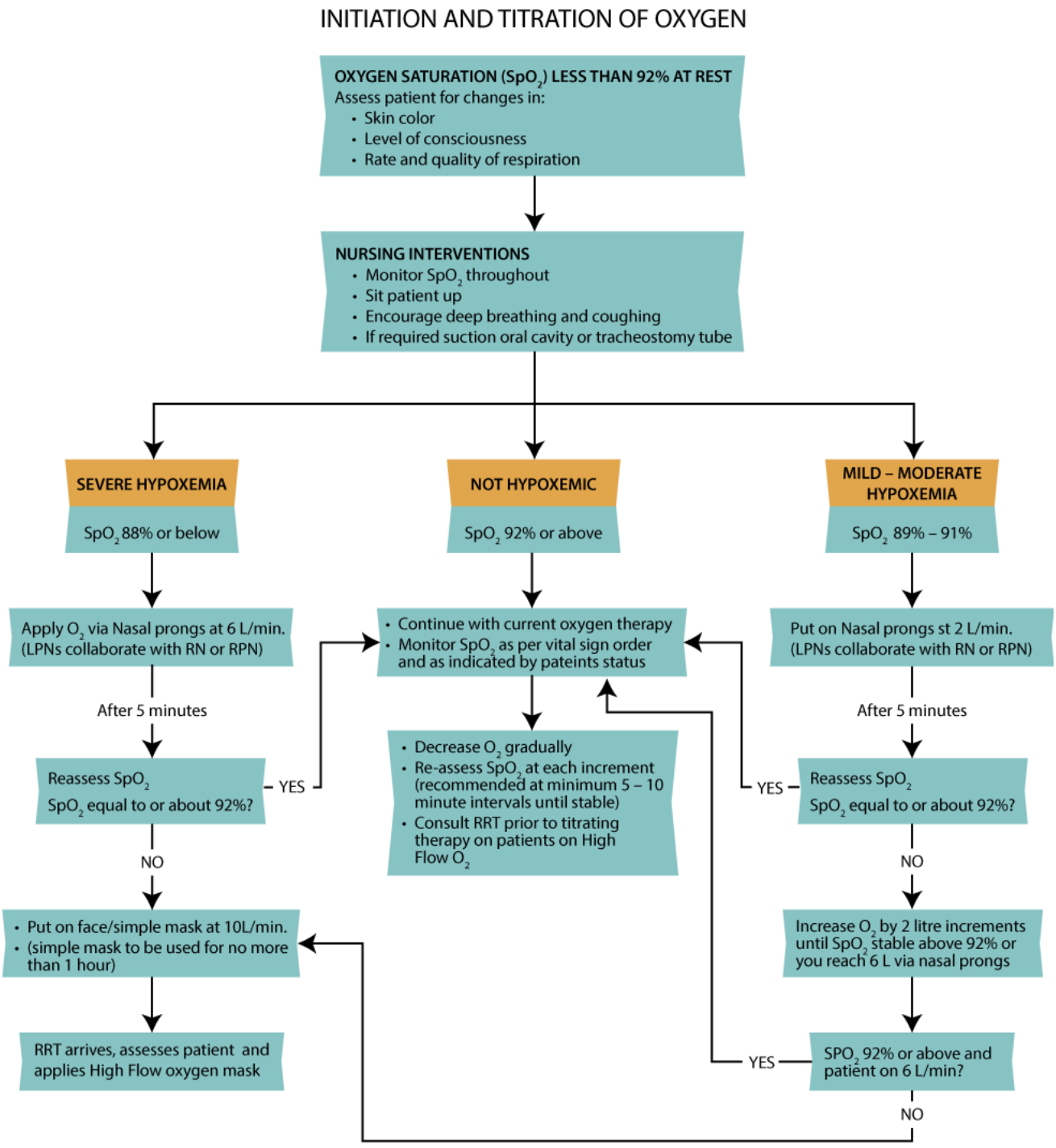


Figure 5.4 Oxygen therapy protocol

Critical Thinking Exercises

1. A patient is admitted with COPD and pneumonia and has an oxygen saturation of 88% on 1 L/min of oxygen. Is this an appropriate oxygenation level for a patient with COPD? Why or why not?
2. A patient with no underlying respiratory disease is hypoxic with an oxygen saturation level of 91% on room air. What are two additional interventions that may help improve oxygen saturation levels without applying oxygen therapy?
3. Examine a DST for the initial treatment of hypoxemia from your health authority / agency. What is the maximum flow of oxygen allowed to be administered without an order according to that specific tool?

Attributions

Figure 5.4 MDI with Spacer Child P Buchanan is used under a CC-BY SA license

Figure 5.5 Oxygen therapy protocol adapted from Providence Health Care, 2008

5.7 Cautions with Oxygen Therapy

Oxygen therapy supports life and supports combustion. While there are many benefits to inhaled oxygen, there are also hazards and side effects. Anyone involved in the administration of oxygen should be aware of potential hazards and side effects of this medication. Oxygen should be administered cautiously and according to the safety guidelines listed in Table 5.5.

Table 5.5 Oxygen Safety Guidelines for Home and Hospital

Guideline	*Additional Information*
Oxygen is a medication.	Remind patient that oxygen is a medication and should not be adjusted without consultation with a physician or respiratory therapist.
Storage of oxygen cylinders	When using oxygen cylinders, store them upright, chained, or in appropriate holders so that they will not fall over.
No smoking	Oxygen supports combustion. No smoking is permitted around any oxygen delivery devices in the hospital or home environment.
Keep oxygen cylinders away from heat sources.	Keep oxygen delivery systems at least 1.5 metres from any heat source.
Check for electrical hazards in the home or hospital prior to use.	Determine that electrical equipment in the room or home is in safe working condition. A small electrical spark in the presence of oxygen will result in a serious fire. The use of a gas stove, kerosene space heater, or smoker is unsafe in the presence of oxygen. Avoid items that may create a spark (e.g., electrical razor, hair dryer, synthetic fabrics that cause static electricity, or mechanical toys) with nasal cannula in use.
Check levels of oxygen in portable tanks.	Check oxygen levels of portable tanks before transporting a patient to ensure that there is enough oxygen in the tank.
ABGs should be ordered for all critically ill patients on oxygen therapy.	High concentrations of oxygen therapy should be closely monitored with formal assessments (pulse oximetry and ABGs).
Data source: Perry et al., 2018; O'Driscoll et al., 2008	

Precautions and Complications of Oxygen Therapy

Oxygen is essential to life, but as a drug it has both a maximum positive benefit and an accompanying toxicity effect. The toxic effects from oxygen therapy can occur based on the condition of the patient and the duration and intensity of the oxygen therapy. For example, with normal lung function a stimulation to take another breath occurs when a patient has a slight rise in **$PaCO_2$**. The slight rise in $PaCO_2$ stimulates the respiratory centre in the brain, creating the impulse to take another breath. In some patients with a chronically high level of $PaCO_2$, such as those with chronic obstructive pulmonary disease (COPD), the stimulus and drive to breathe is caused by a decrease in PaO_2. This is called a **hypoxic drive**. When administering oxygen to patients with known CO_2 retention, watch for signs of hypoventilation, a decreased level of consciousness, and apnea (Abdo & Heunks, 2012).

Oxygen therapy can have harmful effects, which are dependent on the duration and intensity of the oxygen therapy. See Table 5.6 for precautions and complications of oxygen therapy.

Table 5.6 Precautions and Complications of Oxygen Therapy

Complications	*Precautions*
Oxygen-induced hypoventilation/ hypoxic drive	If patients with a hypoxic drive are given a high concentration of oxygen, their primary urge to breathe is removed and hypoventilation or apnea may occur. It is important to note that not all COPD patients have chronic retention of CO_2, and not all patients with CO_2 retention have a hypoxic drive. It is not commonly seen in clinical practice. Never deprive any patient of oxygen if it is clinically indicated. It is usually acceptable to administer whatever concentration of oxygen is needed to maintain the SpO_2 between 88% and 92% in patients with known chronic CO_2 retention verified by an ABG.
Absorption atelectasis	About 80% of the gas in the alveoli is nitrogen. If high concentrations of oxygen are provided, the nitrogen is displaced. When the oxygen diffuses across the alveolar-capillary membrane into the bloodstream, the nitrogen is no longer present to distend the alveoli (called a nitrogen washout). This reduction in alveolar volume results in a form of collapse called **absorption atelectasis**. This situation also causes an increase in the physiologic shunt and resulting hypoxemia.
Oxygen toxicity	**Oxygen toxicity**, caused by excessive or inappropriate supplemental oxygen, can cause severe damage to the lungs and other organ systems. High concentrations of oxygen, over a long period of time, can increase free radical formation, leading to damaged membranes, proteins, and cell structures in the lungs. It can cause a spectrum of lung injuries ranging from mild tracheobronchitis to diffuse alveolar damage. For this reason, oxygen should be administered so that appropriate target saturation levels are maintained. Supplemental oxygen should be administered cautiously to patients with herbicide poisoning and to patients receiving bleomycin. These agents have the ability to increase the rate of development of oxygen toxicity.
Data source: Perry et al., 2018; O'Driscoll et al., 2008	

Critical Thinking Exercises

1. A patient is being discharged with low SpO_2 and will receive home oxygen. Name four vital safety

components to review with the patient prior to discharge.

2. Persons with COPD are at risk for developing a complication called oxygen-induced hypoventilation. What is the cause of this complication and how can it be prevented?

5.8 Oral Suctioning

The purpose of oral suctioning is to maintain a patent airway and improve oxygenation by removing mucous secretions and foreign material (vomit or gastric secretions) from the mouth and throat (oropharynx). **Oral suction** is the use of a rigid plastic suction catheter, known as a yankauer (see "Suctioning with a Yankauer" figure), to remove pharyngeal secretions through the mouth (Perry et al., 2018). A yankauer is never inserted into a tracheotomy due to its large size. Oral secretions can also be removed fusing a soft suction catheter. Oral suctioning is useful to clear secretions from the mouth in the event a patient is unable to do this independently. Patients who benefit the most include those with CVAs, drooling, impaired cough reflex related to age or condition, or impaired swallowing (Perry et al., 2018). The procedure for oral suctioning can be found in Checklist 43.

Suctioning with a yankauer

Checklist 43: Oral Suctioning with a Yankauer Suction Tip

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

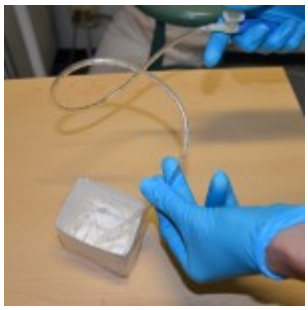
- Perform hand hygiene.
- Complete QPA including safety.
- Apply principles of asepsis
- Avoid oral suctioning on patients with recent head and neck surgeries.
- clean technique for oral suctioning.
- Know which patients are at risk for aspiration and are unable to clear secretions because of an impaired cough reflex. Keep supplies readily available at the bedside and ensure suction is functioning in the event oral suctioning is required immediately.
- Know appropriate suctioning limits and the risks of applying excessive pressure or inadequate pressure.
- Avoid mouth sutures, sensitive tissues, and any tubes located in the mouth or nares.
- Avoid stimulating the gag reflex.
- Always perform a pre- and post-respiratory assessment to monitor patient for improvement.
- If an abnormal side effect occurs (e.g., increased difficulty in breathing, hypoxia, discomfort, worsening vital signs, or bloody sputum), notify appropriate health care provider.

Steps	*Additional Information*
1. Assess patient need for suctioning (respiratory assessment for signs of hypoxia), risk for aspiration, and inability to protect own airway or clear secretions adequately, which may lead to upper airway obstruction.	Baseline respiratory assessment, including an O_2 saturation level, can alert the health care provider to worsening condition. Signs and symptoms include obvious excessive secretions; weak, ineffective cough; drooling; gastric secretions or vomit in the mouth; or gurgling sounds with inspiration and expiration. Pooling of secretions may lead to obstruction of airway. Suctioning is required with alterations in oxygen levels and with increased secretions.
2. Explain to patient how the procedure will help clear out secretions and will only last a few seconds. If appropriate, encourage patient to cough.	This allows patient time to ask questions and increase compliance with the procedure. Minimizes fear and anxiety. Encourage the patient to cough to bring secretions from the lower airways to the upper airways.

3. Position patient in semi-Fowler's position with head turned to the side.	This facilitates ease of suctioning. Unconscious patients should be in the lateral position.
4. Perform hand hygiene, gather supplies, and apply non-sterile gloves. Perform a point of contact risk assessment. Apply PPE if necessary (i.e., mask, eye protection)	 *Wash hands*  *Apply non-sterile gloves* This prevents the transmission of microorganisms. Supplies include a suction machine or suction connection, connection tubing, non-sterile gloves, yankauer, water and a sterile basin, mask, and clean towel. Suctioning may cause splashing of body fluids.

5. Fill basin with water.	Water is used to clear connection tubing in between suctions. Fill basin with enough water to clear the connection tubing at least three times.  *Tap water is OK to use. This is a clean procedure.*
6. Attach one end of connection tubing to the suction machine and the other end to the yankauer.	This prepares equipment to function effectively.  *Suction container*

7. Turn on suction to the required level. Test function by covering hole on the Yankeur with your thumb and suctioning up a small amount of water.	Suction levels for adults are 100 to 150 mmHg on wall suction and 10 to 15 mmHg on portable suction units. Always refer to agency policy for suction levels.
8. Remove patient's oxygen mask if present. Nasal prongs may be left in place. Place towel on patient's chest.	Always be prepared to replace the oxygen if patient becomes short of breath or has decreased O_2 saturation levels. The towel prevents patient clothing from coming in contact with secretions.
9. Insert Yankuer catheter. Run catheter along gum line to the pharynx in a circular motion, keeping yankauer moving. Encourage patient to cough. Another option: insert suction catheter along the gum line to the pharynx. Apply suction by covering the thumb hole of the suction catheter	Movement prevents the catheter from suctioning to the oral mucosa and causing trauma to the tissues.  Coughing helps move secretions from the lower airways to the upper airways. Apply suction for a maximum of 10 to 15 seconds. Allow patient to rest in between suction for 30 seconds to 1 minute.

10. If required, replace oxygen on patient. Clear out suction catheter by placing yankauer in the basin of water.	Replace oxygen to prevent or minimize hypoxia.  *Clear suction tubing with water* Clearing out the catheter prevents the catheter and connection tubing from plugging.
11. Reassess and repeat oral suctioning if required.	Compare pre- and post-suction assessments to determine if intervention was effective.
12. Reassess respiratory status and O_2 saturation for improvements. Call for help if any abnormal signs and symptoms appear.	This identifies positive response to suctioning procedure and provides objective measure of effectiveness.

13. Ensure patient is in a comfortable position and call bell is within reach. Provide oral hygiene if required.	This promotes patient comfort.
14. Clean up supplies, remove gloves, and wash hands. Document procedure according to hospital policy.	Cleanup prevents the transmission of microorganisms. Documentation provides accurate details of response to suctioning and clear communication among the health care team. Sample documentation: date / time: Not *able to swallow own secretions. ++ drooling noted. Oral care provided and assisted with suctioning via yankauer. —SPit RN*
Data source: Perry et al., 2018; Potter et al., 2010	

For a demonstration of oral suctioning, watch the following video.

Watch the *Oral Suctioning* video developed by Renée Anderson and Wendy McKenzie of TRU School of Nursing (2018).

Critical Thinking Exercises

1. What is the purpose of oral suctioning?
2. Name three types of patient conditions that present risk for airway obstruction or ineffective cough.
3. What is the rationale for encouraging the patient to cough before suctioning?

5.9 Oropharyngeal suctioning

Oropharyngeal / Naso Pharyngeal Suctioning

Oral suctioning involves the mouth. Oropharyngeal involves the mouth and the pharynx and sometimes the trachea. The pharynx and trachea can also be reached through the nose. Suctioning via all of these routes are indicated when the patient has secretions in the pharynx and upper airway that they cannot clear independently. The choice of route will depend on patient factors like facial trauma, presence of airways, and the urgency of the situation. Symptoms to suggest the patient may need tracheal suctioning include visible secretions in the airway, coarse gurgling breath sounds, diminished breath sounds, suspected aspiration of gastric or upper airway secretions, increased work of breathing, deteriorating SaO_2 or SpO_2, restlessness (AARC, 2004). Because the suctioning occurs deeper into the respiratory tract, there is increased risk of respiratory infection. As such the procedure must be sterile and thus observe principles of asepsis. Other risks associated with oropharyngeal / tracheal suctioning include hypoxia, trauma, laryngospasm, increased intracranial pressure for persons with head injury, cardiac dysrhythmias, and death (Strickland et al., 2013).

Respiratory assessment should always include underlying pathology including respiratory, neuromuscular, musculoskeletal factors influencing respiratory status. Recent surgery, or trauma to face or nose may influence the need and/or ability to insert suction catheters (Perry et al., 2018). Consider reasons why the patient is unable to clear secretions independently and consider strategies that may reduce the need for tracheal suctioning (i.e., humidity may help to liquefy secretions, sitting in chair and/or ambulation may help the patient to clear secretions independently) (Strickland et al., 2013). Checklist 44 describes the procedure for oropharyngeal suctioning.

Checklist 44: Oropharyngeal Suctioning

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Hand hygiene
- Review all safety considerations for oral suctioning.
- The mouth and pharynx contain bacteria that can potentially contaminate the trachea. If necessary, suction the mouth with a different suction catheter / yankauer prior to beginning this procedure. Perform regular good mouth care.
- Monitor the client throughout the procedure, and stop suctioning if the client experiences rapid changes in status.
- Suctioning can cause increased intracranial pressure in patients with head injury. The nurse can reduce this risk by hyper-oxygenating the patient before suctioning and/or limit the number of times a suction catheter is inserted into the trachea.
- Use sterile technique for oropharyngeal suctioning.
- Perform point of care risk assessment for PPE.

Steps	*Additional Information*
	Perform baseline respiratory assessment including SpO_2.
1. Assess the need for suctioning including respiratory assessment, signs of hypoxia, inability to clear own secretions adequately, alterations in oxygenation levels	Assess for additional factors that might influence procedure, i.e., recent surgery; head, chest, or neck tumors; facial or nasal trauma; and neuromuscular diseases. Determine if the patient is on any medications that increase risk of bleeding
2. Explain the procedure in calm reassuring manner explaining the benefits to remove secretions to make breathing easier.	Procedure can cause patient anxiety. This is part of the consent procedure. Allow the patient an opportunity to ask questions.
3. Position the patient in semi to high Fowler's – unless contraindicated. Drape chest with towel or disposable pad.	Promotes lung expansion and promotes secretion clearance.

4. Perform hand hygiene. Gather equipment. Ensure suction set up is working.

Suction machine (portable or wall); canister & liner; connective tubing (2), suction catheter, lubricant, sterile saline or water (acts as lubricant), PPE (sterile gloves, face shield and / or gown), pulse oximeter.

5. Administer oxygen if needed

Hyper-oxygenating might be necessary if the patient is hypoxic or at risk of hypoxia during procedure.

6. Estimate the appropriate suctioning depth by measuring the catheter from the tip of the patient's nose to the angle of the mandible or to the earlobe

This is done with the suction catheter still in the sterile package. Ensures that the catheter remains sterile and at minimum reaches the pharynx.

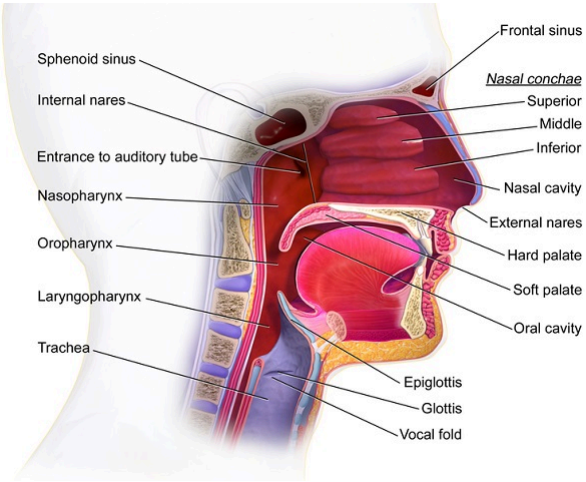


Figure 5.6 Structures of the mouth and pharynx

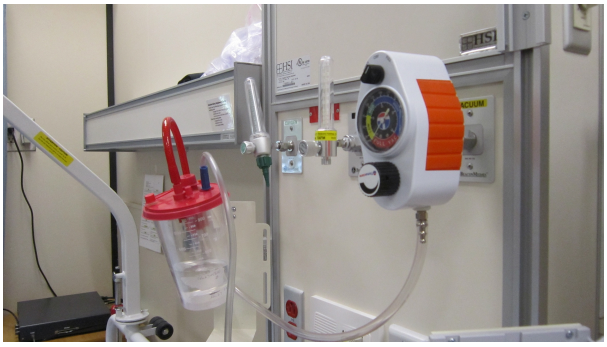


Figure 5.7 Suction regulator and canister

7. Turn the suction device on, and set the vacuum regulator to the appropriate negative pressure. Set suction levels to medium / moderate.

Attach the suction catheter to the tubing whilst remaining in the sterile package.

Open the sterile water / saline.

If using lubricant, squeeze water soluble lubricant onto sterile surface.

It is the tip of the catheter that you try to keep sterile.

Suction setting:

- Adult 80 to 100 mmHg
- Children 60 to 80 mmHg
- *Not to exceed 150 mmgHg (AARC 2004)

8. Hand hygiene & Donne PPE

At minimum PPE should include: sterile gloves & face shield.

Sterile gloves reduce risk of transmitting microorganisms into the lungs.

9. Apply sterile gloves. With the non-dominant hand, pick up the packaged connecting tubing.

Expose the suction catheter enough to allow the dominant hand to grab the sterile catheter.

Wrap the sterile catheter around the dominant hand.

Suction a small amount of sterile NS / water.

Apply lubricant if necessary (to 10 cm of catheter tip)

You can also apply a non sterile glove to the non dominant hand and a sterile glove to the dominant hand.

There is more than one way to remove the sterile suction catheter from the package: the principle is keep the dominant hand & the suction catheter tip sterile.

Suctioning sterile NS/ water ensures properly functioning equipment.

10. Insert suction catheter via route of choice (oral / nasal) until you feel that you are in the pharynx or until you feel resistance:

- Oral (last resort)
- Nasal

The route chosen will depend on the urgency of the situation and presence of tubes and the skill level of the nurse. Each route comes with inherit risks:

- Oral (increases risk of respiratory infection by introduction of oral bacteria to the trachea). This route should be used as a last resort
- Nasal (increases risk of nasal trauma – chose a nare with least resistance). Can also be done through a nasal airway
- All: increased risk of vasovagal response laryngospasm (which could lead to airway obstruction / hypoxia)

Important for this patient population is frequent and adequate mouth care and collaboration with respiratory therapy and physiotherapy

Introduction of the catheter sometimes stimulates a cough response.

Suction applied during insertion increases risk of mucosal damage and increases risk of hypoxia

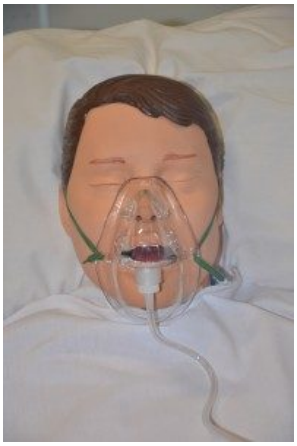
11. Apply intermittent suction as the catheter is withdrawn. This means occluding and releasing the catheter vent with the non-dominant thumb. Some sources suggest twisting catheter back and forth as the catheter is withdrawn. Always encourage the patient to cough.

Do not apply suction for longer than 10 to 15 seconds. Suction removes oxygen and increases risk of hypoxia as oxygen is sucked out.

The need to rotate the catheter is questioned in the literature because modern suction catheters have multiple eyes / holes (Moore, 2003).

Encourage patient to cough to promote secretion clearance.

12. Replace the oxygen delivery device, if applicable, and instruct the patient to take deep breaths to encourage oxygenation.



Reapply oxygen delivery device, if applicable

13. Clear secretions from the suction catheter by suctioning sterile water / saline to clear tubing of secretions.

Clears tubing of secretions to maintain patency

Observe for changes to cardiopulmonary status.

Can often be done through observation of breathing pattern including HR and SpO_2.

14. Assess the need to repeat the procedure.

If stethoscope is needed, hand hygiene and reapplication of sterile gloves is necessary if you are going to repeat the procedure.

When possible, provide recovery time (at least 1 minute) between suction passes to allow for ventilation and oxygenation to occur.

15. Discard suction catheter, sterile saline / water, lubricant, sterile gloves. Turn off suction. Remove gloves. Perform hand hygiene. Ensure the patient is comfortable and the call bell within reach.

Open suctioning method requires new suction catheter after each round of suctioning. Reuse may introduce microorganisms into the patient's respiratory tract increasing risk of infection

	Sample narrative documentation:
16. Document the procedure in the patient's record.	*date/time: Patient drowsy. Audibly moist respiration's. Encourage to cough but unable to clear secretions . T 37.5 HR 87 RR 26 BP 148/86. SpO_2 90%3L/prongs. Chest auscultated ++ course crackles and ↓air entry throughout. Oropharyngeal suctioning using #16 suction catheter for moderate thick white / yellow secretions. Some coughing noted through procedure. Resps now less audibly moist. Chest sounds / vital signs unchanged ————-P. Lescgh RN*

Data sources: AARC, 2004 ; Moore, 2003; Strickland et al. 2013; Perry et al, 2018

- Adaptations for neonates / children may be necessary. Consult agency policy and procedure guidelines.

To better understand oropharyngeal and tracheal suctioning, watch the following video.

Watch the videos *Oropharyngeal Suctioning* developed by Renée Anderson and Wendy McKenzie, Thompson Rivers University (2018).

Critical Thinking Exercises

1. Name four potential complications of oropharyngeal suctioning.
2. Why is oropharyngeal suctioning treated as a sterile procedure?

Attributions

Figure 5.6. Structures of the mouth & pharynx by Blausen.com staff is used under a CC BY 3.0 license.

5.10 Summary

Oxygen is essential to life. The main goal of oxygen therapy is to prevent hypoxemia, thereby preventing hypoxia that could result in tissue damage and cell death. Hypoxia, if caused by certain medical conditions, can be managed and prevented by oxygen therapy. In other instances, such as with anemia and decreased cardiac output, the effects of oxygen therapy will be limited.

Always follow the guiding principles of the oxygen therapy protocols of your local health authority to administer oxygen safely to manage hypoxia and prevent the side effects and hazards of oxygen therapy.

Key Takeaways

- Understand the pathophysiological factors affecting the gas exchange of oxygen. Understanding how the respiratory system works is key to knowing how to prevent and manage hypoxia.
- Hypoxia is a medical emergency. Be aware of the signs and symptoms of hypoxia, and of patients who are at risk for hypoxia.
- Oxygen therapy is a medical intervention. Ensure correct patient, correct flow rate, and correct connection to oxygen source.
- RN regulation in BC allows RNs to practice within their independent scope of practice and to diagnose hypoxia and begin oxygen administrion without orders from an authorized prescriber.
- Care should be taken to avoid interruptionof oxygen therapy in situations including ambulation or transport for procedures. If using a portable tank during transport or ambulation, ensure that the tank is full.
- For adults, the recommended target range for oxygen saturation is 92% to 98%. Oxygen levels decrease slightly with age, especially in patients over 70 years. A saturation of 92% to 94% may be considered normal in a patient with heart failure or underlying lung disease.
- For most patients with COPD, the target oxygen saturation range is 88% to 92%.
- Be aware of the causes of hypoxemia and treatments related to managing and preventing hypoxia.
- Oxygen therapy has benefits and hazards. Be aware of how to handle the administration of oxygen safely and monitor for side effects.
- Contact the respiratory therapist in the health care agency with questions or concerns related to oxygen therapy.

Suggested Online Resources

1. Canadian Centre for Occupational Health and Safety. This website provides standards for the safe use of oxygen in the hospital and home.

2. Canadian Thoracic Society: Canadian respiratory guidelines. This website provides Canadian guidelines related to respiratory conditions such as chronic obstructive pulmonary disease (COPD), asthma, bronchitis, infectious respiratory diseases, and sleep apnea, as well as home ventilation.

3. College of Respiratory Therapists of Ontario: Oxygen therapy. Clinical best practice guidelines. This document reviews Canadian standards for the management of oxygen therapy. This resource provides information on oxygen equipment, describes how oxygen works in the body, lists oxygen guidelines according to Canadian law, and gives a review of hyperbaric oxygen therapy.

4. British Medical Journal (2018). Oxygen therapy for acutely ill medical patients: A clinical practice guideline. doi: https://doi.org/10.1136/bmj.k4169

5. Thorax: Guideline for emergency oxygen use in adult patients. This British journal article provides the most current evidence-based material related to oxygen therapy.

6. PHSA. Learning Hub. This system offers over 600 online and classroom health-related courses from Vancouver Coastal Health, Providence Health Care, Fraser Health Authority, and Island Health. You must create an account to access this system of free courses (select the "New User" button).

References

AARC. (2004). Nasotracheal suctioning—2004 revision and update. *Respiratory Care, 49*(9), 1080-1084. Retrieved from https://www.aarc.org/wp-content/uploads/2014/08/09.04.1080.pdf.

Abdo, W., & Heunks, L. (2012). Oxygen induced hypercapnia in COPD: myths and facts. *Critical Care*, 16(5). https://doi.org/10.1186/cc11475

Alberta Health Services. (2015). *Oxygen therapy for acute adult inpatients. Learning module for Allied Health staff (category 1 and 2)*. Retrieved from http://www.albertahealthservices.ca/assets/info/hp/edu/if-hp-edu-ahc-oxygen-therapy-learning-module-cat-1and2.pdf.

Astle, B., & Duggleby, W. (Eds.). (2019). *Canadian fundamentals of nursing* (6th ed.). Milton, ON: Elsevier.

British Columbia College of Nursing Professionals (BCCNP). (2019). *RN scope of practice – inhalation*. Retrieved from https://www.bccnp.ca/Standards/RN_NP/RNScopePractice/part4/section6/Pages/inhalation.aspx

British Thoracic Society Emergency Oxygen Guideline Development Group. (2017). BTS guideline for oxygen use in adults in health care and emergency settings. *Thorax*, 72(1), i1-i90. Retrieved https://www.brit-thoracic.org.uk/document-library/clinical-information/oxygen/2017-emergency-oxygen-guideline/bts-guideline-for-oxygen-use-in-adults-in-healthcare-and-emergency-settings/

Cigna, J. A., & Turner-Cigna, L. M. (2005). Rehabilitation for the home care patient with COPD. *Home Healthcare Nurse*, 23(9), 578-584.

Considine, J. (2007). *Emergency assessment of oxygenation*. Retrieved from https://acutecaretesting.org/en/articles/emergency-assessment-of-oxygenation.

Fisher & Paykel Health Care. (2018). *Optiflow™ provides respiratory support via nasal cannula*. Retrieved from https://www.fphcare.com/nz/hospital/adult-respiratory/optiflow/mechanisms-of-action/.

Fournier, M. (2014). Caring for patients in respiratory failure. *American Nurse Today*, 9(11). Retrieved from https://www.americannursetoday.com/caring-patients-respiratory-failure/

Henderson, R., & Bonsall, A. (2014). Cheyne-Stokes and Abnormal Patterns of Respiration. Retrieved https://patient.info/doctor/Cheyne-Stokes-and-Abnormal-Patterns-of-Respiration#nav-5

Howell, M. (2002, March). The correct use of pulse oximetry in measuring oxygen status. *Nursing Times*. Retrieved from http://www.nursingtimes.net/the-correct-use-of-pulse-oximetry-in-measuring-oxygen-status/199984.article

Jardins, T., & Burton, G. G. (2011). *Clinical manifestations and assessment of respiratory diseases* (6th ed.). St. Louis, MO: Elsevier-Mosby.

Kane, B., Decalmer, S., & O'Driscoll, B. R. (2013). Emergency oxygen therapy: From guideline to implementation. *Breathe*, 9(4), 246-253. doi: 10.1183/20734735.025212l.

Karius, D. (n.d.). *Respiratory adaptations in health and disease: Ventilation-perfusion (V/Q) ratio*. Retrieved from http://courses.kcumb.edu/physio/adaptations/vq.htm.

Maurer, J., Rebbapragada, V., Borson, S., Goldstein, R., Kunik, M., Yohannes, A., & Hanania, N. (2008). Understanding depression and COPD. Current understanding, unanswered questions and research needs. *Chest*, 134(4), 43s-56s. doi: 10.1378/chest.08-0342.

McCance, K., Huether, S., Brashers, V., & Rote, N. (2014). *Pathophysiology: The biological basis for disease in adults and children* (6th ed.). St. Louis, MO: Mosby Elsevier.

Meštrović, T. (2014). *What is hypoxemia?* Retrieved from http://www.news-medical.net/health/What-is-Hypoxemia.aspx.

Moore T. (2003) Suctioning techniques for the removal of respiratory secretions. *Nursing Standard*, 18(9), 47-55.

O'Driscoll, B. R., Howard, L. S., & Davison, A. G. (2008). Guideline for emergency oxygen use in adult patients. *Thorax*, 63(6). Retrieved from https://thorax.bmj.com/content/63/Suppl_6/vi1.

Perry, A. G., Potter, P. A., & Elkin, M. K. (2007). *Nursing interventions and clinical skills* (5th ed.). St. Louis, MO: Elsevier-Mosby.

Perry, A. G., Potter, P. A., & Ostendorf, W. R. (2014). *Clinical skills and nursing techniques* (8th ed.). St. Louis, MO: Elsevier-Mosby.

Perry, A. G., Potter, P. A., & Ostendorf, W. R. (2018). *Clinical nursing skills & techniques* (9th ed.). St. Louis: Elsevier-Mosby.

Potter, P. A., Perry, A. G., Ross-Kerr, J. C., & Wood, M. J. (Eds.). (2010). *Canadian fundamentals of nursing* (4th ed.). Toronto: Elsevier Canada.

Providence Health Care. (2008). *Nursing care standards: Oxygen therapy protocol*. Vancouver, BC: Providence Health Care.

Shackell, E., & Gillespie, M. (2009). The oxygen supply and demand framework: A tool to support integrative learning. *Journal of the Canadian Association of Critical Care Nurses*, 20(4), 15-19. Retrieved from https://www.caccn.ca/pdfs/L2%20Oxygen%20Supply%20&%20Demand%20Framework%20(E%20Shackell,%20M%20Gillespie).pdf.

Simpson, H. (2004). Interpretation of arterial blood gases: A clinical guide for nurses. *British Journal of Nursing*, 13(9), 522-528.

Strickland, S. L., Rubin, B. K., Drescher, G. S., Haas, C. F., O'Malley, C. A., Volsko, T. A., ... Hess, D. R. (2013). *AARC clinical practice guideline: Effectiveness of nonpharmacologic airway clearance*

therapies in hospitalized patients. Retrieved from https://www.aarc.org/wp-content/uploads/2014/08/nonpharmacologic_2013.pdf.

World Health Organization. (2011). *Pulse oximetry training manual*. Retrieved from http://www.who.int/patientsafety/safesurgery/pulse_oximetry/who_ps_pulse_oxymetry_training_manual_en.pdf.

CHAPTER 6. NON-PARENTERAL MEDICATION ADMINISTRATION

6.1 Introduction

This chapter describes nursing responsibilities in relation to the administration of medications given orally (including NG, G tube, J tube), rectally, vaginally, via eyes, ears, and nose, inhaled and topically. Drugs often require a specific preparation when used for a particular route. For example suppositories have medication dispersed in a fat or wax, which when inserted rectally melt and are absorbed into the intestinal mucosa. Medications for a particular route are often available in a variety of forms. For example oral medications might be a liquid, a suspension, capsule, or a scored tablet. Some oral medications are enteric coated (EC); others are sustained release (SR). Knowing the unique characteristics of these and the accompanying nursing considerations is important for safe medication administration.

Although not in the scope of this textbook, nurses require a working knowledge of pharmacokinetics (absorption, distribution, metabolism, and excretion) and the ability to apply this understanding to unique patient situations. Nurses also require knowledge about the intended action of the drug on the body (pharmacodynamics) in order to determine if medications are working and/or if adverse events are apparent. Every medication has the potential to harm a patient, and as such a nurse can assume that:

- No medication is completely safe and absolutely free of non-therapeutic effects.
- Medication interactions are common in individuals taking many medications.
- When one medication modifies the action of another, a medication interaction occurs (Perry, Potter, & Ostendorf, 2018; Lilley, Rainforth Collins, Snyder, & Swart, 2016).

Learning Outcomes

- Discuss ten principles for safer medication administration.
- Discuss what is meant by timely medication administration.
- List and discuss the seven rights of medication administration.
- Outline procedures for administering medication safely via the following routes:
    - Mouth and gastric tube
    - Rectally and vaginally
    - Eyes, ears, and nose
    - Inhalation
    - Topically

6.2 Safe Medication Administration

Safe and accurate medication administration is an important and potentially challenging nursing responsibility. Medication administration not only requires understanding medications, how they work, side effects, and significant nursing considerations, it also involves good decision-making skills and clinical judgment. Nurses must understand why patients take particular medications, anticipate potential med-med interactions, and assess individual patient response.

Nurses are human, so naturally medication errors do happen. The Joint Commission (TJC), a non profit organization that accredits health care organizations and programs, defines medication errors as any preventable event that may cause inappropriate medication use or jeopardize patient safety (TJC, 2012).

Medication errors have a substantial impact on health care in Canada (Butt, 2010) and are the number-one error in health care (Centers for Disease Control [CDC], 2018).

In one study looking at drug related hospital admissions and emergency department (ED) visits, Zed et al. (2008) found that adverse drug reactions are estimated to account for more than 25% of drug-related hospital admissions and ED visits (as cited in CIHI, 2013). Of these, 68% are considered preventable. Of the patients whose ER visits were drug related, their hospital admission rates were higher and their length of stay longer when compared to patients who presented for other reasons. Studies by other researchers reveal similar and equally concerning findings about negative medication related effects on people (Baker et al., 2004; Bell et al., 2011). The cost to patients and families, as well as to the healthcare system, points to the importance of safety in relation to all phases of the medication administration process.

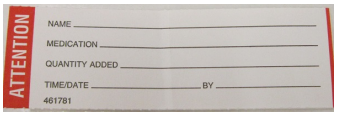
Review Table 6.1 for principles for safer medication administration.

Table 6.1 Principles for Safer Medication Administration

Safety considerations:

- Always receive the required training on the use of each agency's medication system to avoid preventable errors. Agency policy on medication administration and on the medication administration record (MAR) may vary. Follow your agency guidelines for confirming accuracy of MARs.
- The Institute for Safe Medication Practices (ISMP) Canada provides important safety information and guidelines around medication administration.

Principle	*Additional Information*
Be vigilant when preparing medications.	Avoid distractions. Some agencies have a no-interruption zone where healthcare providers can prepare medications without interruptions.
Perform hand hygiene before preparing meds and after administration.	Reduces risk of transmitting microorganisms.
Check for allergies. Ask about type of allergy and severity.	Always ask patient about allergies, types of reactions, and severity of reactions.
Prepare medications for ONE patient at a time.	Reduces risk of error during preparation.
Use two patient identifiers at all times. Always follow agency policy for patient identification.	Use at least two patient identifiers before administration AND compare against the medication administration record (MAR). Whenever possible, MARs and eMARs should be taken to the bedside. Confirm patient ID using two patient identifiers (i.e., name and date of birth) and check against MAR.
For all medications being administered, review purpose, normal dose, route, common side effects, onset, peak, contraindications, and nursing considerations.	Knowledge is key to safer medication administration.

Label all meds prepared away from the bedside.	Label should include two patient identifiers, drug, dose, time prepared, and initials of the nurse who prepared it. Labeling clearly identifies the drug, dose, patient, and person preparing the medication. Be confident that you know what you are administering.  *Figure 6.1 sample label*
Assessment comes before, during, and after medication administration.	Complete necessary focused assessment depending on what medication is to be administered (i.e., heart rate for beta blockers and calcium channel blockers; BP for diuretics, ACE inhibitors, and calcium channel blockers; INR for warfarin; blood glucose for antidiabetic agents; etc.). Assessment after medication administration helps to determine if the medication is having its intended effect and/or to determine possible adverse reactions.
Be diligent in all medication calculations.	Errors in medication calculations have contributed to dosage errors, especially when adjusting or titrating dosages. If in doubt, ask a colleague for an independent double check.
Avoid reliance on memory; use checklists and memory aids.	Slips in memory are caused by lack of attention, fatigue, and distractions. Mistakes are often referred to as attentional behaviours, and they account for most errors in healthcare. If possible, follow a standard list of steps for every patient.
Communicate with your patient before, during, and after administration.	Provides opportunities for patient education and continued assessment by the nurse.
Avoid work-arounds.	A work-around is a process that bypasses a procedure, policy, or problem in a system. For example, nurses may “borrow” a medication from another patient while waiting for an order to be filled by the pharmacy. These work-arounds fail to follow agency policies that ensure safe medication practices.
Ensure medication has not expired.	Medication may be inactive if expired.
Always clarify an order or procedure that is unclear.	Always ask for help whenever you are uncertain or unclear about an order. Consult with the pharmacist, charge nurse, or other healthcare providers, and be sure to resolve all questions before proceeding with medication administration.
Use available technology to administer medications.	Technology has the potential to help decrease errors. Use technology that is available to you when administering medications, but be aware of technology-induced errors.
Report all near misses, errors, and adverse reactions.	Reporting through patient safety learning systems (PSLS) allows characteristics of each near miss, error, and adverse reaction to be tracked. Analysis of this information is intended to find root causes and solutions toward safer medication administration practices.

Be alert to error-prone situations and high-alert medications.	High-alert medications are those that are most likely to cause significant harm, even when used as intended. The most common high-alert medications are anticoagulants, narcotics and opiates, insulin, and sedatives. The types of harm most commonly associated with these medications include hypotension, respiratory depression, delirium, bleeding, hypoglycemia, bradycardia, and lethargy. High-alert situations include: frequent dosing to the same patient (i.e., q4h insulin sliding scale; q1h morphine IV), multiple meds (i.e., having to administer meds to multiple patients and each have multiple medications), high stress environments, noisy environments, and multiple distractions during medication preparation.
Independent double checks. High-alert meds require a second person verifier (insulin, anticoagulants, chemo, etc.—check agency policy).	Two clinicians independently check each high-alert medication in relation to prescribing, dispensing, and administration (i.e., insulin, anticoagulants, IV direct medications).
When possible take MARs to the bedside, open medication packages at the bedside, and label medications prepared away from the bedside.	Two identifiers and having MARs and comparing these with the wrist band reduces risk of administering medications to the wrong patient. Having MARs at the bedside provides a quick reference to assist with informing the patient. It gives the nurse time to think about the rights of safe medications within each patient context and allows the patient an opportunity to ask questions.
Use a system to help you keep track of which meds you've prepared. Some nurses use a "dot" on the MAR; others circle the medication on the MAR.	Having a method to organize and keep track of medication preparation reduces risk of omission errors.
Follow the SEVEN rights of medication preparation (right patient, medication, dose, route, time, reason, documentation).	Fundamental principles of safe medication administration intended to reduce risk of error.
Complete three checks before administration of medications. Labels on the medication must be checked for name, dose, and route, and compared with the MAR at three different times:	
1. when the medication is taken out of the drawer / dispensing system;	Fundamental principles of safe medication administration intended to reduce risk of error.
2. when the medication is being poured;	
3. after the medication is poured and PRIOR to the medication being administered.	
If a patient questions or expresses concern regarding a medication, stop and do not administer it.	If a patient questions a medication, stop and explore the patient's concerns, review the physician's order, and, if necessary, notify the prescriber.

Provide patient education.	Provide information to patient about the medication before administering it. Patients should known what medications they are receiving and what the intended purpose is, any significant side effects, and special considerations. Give the patient the opportunity to ask questions. Include family members if appropriate.
Strive to give medications on time.	Consult agency guidelines for medication administration "windows". The historic 30 minute window on either side of the medication administration time is debatable for some medications. See Table 6.2.
Sign the MAR AFTER the medication has been administered.	Ensures right documentation.
Check MAR to guide you to which medications you are preparing. Follow agency policy to ensure MARs are accurate and verified appropriately.	An MAR that is checked by more than one healthcare professional provides a very reliable record for administering medications. Agencies may vary in relation to MAR verification processes.

Data sources: Agency for Healthcare Research and Quality, 2014; Canadian Patient Safety Institute, 2012; Debono et al., 2013; Institute for Healthcare Improvement, 2015; Institute for Safe Medication Practices, 2018; Lilley et al., 2016; Lynn, 2011; National Patient Safety Agency, 2009; National Priority Partnership, 2010; Perry et al., 2018; Prakash et al., 2014.

Administering medications in a timely fashion and according to the prescribed frequency is considered an important part of safe medication administration in terms of maintaining therapeutic drug levels and, therefore, therapeutic drug effectiveness. Traditionally, a 30 minute window on either side of a medication administration time was considered responsible practice. In a study involving acute care nurses, ISMP (2011) found that increasing patient acuity, polypharmacy, and increasing nursing workloads made it difficult for nurses to administer medications within this time frame. The resulting work-arounds done by nurses to try and avoid medication errors due to being "late" led to other, sometimes serious, errors. In response, the ISMP has challenged this 30 minute tradition and has developed guidelines for timely medication administration. The ISMP does not dictate to institutions what they must do, rather they encourage all institutions to create their own list of time critical medications.

Table 6.2 reflects these new recommendations.

Table 6.2 Acute Care Guidelines for Timely Administration of Schedule Medications (ISMP)

Disclaimer: Always check your agency's policy and guidelines.

Time-Critical Scheduled Medications

Type of Scheduled Med	Goals of Timely Administration
Hospital defined time critical medications: Delayed or early administration (more than 30 minutes) can cause harm or sub-therapeutic effect. Example: • Aspart insulin q4h • Vancomycin q12h Medications with a dosing schedule more frequent than every 4 hours. Example: • Antibiotic eye drops every hour for 6 hours	Administer at the exact time indicated as necessary, or within the 30 minutes before and after the window of the scheduled time.

Non-Time-Critical Scheduled Medications

Type of Scheduled Med	Goals of Timely Administration
Daily, weekly, monthly. Examples: • ASA daily • B12 injection monthly	Within 2 hours before or after the scheduled time
Medications prescribed more frequently than daily but no more frequently than every 4 hours. Examples: • Metoprolol BID • Heparin q12h	Within 1 hour before or after the scheduled time

Data source: ISMP, 2011

Technological Advances that Help Mitigate Medication Errors

Computerized physician order entry (CPOE) is a system that allows prescribers to electronically enter orders for medications, thus eliminating the need for written orders. CPOE increases the accuracy and legibility of medication orders; the potential for the integration of clinical decision support; and the optimization of prescriber, nurse, and pharmacist time (Agrawal, 2009). Decision support software integrated into a CPOE system can allow for the automatic checking of drug allergies, dosage indications, baseline laboratory results, and potential drug interactions. When a prescriber enters an order through CPOE, the information about the order will then transmit to the pharmacy and ultimately to the MAR.

The use of electronic bar codes on medication labels and packaging has the potential to improve patient safety in a number of ways. A patient's MAR is entered into the hospital's information system and encoded into the patient's wristband, which is accessible to the nurse through a handheld device. When administering a medication, the nurse scans the patient's medical record number on the wristband, and the bar code on the drug. The computer processes the scanned information, charts it, and updates the patient's MAR record appropriately (Poon et al., 2010).

Automated medication dispensing systems provide electronic automated control of all medications, including narcotics. Each nurse accessing the system has a unique access code. The nurse will enter the patient's name, the medication, the dosage, and the route of administration. The system will then open either the patient's individual drawer or the narcotic drawer to dispense the specific medication. If the patient's electronic health record is linked to the automated medication dispensing system, the medication and the nurse who accessed the system will be linked to the patient's electronic record.

Read ISMP's *Top 10 Practical Tips* about how to obtain a best possible medication history.

Medication Reconciliation

Medication safety is an important component of healthcare delivery. Evidence to support this is provided by the Canadian Patient Safety Institute and the Institute for Safe Medication Practices (ISMP) Canada. The later is an independent, national, not-for-profit agency committed to the advancement of medication safety in all healthcare settings. *Safer Healthcare Now!* is an initiative to improve patient safety and prevent medication errors in the Medication Reconciliation process.

Critical Thinking Exercises

1. What does the Canadian Patient Safety Institute mean by medication reconciliation?
2. Name four things within the medication reconciliation process that a nurse can do to reduce the risk of an adverse drug event (ADE).
3. View the Canadian Patient Safety Institute's (2017) List of Error-Prone Abbreviations to see what abbreviations have the potential to compromise medication safety.
4. As a nurse you must be aware that some medications have the potential to cause great harm to patients. Lists of high-alert medications are meant to draw the nurse's attention and result in heightened awareness. Depending on your interest view one or both of the following sites:

- ISMP (2018) High-Alert Medications in Acute Care Settings
- ISMP (2017) High-Alert Medications in Long-Term Care (LTC) Settings
    - Have you seen any of these in practice yet?

Attribution

6.3 Administering Medications by Mouth and Gastric Tube

Administering Medication by Mouth

Figure 6.2 Various oral medications

Medication is usually given orally, which is generally the most comfortable and convenient route for the patient. Medication given orally has a slower onset and a more prolonged, but less potent, effect than medication administered by other routes (Lynn, 2011). Prior to oral administration of medications, ensure that the patient has no contraindications to receiving oral medication, is able to swallow, and is not on gastric suction. If the patient is having difficulty swallowing (dysphagia), some tablets may be crushed using a clean mortar and pestle or pill crusher. Verify that a tablet may be crushed by consulting a drug reference or a pharmacist.

Medications such as enteric-coated (EC) tablets, capsules, and sustained-release (SR) or long-acting (LA) drugs should never be crushed because doing so will affect the intended action of the medication (Lilley et al., 2016). EC medications are designed to be absorbed in the small bowel. Crushing it would cause absorption in the stomach, potentially causing adverse events. SR and LA medications if crushed would result in high doses being absorbed quickly potentially causing adverse events—some of which could be fatal. If medications are able to be crushed and must be in order to allow the patient to swallow them, they should be crushed one at a time and not mixed. This will allow the administrator to tell drugs apart if there is a spill or if the patient refuses some of them. Mixing crushed medications in a small amount of soft food, such as applesauce or pudding may facilitate easier swallowing.

Position the patient in a side-lying or upright position to decrease the risk of aspiration. Offer a glass of water or other oral fluid (that is not contraindicated with the medication) to ease swallowing and improve absorption and dissolution of the medication, taking any fluid restrictions into account. Remain with the patient until all medication has been swallowed. Sign for the medication AFTER the medication has been swallowed / administered.

Checklist 45 outlines the steps for administering medication by mouth.

Checklist 45: Administering Medication by Mouth

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Review everything in Table 6.1 Principles for Safer Medication Administration
- Ensure the patient can swallow and that there are no contraindications to receiving oral medications.
- Consider timing—some medications are to be given on an empty stomach.
- Scored tablets can be safely cut.
- EC, LA, SR medications cannot be crushed or chewed.
- Remain with the patient until all medications have been swallowed.
- Be knowledgeable about pharmacokinetics and pharmacodynamics of the medications being administered.

Steps	*Additional Information*

1. Perform hand hygiene before medication preparation. Check MAR to guide you to which medications you are preparing. Follow agency policy to ensure MARs are accurate and verified appropriately.	 *Comparing physician orders and MAR* An MAR that is checked by more than one healthcare professional provides a very reliable record for administering medications. Agencies may vary in relation to MAR verification processes.

2 a. As you are removing medications from the dispensing system, perform the SEVEN rights three times with each individual medication: (single dose packaging is not opened at this time)

- The right patient
- The right medication (drug)
- The right dose
- The right route
- The right time
- The right reason
- The right documentation

Perform any necessary medication calculations.

Medication calculation: **D/H × S = A**

D (desired dosage) / **H** (have available) × **S** (stock) = **A** (amount prepared)

Example order: Liquid sunshine 5 mg PO now.

Desired 5 mg/**H**ave 1 mg × **S**tock 4 ml = **A** 20 ml

Figure 6.3 Liquid sunshine 1mg/ 4 ml

The right patient: Check that you have the correct patient using two patient identifiers (e.g., name and date of birth).

The right medication (drug): Check that you have the correct medication and that it is appropriate for the patient in the current context.

The right dose: Check that the dose makes sense for the age, size, and condition of the patient. Different dosages may be indicated for different conditions.

The right route: Check that the route is appropriate for the patient's current condition.

The right time: Adhere to the prescribed dose and schedule. Determine if oral meds should be taken on an empty stomach.

The right reason: Check that the patient is receiving the medication for the appropriate reason.

The right documentation: Always verify any unclear or inaccurate documentation prior to administering medications.

2 b. The label on the medication must be checked for name, dose, and route, and compared with the MAR at **three** different times:

1. When the medication is taken out of the dispensing system / drawer
2. Prior to the package being opened
3. After the package is opened and medication put into a medication cup but PRIOR to the patient receiving the medication.

Perform seven checks three times BEFORE administering medication

Whenever possible, take the MARs to the bedside and open medication packages at the bedside.

Some liquid medications require shaking prior to dispensing.

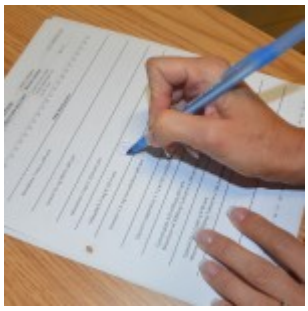
If using an oral syringe, ISMP recommends the use of a special oral medication syringe. These are different than the Luer lock syringes used for parenteral medication administration.

2 c. As medications are taken from the drawer / dispensing system, identify on the MAR when a medication is obtained.

Single dose packages are not opened at this time.

Liquids or meds from bulk containers can be poured into med cups and labeled.

Figure 6.4 Liquids prepared away from the bedside are labeled



Circle or put a dot on the MAR to show that medication has been obtained.

Helps you to keep track of what you've obtained and what you haven't.

Meds that are prepared away from the bedside (i.e., liquids, injectables) are labeled before being brought to the bedside.

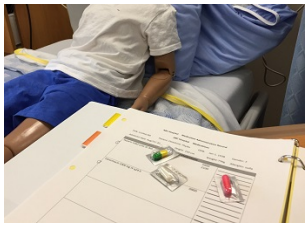
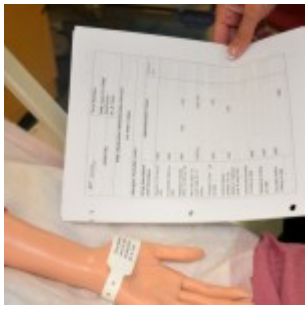
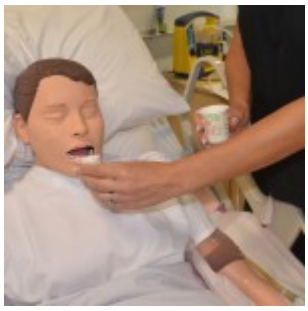


Figure 6.5 Meds & MARs are taken to the bedside whenever possible

3. Take medications and MARs to the bedside: • Packages are taken to the bedside unopened. • Identify the patient using two identifiers. • Confirm allergies. • Inform the patient of the medication and its intended action. • Complete any necessary assessment.	MARs cannot be taken into rooms where additional precautions are required.  *Use two patient identifiers, compare the MAR with the patient's wrist band.* The patient has the right to be informed, and providing reasons for medication, actions, and potential adverse effects may improve adherence to medication therapy and patient reporting of adverse effects.
4. Open packages, putting them into an appropriate medication cup. Complete three checks.	Do not touch any medication with ungloved hands. Use clean gloved hands if it is necessary to touch the medication. Scored tablets can be cut and reliably provide accurate dosing because of evenly dispersed medication in each half of the medication. Chemotherapy drugs are toxic to the administrator. Use gloves when preparing these kinds of medications. If a patient expresses concerns over medications, STOP. Do not give medication. Verify prescriber's order and explore patient concerns. Notify prescriber if necessary.

5. Positioning • Help patient to sitting position. If patient is unable to sit, use the side-lying position. • Have patient stay in this position for 30 minutes after administering medication. • Offer patient water or desired oral fluid. • Ensure proper body mechanics for health care provider.	 *Position patient appropriately for medication administration* Correct positioning reduces risk of aspiration during swallowing. Water or other oral fluids will help with swallowing of medication. Proper body mechanics reduces risk of injury to health care provider.
6. Administer medication orally as prescribed. • **Tablets**: Place in mouth and swallow using water or other fluids. • **Orally disintegrating medications**: Remove carefully from packaging. Place medication on top of patient's tongue, and have patient avoid chewing the medication. Water is not needed. • **Sublingually**: Place medication under patient's tongue and allow to dissolve completely. Ensure patient avoids swallowing the medication. • **Buccal**: Place medication in mouth and against inner cheek and gums and allow to dissolve completely. • **Powdered medication**: Mix at bedside with water to avoid thickening of medication that may occur with time.	Follow any specific descriptions for administration of the medication. Wear gloves if placing the medication inside the patient's mouth to protect the healthcare worker from BBF exposure and to reduce risk of absorbing the medication through the skin.

7. Post-medication safety check: • Stay with patient until all medications are swallowed or dissolved. • Perform post assessments and/or vital signs if applicable. • Sign MAR. • Perform hand hygiene.	Right documentation includes signing for medications after administration. Document any additional information, such as patient education, reasons why medication not administered, and adverse effects, as per agency policy. Post assessments determine effectiveness and potential adverse effects of medications.
8. Return within appropriate time to evaluate patient's response to the medications and to check for possible adverse effects. If patient presents with any adverse effects: • Withhold further doses. • Assess vital signs. • Notify prescriber. • Notify pharmacy. • Document as per agency policy.	Most sublingual medications act in 15 minutes, and most oral medications act in 30 to 40 minutes.
Data sources: BCIT, 2015; ISMP, 2011; Lilley et al., 2016; Perry et al., 2018	

Administering Medication via a Gastric Tube

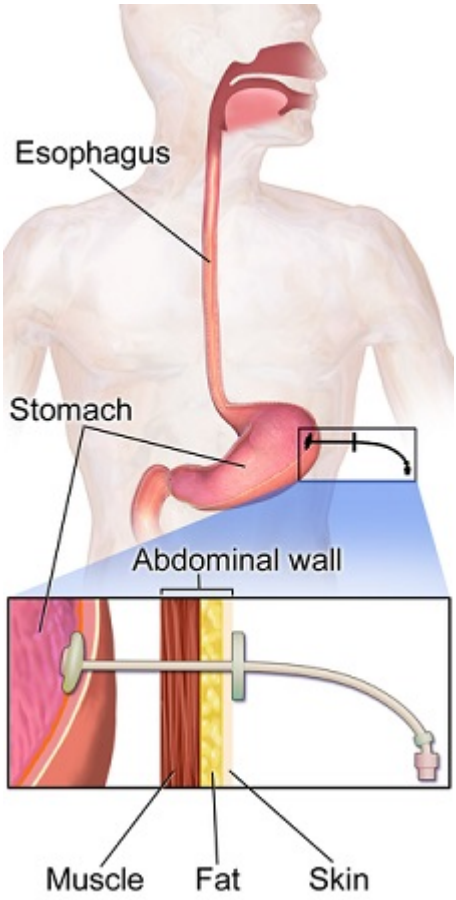


Figure 6.6 Gastric tube placement

Patients with a gastric tube (nasogastric, nasointestinal, percutaneous endoscopic gastrostomy [PEG], or jejenostomy [J] tube) will often receive medication through this tube (Lynn, 2011). Liquid medications should be used when possible because absorption is better and less likely to cause blockage of the tube. Liquid forms of medication should be used when possible. However, some solid forms of medication can be crushed and mixed with water for administration. Important safety considerations for administering medications via this route include knowing which medications can be crushed and which can't; verify tube placement; elevate the head of bed to at least 30 degrees to decrease risk of aspiration; flush with water before and after each medication to reduce risk of blockage; dilute medications with water and administer one medication at a time to prevent tube blockage.

If a tube feed is infusing, temporarily stop it for medication administration. If medications need to be given on an empty stomach, stop the tube feed for approximately 30 minutes prior and resume the feed 30 to 40 minutes after. If the patient has one of these tubes for gastric decompression, you will need an order to administer medications via this route. It is also important to keep the tube clamped for 30 to 40 minutes afterward to allow for medication absorption.

Checklist 46 outlines the steps for administering medication via a gastric tube.

Checklist 46: Administering Medication via a Gastric Tube

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Review everything in Table 6.1 Guidelines for Safer Medication Administration
- Whenever possible use liquid forms of medications.
- Know which medications can be crushed and which can't. Prepare them to a liquid form using warm water. Some agencies require sterile water for mixing and flushing.
- The head of bed must be elevated at least 30 degrees.
- Verify tube placement before administration of medications.
- Flush the tube before, between, and after each medication with warm water.
- Know if the medication must be given on an empty stomach. If so, stop the tube feed for approx 30 minutes prior, and leave plugged for 30 to 40 minutes after. Then resume the feed.

Steps	*Additional Information*

1. Perform hand hygiene before medication preparation. Check MAR to guide you to which medications you are preparing. Follow agency policy to ensure MARs are accurate and verified. If a tube feed is infusing, temporarily stop it for medication administration.	 *Comparing physician orders and* MAR An MAR that is checked by more than one healthcare professional provides a very reliable record for administering medications. Agencies may vary in relation to MAR verification processes.

2 a. As you are removing medications from the dispensing system, perform the SEVEN rights three times with each individual medication: (single dose packaging is not opened at this time)

- The right patient
- The right medication (drug)
- The right dose
- The right route
- The right time
- The right reason
- The right documentation

Perform any necessary medication calculations. Medication calculation formula:

Want / **H**ave × **D**rug form = **A**mount prepared

Order: Liquid sunshine 5 mg PO now.

Want 5 mg / **H**ave 1 mg × **D** 4 ml = 20ml

Figure 6.3

The right patient: Check that you have the correct patient using two patient identifiers (e.g., name and date of birth).

The right medication (drug): Check that you have the correct medication and that it is appropriate for the patient in the current context.

The right dose: Check that the dose makes sense for the age, size, and condition of the patient. Different dosages may be indicated for different conditions.

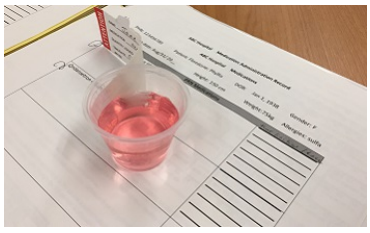
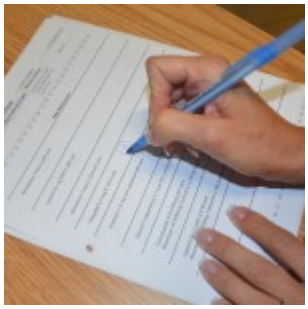
The right route: Check that the route is appropriate for the patient's current condition.

The right time: Adhere to the prescribed dose and schedule. Determine if oral meds should be taken on an empty stomach.

The right reason: Check that the patient is receiving the medication for the appropriate reason.

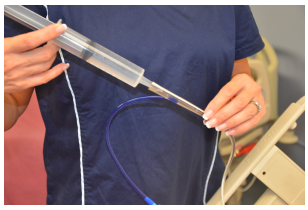
The right documentation: Always verify any unclear or inaccurate documentation prior to administering medications.

Check the right patient, medication, dose, route, time, reason, documentation

2 b. The label on the medication must be checked for name, dose, and route, and compared with the MAR at **three** different times: 1. When the medication is taken out of the dispensing system / drawer. 2. Prior to the package being opened. If this is a liquid, prior to pouring the liquid. 3. After the package is opened and medication put into a medication cup. If this is a liquid confirm after the liquid is poured and prior to putting the bulk container away. The third check must be done PRIOR to the patient receiving the medication.	 *Perform seven checks three times BEFORE administering medication* Whenever possible, take the MARs to the bedside and open medication packages at the bedside.
2 c. As medications are taken from the drawer / dispensing system, identify on the MAR when a medication is obtained. Single dose packages are not opened at this time.  *Figure 6.7 liquid meds prepared away from the bedside are labelled* Liquids or meds from bulk containers can be poured into med cups and labeled.	 *Circle or put a dot on the MAR to show that medication has been obtained.* Helps you to keep track of what you've obtained and what you haven't. Meds that are prepared away from the bedside (i.e., liquids, injectables) are labeled before being brought to the bedside to help ensure right drug.
3. If necessary, crush any tablets.	EC (enteric coated), LA (long acting), SR (sustained release) medications cannot be crushed. Some capsules cannot be opened. Consult the pharmacy and agency guidelines for clarification.

4. Take medications and MARs to the bedside. • Packages are taken to the bedside unopened. • Identify the patient using two identifiers. • Confirm allergies. • Inform the patient of the medication and its intended action. • Complete any necessary assessment.	MARs cannot be taken into rooms where additional precautions are necessary.  *Compare MAR with patient name band* The patient has the right to be informed. Providing reasons for medication, actions, and potential adverse effects may improve adherence to medication therapy and patient reporting of adverse effects. Determine if medication should be given with or without food. If the medication is to be given on an empty stomach, the enteral feeding may need to be stopped from 30 minutes before and until approximately 60 minutes after the medication is given.
5. Open medications each into its own medication cup. Complete three checks. Dilute each medication with approximately 20 ml warm water to each medication cup.	Warm water helps to dissolve the medication allowing it to be administered. Dilution reduces risk of tube blockage.  *Figure 6.4 Meds are crushed, diluted and administered individually*

6. Anyone with an NG should be positioned with the head of bed at 30-45 degrees.	This position reduces risk of aspiration.
7. Apply clean non-sterile gloves.	Using gloves protects the healthcare worker from BBF exposure.
8. Check gastric tube for correct placement as described in Chapter 10.	Always trace tubes back to their point of origin and confirm the kind of tube. • X-ray is the gold standard for NG tube placement verification. • Gentle aspiration with a syringe to observe gastric contents for colour and quality. Gastric contents can be green, off-white, tan, bloody, brown, or yellow. • Use pH paper to measure pH of aspirate. Keep in mind that certain medications can alter gastric pH making this part of the assessment unreliable for some patients. pH cannot accurately distinguish between gastric and respiratory placement. Radiographic confirmation may still be necessary. • External length when recorded, assessed frequently, and compared with current readings helps to determine tube migration.

9. Remove plunger from a 60 ml catheter tip syringe, and attach syringe to the end of the gastric tube while pinching the gastric tube.	Make sure the tip of the syringe fits the end of the gastric tube. Pinching the tube prevents reflux of tube feed / gastric secretions onto the patient and bedding.
10. Flush with 30 ml of warm water before medication. Pour prepared medication into the 60 ml syringe, release pinch, and allow fluid to drain slowly by gravity into the gastric tube Flush tube with 15 ml of water between each medication. Flush with 30 ml warm water after medication.	Flush using a 60 ml syringe with appropriate tip to access the G tube. Use a push / pause technique to clean the lumen of the tube. Administering one medication at a time reduces risk of medication interactions and blockage of the tube. Water flushes before, between, and after medications cleanses the tube's lumen and reduces risk of medication interaction and risk of tube blockage. If fluid does not drain by gravity, gentle pressure may be applied using the plunger of the syringe, but do not force the medication through the tube.  *Flushing with warm water before, between, and after administering medication via gastric tube.*

11. Post-medication safety check: • Stay with patient until all medications are instilled. • Perform post assessments and/or vital signs if applicable. • Sign MAR and place in appropriate chart. • Perform hand hygiene. • Document any additional information, such as patient education, reasons why medication not administered, adverse effects, as per agency policy.	If this is a tube intended for gastric decompression, clamp for 30 to 60 minutes then resume gastric suction. If this tube is used for enteral feeds, resume feed.
12. Return within appropriate time frame to evaluate patient's response to the medications and to check for possible adverse effects. If patient presents with any adverse effects: • Withhold further doses. • Assess vital signs. • Notify prescriber. • Notify pharmacy. • Document as per agency policy.	Evaluate patient for intended and adverse effects.
Data sources: BCIT, 2015; Boulatta, 2009; Lilley et al., 2016; Perry et al., 2018; RCH, 2017; Saskatoon Health Region, 2017	

Critical Thinking Exercises

1. Your patient is dysphagic. Discuss the steps you should take and the considerations you should be cognizant of to administer oral medication safely.
2. Your patient is unable to swallow and is receiving medication and nutritional sustenance via an enteral jujenostomy tube. The drug reference guide recommends that medication should be given on an empty stomach. Discuss how you would approach this situation.

Attributions

Figure 6.2. Bunch of pills by E-magine Art is used under a CC BY 2.0 license.

Figure 6.3. Liquid sunshine by author is licensed under a Creative Commons Attribution 4.0 International License.

Figure 6.4. Three liquid meds with labels by author is licensed under a Creative Commons Attribution 4.0 International License.

Figure 6.5 Meds and MARs at bedside by author is licensed under a Creative Commons Attribution 4.0 International License.

Figure 6.6. Illustration depicting a gastric feeding tube for an adult by BruceBlaus is used under a CC BY-SA 4.0 International license.

Figure 6.7. Liquid med with label by author is licensed under a Creative Commons Attribution 4.0 International License.

6.4 Administering Medications Rectally and Vaginally

Medication Administered Rectally

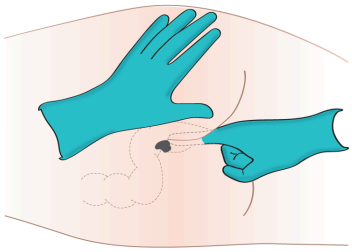


Figure 6.8 Administering medication rectally

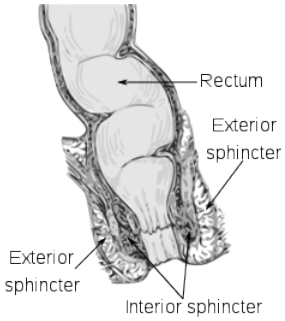


Figure 6.9 Anatomy of the anus

The rectal route (see Figure 6.8) is not as reliable in terms of absorption and distribution as oral and parenteral routes. The rectal route is, however, relatively safe because there is less potential for adverse effects (Perry et al., 2018). Rectal medications are given for their local effects in the gastrointestinal system (e.g., laxatives) or their systemic effects (e.g., analgesics when oral route is contraindicated). Rectal medications are contraindicated in persons with active rectal bleeding, diarrhea, recent rectal or prostate surgery, local trauma and those with undiagnosed GI disturbances (Martindale Pharma, n.d.). They are contraindicated in persons with cardiac arrhythmias because they can stimulate the vagus nerve causing cardiac arrhythmias (Perry et al., 2018). Suppositories cannot be cut to divide a dose because the drug is not distributed evenly throughout the suppository (Burcham & Rosenthal, as cited in Perry et al., 2018). Water-soluble lubricants or water can be used for lubrication to ease insertion into the rectum. Petroleum products can interfere with medication absorption (Munden, 2007) and as such should not be used.

Checklist 47 outlines the procedure for administering rectal suppositories or enemas.

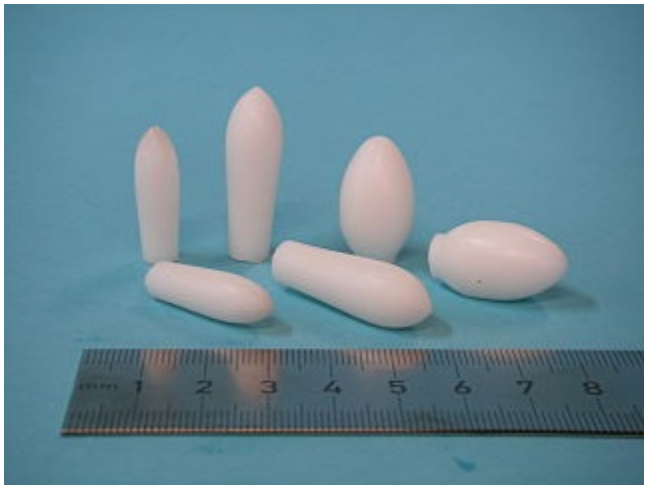


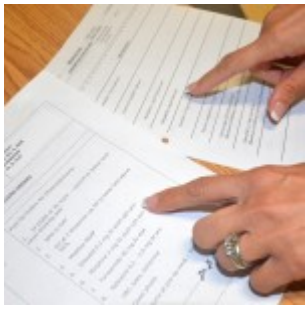
Figure 6.10 Suppositories

Checklist 47: Medication Administered Rectally

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Review everything in Table 6.1 Guidelines for Safer Medication Administration
- Rectal route medications are contraindicated in persons with rectal bleeding, diarrhea, recent prostate or rectal surgery, local trauma, undiagnosed GI disturbances, cardiac arrhythmias.
- Use water soluble lubricant or water to ease insertion into rectum.

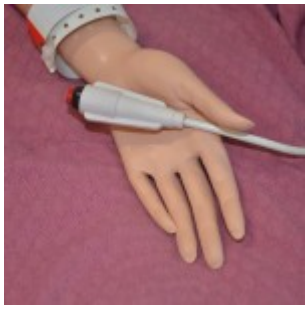
Steps	*Additional Information*
1. Perform hand hygiene before medication preparation. Check MAR to guide you to which medications you are preparing. Follow agency policy to ensure MARs are accurate and verified appropriately.	 *Compare physician orders and MAR* An MAR that is checked by more than one healthcare professional provides a very reliable record for administering medications. Agencies may vary in relation to MAR verification processes.

2. a. As you are removing medications from the dispensing system, perform the SEVEN rights three times with each individual medication (single dose packaging is not opened at this time): • The right patient • The right medication (drug) • The right dose • The right route • The right time • The right reason • The right documentation	**The right patient**: Check that you have the correct patient using two patient identifiers (e.g., name and date of birth). **The right medication (drug)**: Check that you have the correct medication and that it is appropriate for the patient in the current context. **The right dose**: Check that the dose makes sense for the age, size, and condition of the patient. Different dosages may be indicated for different conditions. **The right route**: Check that the route is appropriate for the patient's current condition. **The right time**: Adhere to the prescribed dose and schedule. **The right reason**: Check that the patient is receiving the medication for the appropriate reason. **The right documentation**: Always verify any unclear or inaccurate documentation prior to administering medications.  *Check the right patient, medication, dose, route, time, reason, documentation*

2 b. The label on the medication must be checked for name, dose, and route, and compared with the MAR at three different times: 1. When the medication is taken out of the drawer or dispensing system; 2. When the medication is being poured; 3. After the medication is poured and just prior to setting down the medication package or container.	 *Perform SEVEN checks three times before administering medication* These checks are done before administering the medication to your patient.
3. If possible, have patient defecate prior to rectal medication administration.	Medication should not be inserted into feces.
4. Ensure that you have water-soluble lubricant available for medication administration.	Lubricant reduces friction as suppository enters rectal canal. Petroleum based lubricants can interfere with medication absorption.
5. Explain the procedure to the patient. If patient prefers to self-administer the suppository/enema, give specific instructions to patient on correct procedure.	Patient may feel more comfortable self-administering suppository. If so provide glove, lubricant, and instructions.
6. Raise bed to working height. • Position patient on left side with upper leg flexed over lower leg toward the waist (Sims' position). • Provide privacy and drape the patient with only the buttocks and anal area exposed. • Place a drape underneath the patient's buttocks.	Positioning helps prevent injury to nurse administering medication. This protects patient's privacy and facilitates relaxation. Some literature suggests that left side-lying Sims' position lessens the likelihood of the suppository being expelled. Drape protects linens from potential fecal drainage.

7. Apply clean, non-sterile gloves.	Gloves protect the nurse from contact with mucous membranes and body fluids.  *Apply non-sterile gloves*
8. Examine the anal area for signs of hemorrhoids, rectal bleeding.	If hemorrhoids are present, use extra lubricant to minimize trauma. Suppositories are contraindicated in persons with rectal bleeding. If necessary, remove and reapply clean gloves.
9. Remove wrapper from suppository/tip of enema and lubricate rounded tip of suppository and index finger of dominant hand with lubricant. If enema, lubricate only tip of enema.	 *Lubricate rounded tip of suppository* Lubricant reduces friction as suppository/enema enters rectal canal. Inserting the rounded top promotes patient comfort.
10. Separate buttocks with non-dominant hand and, using gloved index finger of dominant hand, insert suppository (rounded tip toward patient) into rectum toward umbilicus while having patient take a deep breath, exhale through the mouth, and relax anal sphincter. If enema: Expel air from enema and then insert tip of enema into rectum toward umbilicus while having patient take a deep breath, exhale through the mouth, and relax anal sphincter.	Ensure the suppository is removed from the package. Upon insertion, you should feel the anal sphincter close around your finger. Forcing the suppository/enema through a clenched sphincter will cause pain.

11. With your gloved finger, insert suppository along wall of rectum about 5 cm beyond anal sphincter. Do not insert the suppository into feces. If enema: Roll plastic bottle from bottom to tip until all solution has entered rectum and colon.	Suppository should be against rectal mucosa for absorption and therapeutic action. Inserting suppository into feces will decrease its effectiveness. If the patient experiences cramping during enema administration, stop. Ask the patient to take a deep breath. Resume administration when cramps subside. Hold buttock cheeks together if patient feels immediate need for BM.
12. Option: A suppository may be given through a colostomy (not ileostomy) if prescribed.	The patient should lie supine and a small amount of lubricant should be used.
13. Remove finger and wipe patient's anal area.	Wiping removes excess lubricant and provides comfort to the patient.
14. Ask patient to remain on side for 5 to 10 minutes.	This position helps prevent the expulsion of suppository.
15. Discard gloves by turning them inside out and disposing of them and any used supplies as per agency policy. Perform hand hygiene.	Using gloves reduces transfer of microorganisms.  *Dispose of gloves*  *Hand hygiene with* ABHR

16. Ensure call bell is nearby and bedpan or commode is available and close by.	If suppository is a laxative or stool softener, patient will require a bedpan/commode or close proximity to toilet.  *Ensure call bell is available to patient*
17. Document procedure as per agency policy and include patient's tolerance of administration.	Timely and accurate documentation promotes patient safety.
Data sources: BCIT, 2015; Lilley et al., 2016; Perry et al., 2018	

Medication Administered Vaginally

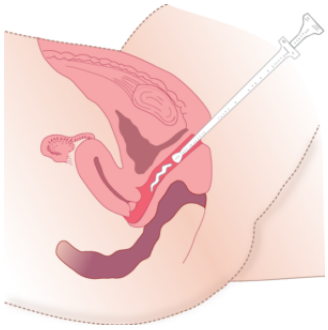


Figure 6.11 Administering medication vaginally using an applicator

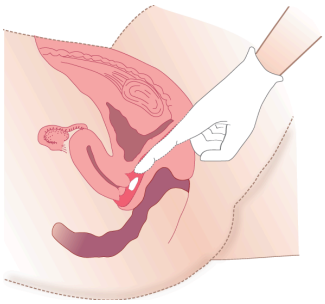


Figure 6.12 Administering medication vaginally without an applicator

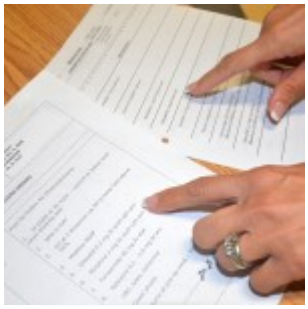
Female patients may require medications vaginally to treat vaginal infections. This may include suppositories, foams, and or creams. Vaginal suppositories are larger and more oval than rectal suppositories, and are inserted with an applicator (see Figure 6.11) or by hand (see Figure 6.12). Checklist 48 outlines the procedure for administering vaginal suppositories or medications.

Checklist 48: Medication Administered Vaginally

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Review everything in Table 6.1 Guidelines for Safer Medication Administration
- Use water-soluble lubricant for suppositories.
- Consider the nature of the medication and the most appropriate timing. For example, foams might be best inserted at night when a recumbent position will allow the mediation to remain in place longer than if the patient were to be upright after administration.

Steps	*Additional Information*
1. Perform hand hygiene before medication preparation. Check MAR to guide you to which medications you are preparing. Follow agency policy to ensure MARs are accurate and verified appropriately.	 *Compare physician orders and MAR* A MAR that is checked by more than one healthcare professional provides a very reliable record for administering medications. Agencies may vary in relation to MAR verification processes.

2 a. As you are removing medications from the dispensing system, perform the SEVEN rights three times with each individual medication (single dose packaging is not opened at this time): • The right patient • The right medication (drug) • The right dose • The right route • The right time • The right reason • The right documentation	**The right patient**: Check that you have the correct patient using two patient identifiers (e.g., name and date of birth). **The right medication (drug)**: Check that you have the correct medication and that it is appropriate for the patient in the current context. **The right dose**: Check that the dose makes sense for the age, size, and condition of the patient. Different dosages may be indicated for different conditions. **The right route**: Check that the route is appropriate for the patient's current condition. **The right time**: Adhere to the prescribed dose and schedule. **The right reason**: Check that the patient is receiving the medication for the appropriate reason. **The right documentation**: Always verify any unclear or inaccurate documentation prior to administering medications.  *Check the right patient, medication, dose, route, time, reason, and documentation*

2 b. The label on the medication must be checked for name, dose, and route, and compared with the MAR at three different times: 1. When the medication is taken out of the dispensing system or drawer; 2. Prior to the package being opened; 3. After the package is opened and medication put into a medication cup but PRIOR to the patient receiving the medication.	 *Perform SEVEN checks three times BEFORE administering medication*
4. Have patient void prior to procedure.	Voiding empties the bladder and promotes patient comfort.
5. Before inserting the medication vaginally, explain the procedure to the patient. If patient prefers to self-administer the vaginal medication, give specific instructions to patient on correct procedure.	Patient may feel more comfortable self-administering vaginal medication.
6. Raise bed to working height. • Position patient on back with legs slightly bent and feet flat on the bed. • Provide privacy, and drape patient so that vaginal area is exposed.	Position helps prevent injury to nurse administering medication. Draping protects patient's privacy and facilitates relaxation.
7. Apply clean, non-sterile gloves. Assess the vaginal area for discharge, ask about pruritis or burning discomfort.	Gloves protect the nurse from contact with mucous membranes and body fluids.  *Apply non-sterile gloves*

8. Remove suppository from wrapper and apply a liberal amount of water-soluble lubricant to suppository and index finger of dominant hand. Suppository should be at room temperature.	Lubricant reduces friction against vaginal mucosa as medication is inserted.  *Lubricate suppository*
10. With non-dominant hand, gently separate labial folds. With gloved index finger of dominant hand, insert lubricated suppository about 8 to 10 cm along posterior vagina wall.	Exposes vaginal orifice and helps to ensure equal distribution of medication.
11. Withdraw finger and wipe away excess lubricant.	Wiping maintains patient comfort.
Note: An applicator may be used to insert vaginal medication. Follow the procedure above and specific manufacturer directions.	
12. Discard gloves by turning them inside out and disposing of them and any used supplies as per agency policy. Perform hand hygiene.	 *Dispose of gloves*  *Hand hygiene with* ABHR

13. Document procedure as per agency policy, and include patient's tolerance of administration.	Timely and accurate documentation promotes patient safety.
Data sources: Lilley et al., 2016; Perry et al., 2018	

Critical Thinking Exercises

1. Discuss the procedure for administering a suppository for someone with a colostomy.
2. Your patient prefers to self-administer her vaginal suppository. Outline the steps you would explain for safe and appropriate administration of a vaginal medication.

Attributions

Figure 6.9. Diagram of the rectum and anus by Waterced is used under a CC BY-SA 4.0 International license.

Figure 6.10. Suppositories in three different sizes by Alcibiades is in the public domain.

Figure 6.11. Administering medication vaginally using an applicator by Mikael Haggstron is used under a Creative Commons Attribution-ShareAlike License

Figure 6.12. Administering medication vaginally without an applicator by Mikael Haggstron is used under a Creative Commons Attribution-ShareAlike License

6.5 Instilling Eye, Ear, and Nose Medications

Instilling Eye Medications

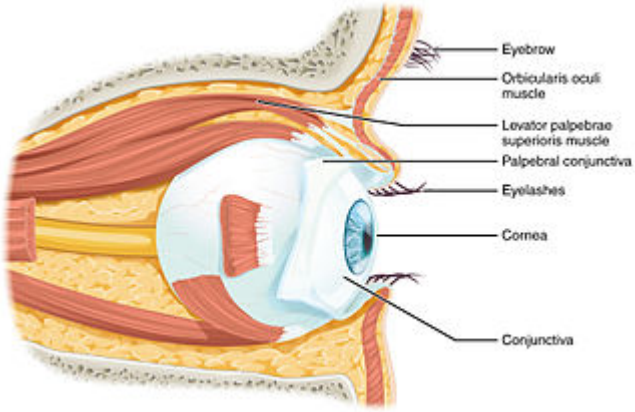


Figure 6.13 Eye anatomy

The eye is the most sensitive organ to which medication may be applied (Perry et al., 2018). The cornea is especially sensitive, making the conjunctival sac the appropriate site for instilling eye (ophthalmic) medications. Eye medications might be necessary for conditions such as glaucoma, infection, and following eye surgery. Of note is that eye medication are for the most part administered into the conjunctival sac, which is much less sensitive than the cornea.

Checklist 49 outlines the steps for instilling eye medications.

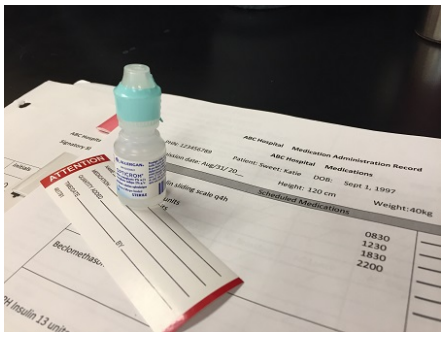
Checklist 49: Instilling Eye (Ophthalmic) Medications

Disclaimer: Always review and follow your agency policy regarding this specific skill.

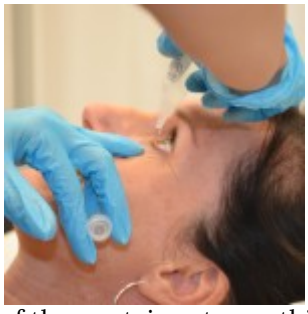
Safety considerations:

- Review everything in Table 6.1 Guidelines for Safer Medication Administration
- Some eye drops require shaking prior to administration
- Some eye medications distort vision requiring safety considerations to prevent patient injury

Steps	*Additional Information*
1. Perform hand hygiene prior to medication preparation. Check MAR to guide you to which medications you are preparing. Follow agency policy to ensure MARs are accurate and verified appropriately.	 *Comparing physician orders and MAR* A MAR that is checked by more than one healthcare professional provides a very reliable record for administering medications. Agencies may vary in relation to MAR verification processes.

2 a. As you are removing medication from the dispensing system, perform the SEVEN right three times with each individual medication: • The right patient • The right medication (drug) • The right dose • The right route • The right time • The right reason • The right documentation	**The right patient**: Check that you have the correct patient using two patient identifiers (e.g., name and date of birth). **The right medication (drug)**: Check that you have the correct medication and that it is appropriate for the patient in the current context. **The right dose**: Check that the dose makes sense for the age, size, and condition of the patient. Different dosages may be indicated for different conditions. **The right route**: Check that the route is appropriate for the patient's current condition. **The right time**: Adhere to the prescribed dose and schedule. **The right reason**: Check that the patient is receiving the medication for the appropriate reason. **The right documentation**: Always verify any unclear or inaccurate documentation prior to administering medications.
2 b. The label on the medication must be checked for name, dose, and route, and compared with the MAR at three different times: 1. When the medication is taken out of the dispensing system or drawer. 2. Prior to opening the eye drop container. 3. After opening the eye drop container but PRIOR to administering the eye medication.	These checks are done before administering the medication to your patient. If taking a drug to the bedside (e.g., eye drops), do the third check at bedside.  *Figure 6.14 Check medication with MAR*

3. Take medications and MARs to the bedside. • Identify the patient using two identifiers. • Confirm allergies. • Inform the patient of the medication and its intended action. • Complete any necessary assessment. • Offer a tissue to the patient.	 MARs cannot be taken into rooms where additional precautions are necessary. The patient has the right to be informed. Drops may spill from the eye during administration.
4. Wear clean, non-sterile gloves.	Using gloves protects the nurse from potential contact with patient body fluids and medications.  *Apply non-sterile gloves*
5. Cleanse the eyelashes and eyelids of any drainage or crusting with a warm washcloth or gauze. Use each area of cleaning surface only once, and move from inner to outer eye area.	Cleansing removes debris from eye area.
6. Tilt patient's head back slightly if patient is sitting up, or place patient's head over a pillow (under the neck) if they are lying down.	Tilting the head back makes it easier to reach the conjunctival sac for instilling drops. Do not tilt head back if patient has a cervical spine injury.

7. Invert the eye-drop container, and have patient look up and focus on something on the ceiling.	Keeping the eye focused will help keep it still.
8. Gently pull patient's lower lid down using thumb or two fingers to expose conjunctival sac.	Place eye drop in conjunctival sac, not directly on eyeball (cornea).
9. **Eye drops**: Hold eye-drop container above eye taking care not to touch the eye, eyelids, or eyelashes. Instill one drop, or more if prescribed, into conjunctival sac. **Eye ointment**: Apply about 1.5 cm of ointment along lower conjunctival sac moving from inner to outer canthus. Twist tube to break off ribbon of ointment.	 Touching the tip of the container to anything can contaminate the medication.
10. Release lower lid after instillation and ask patient to close eyes gently. Ask patient to move the eyeball while eyes are closed.	This step allows the medication to be distributed across the eye.  *Have patient close eyes after drop is instilled*

11. **Eye drops only**: Apply gentle pressure over inner canthus for 30 to 60 seconds to prevent medication from entering the lacrimal duct.	This minimizes systemic absorption and thus systemic effects of the medication.
12. Instruct patient not to rub eye.	This is to prevent irritation and injury to the eye and to allow the medication to be fully absorbed.
13. Remove gloves and assist patient to a comfortable and safe position. Perform hand hygiene.	This ensures patient safety and comfort. Hand hygiene prevents the spread of microorganisms.
14. Document as per agency policy. Include date, time, dose, route; which eye the medication was instilled into; and patient's response to procedure.	Timely and accurate documentation helps to ensure patient safety.
Data sources: BCIT, 2015; Lilley et al., 2016; Perry et al., 2018	

Instilling Ear Medications

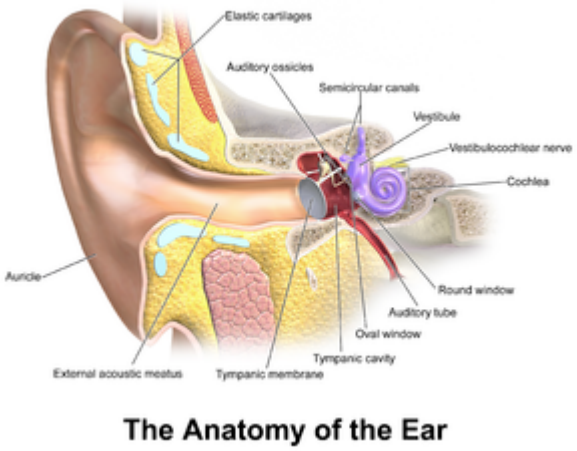


Figure 6.15 Anatomy of the ear

Common medications to be instilled into the ear include antibiotics, anti inflammatory agents, local analgesics, and wax emulsifiers (Lilley et al., 2016). In general, ear drops should be instilled after the ear has been thoroughly cleansed and the dropper cleaned with alcohol. Internal ear structures are particularly sensitive to temperature extremes. Therefore, ear (otic) medications should always be administered at least at room temperature but preferably at body temperature to promote comfort and to reduce risk of vertigo associated with cold ear drops (Lilley et al., 2016). Care must be taken to avoid contaminating the dropper and ear medication, as doing so could introduce microorganisms into the ear which could be very serious in the event the ear drum (tympanic membrane) is ruptured. After administration, the patient should be advised to lie on the unaffected side for 5 minutes to maximize medication absorption.

Checklist 50 outlines the steps for instilling ear medications.

Checklist 50: Instilling Ear (Otic) Medications

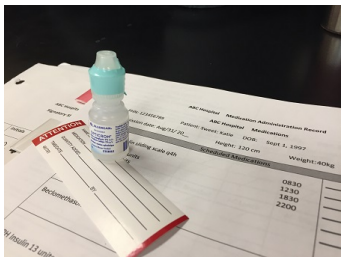
Disclaimer: Always review and follow your agency policy regarding this specific skill.

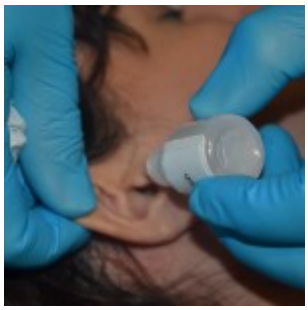
Safety considerations:

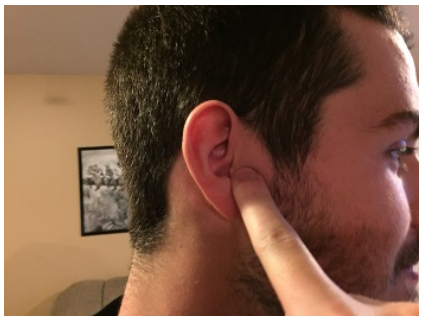
- Review everything in Table 6.1 Guidelines for Safer Medication Administration.
- Administer ear drops that are at room temperature or preferably at body temperature.
- Some ear drops may require shaking prior to administration.
- Only administer sterile ear drops to reduce risk of infection in the event that the ear drum is ruptured.
- Do not occlude the ear canal, as this can cause pressure during instillation of medication causing injury to the ear drum.
- If the patient experiences vertigo following medication administration, exercise safety precautions to avoid falls.
- Infection and/or treatment can result in temporary hearing loss. If hearing loss continues, contact the prescriber.

Steps	*Additional Information*

1. Perform hand hygiene prior to medication preparation. Check MAR to guide you to which medications you are preparing. Follow agency policy to ensure MARs are accurate and verified appropriately.	 *Comparing physician orders and MAR* A MAR that is checked by more than one healthcare professional provides a very reliable record for administering medications. Agencies may vary in relation to MAR verification processes.
2 a. As you are removing medications from the dispensing system, perform the SEVEN rights three times with each individual medication: • The right patient • The right medication (drug) • The right dose • The right route • The right time • The right reason • The right documentation	**The right patient**: Check that you have the correct patient using two patient identifiers (e.g., name and date of birth). **The right medication (drug)**: Check that you have the correct medication and that it is appropriate for the patient in the current context. **The right dose**: Check that the dose makes sense for the age, size, and condition of the patient. Different dosages may be indicated for different conditions. **The right route**: Check that the route is appropriate for the patient's current condition. **The right time**: Adhere to the prescribed dose and schedule. **The right reason**: Check that the patient is receiving the medication for the appropriate reason. **The right documentation**: Always verify any unclear or inaccurate documentation prior to administering medications.

2 b. The label on the medication must be checked for name, dose, and route, and compared with the MAR at three different times: 1. When the medication is taken out of the drawer. 2. When the medication is being poured. 3. When the medication is being put away or at bedside.	 *Figure 6.14 Check medication with MAR*
3. Before instilling ear drops, donne clean, non-sterile gloves.	Using gloves protects the nurse from potential contact with patient body fluids and medications.  *Apply non-sterile gloves*
4. Cleanse external ear of any drainage using a warm wet washcloth.	Drainage or debris may prevent some medication from entering ear canal.
5. If lying down, position patient on unaffected side with affected ear uppermost. Tilt head to side if sitting up.	Proper positioning helps to stop medication from escaping. Do not tilt head if patient has a cervical spine injury.

6. Draw up medication into ear dropper, ensuring correct dosage. Do not return excess medication to stock bottle.	Risk for contamination is increased if medication is returned to bottle.
7. **Adult administration**: Gently pull ear pinna back and up. **Child (up to 3 years) administration**: Gently pull ear pinna down and back.	Pulling the pinna (the external part of the ear) straightens ear canal. 
8. Hold dropper tip just above ear canal. Do not touch dropper tip to ear.	Touching the ear with the dropper tip will contaminate the dropper and the medication.
9. Allow drops to fall on the side of the ear canal.	Dropping the drops directly into the canal and onto the tympanic membrane will cause the patient discomfort.
10. Release ear pinna and have patient remain in the position for at least 5 minutes.	This position prevents medication from escaping from ear.

11. Apply gentle pressure to tragus (the inner side of the external ear) several times.	 *Figure 6.16 massage the tragus after instilling ear drops* Pressure helps move medication toward tympanic membrane.
12. If ordered, a cotton ball may be placed loosely in the ear canal.	Cotton ball helps prevent medication from escaping from ear.
13. Remove gloves and assist patient to a comfortable and safe position.	This ensures patient safety and comfort.
14. Perform hand hygiene.	Hand hygiene prevents the spread of microorganisms.
15. Document as per agency policy. Include date, time, dose, route; which ear the medication was instilled into; and patient's response to procedure.	Timely and accurate documentation helps to ensure patient safety.
Data sources: BCIT, 2015; Lilley et al., 2016; Perry et al., 2018	

Instilling Nasal Medications

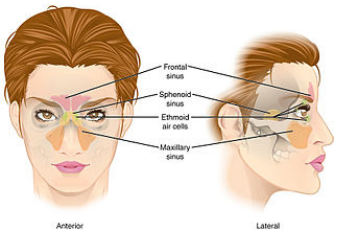


Figure 6.17 Facial sinuses

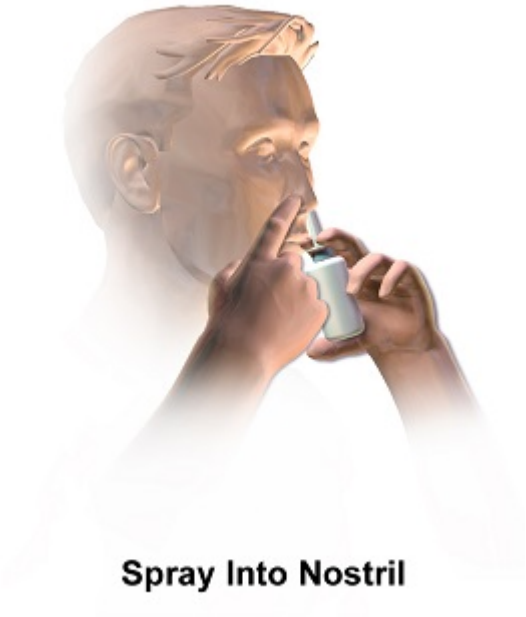


Figure 6.18 Nasal spray

Nasal medications are instilled for the treatment of allergies, nasal congestion, and sinus infections. The nose is not a sterile cavity, but medical asepsis must be observed because of its connection to the sinuses. Prior to administering nasal medications ask the patient to gently blow their nose.

Following administration, burning may be felt. At this point blowing the nose is discouraged, as the medication has not had time to absorb. Depending on the purpose of the nasal medication, different positioning may help facilitate delivery of the medication to the correct sinus area.

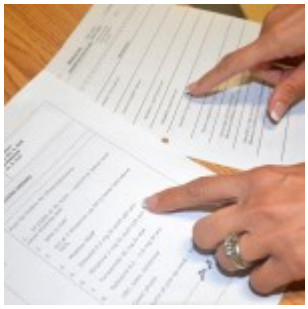
Checklist 51 outlines the steps for instilling nasal medications.

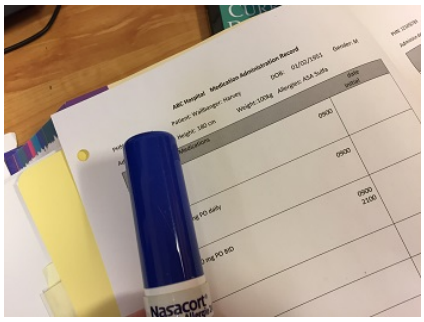
Checklist 51: Instilling Nasal Medications

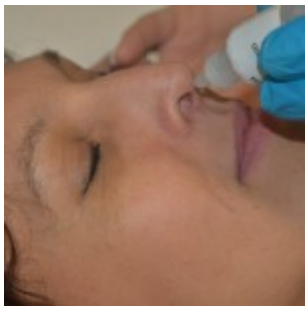
Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Review everything in Table 6.1 Guidelines for Safer Medication Administration
- Have the patient gently blow their nose prior.
- Many nasal medications require shaking to disperse medication in liquid.
- If specific sinuses are targeted for the medication, position accordingly:
- Posterior pharynx—position the head backward
- Ethmoid / sphenoid sinuses—with patient supine place pillow under shoulders and tilt head back
- Frontal / maxillary sinuses—place head back and turned toward the side intended to receive the medication
- Avoid blowing nose immediately after to allow medication an opportunity to absorb.

Steps	*Additional Information*
1. Perform hand hygiene prior to medication preparation. Check MAR to guide you to which medications you are preparing. Follow agency policy to ensure MARs are accurate and verified appropriately.	 *Comparing physician orders and MAR* A MAR that is checked by more than one healthcare professional provides a very reliable record for administering medications. Agencies may vary in relation to MAR verification

2 a. As you are removing medications from the dispensing system, perform the SEVEN rights three times with each individual medication: • The right patient • The right medication (drug) • The right dose • The right route • The right time • The right reason • The right documentation	**The right patient**: Check that you have the correct patient using two patient identifiers (e.g., name and date of birth). **The right medication (drug)**: Check that you have the correct medication and that it is appropriate for the patient in the current context. **The right dose**: Check that the dose makes sense for the age, size, and condition of the patient. Different dosages may be indicated for different conditions. **The right route**: Check that the route is appropriate for the patient's current condition. **The right time**: Adhere to the prescribed dose and schedule. **The right reason**: Check that the patient is receiving the medication for the appropriate reason. **The right documentation**: Always verify any unclear or inaccurate documentation prior to administering medications.
2 b. The label on the medication must be checked for name, dose, and route, and compared with the MAR at three different times: 1. When the medication is taken out of the drawer. 2. When the medication is being poured. 3. When the medication is being put away or at bedside.	 *Figure 6.19 compare medication label with MAR* These checks are done before administering the medication to your patient. If taking drug to bedside (e.g., nose drops), do a third check at the bedside.

3. Before instilling nasal medication, ask the patient to gently blow their nose. Donne clean, non-sterile gloves.	Nose blowing clears the nose prior to medication instillation. Using gloves protects the nurse from potential contact with patient body fluids and medications.  *Apply non-sterile gloves*
4. Position patient. **Nose spray**: Sitting upright with one nostril occluded, insert tip into open nostril. **Nose drops**: Position patient sitting back or lying down with head tilted back over a pillow (underneath neck). Draw fluid into medication dropper with enough for both nares. Do not return excess fluid into stock bottle.	This position allows medication to flow back into nasal cavity. Do not tilt head back if patient has a cervical spine injury. Returning fluid to stock bottle increases risk for contamination of medication.
5. Instill medication: **Nasal spray**: Have patient hold one nostril closed and breathe gently through the other as the spray is being administered. Spray should be directed away from the nasal septum. Repeat as directed. **Nose drops**: Hold dropper about 1 cm above naris and drop medication into one naris and then the other. Position patient with head back for 2 to 3 minutes.	 *Hold dropper about 1 cm above naris* Maintaining position will help medications remain in place and maximize absorption. Advise the patient they may feel like something is in the back of the throat. This is medication dripping into the pharynx.
6. Remove gloves and assist patient to a comfortable and safe position.	This ensures patient safety and comfort.

7. Perform hand hygiene.	Hand hygiene prevents the spread of microorganisms.
8. Document as per agency policy. Include date, time, dose, route; which naris the medication was instilled into (or whether it was both nares); and patient's response to procedure.	Timely and accurate documentation helps to ensure patient safety.
Data sources: BCIT, 2015; Lilley et al., 2016; Perry et al., 2018	

Critical Thinking Exercises

1. Your patient is due to receive a dose of medication instilled into both ears. You find the ear medication stored in the refrigerator. How should you proceed?
2. Your patient is due to receive medication instilled into her right eye, but you notice that her left eye has crusting and discharge. Discuss how you would proceed in this situation.
3. You need to teach a patient how to self administer nasal spray for seasonal allergy symptoms. Describe the key points you will discuss with them.

Attributions

Figure 6.13. Anatomy of eye from OpenStax College, Anatomy & Physiology (2013) is used under a CC BY 3.0 license.

Figure 6.14. Drops with MAR by author is licensed under a Creative Commons Attribution 4.0 International License.

Figure 6.15. Anatomy of ear by Anatomy of the Ear by Blausen.com staff (2014) is used under a CC BY 3.0 license.

Figure 6.16. Massage the tragus after instilling ear drops by author is licensed under a Creative Commons Attribution 4.0 International License.

Figure 6.17. Nasal sinuses illustration from OpenStax College, Anatomy & Physiology. Used under a CC BY 3.0 license. Download for free at http://cnx.org/contents/14fb4ad7-39a1-4eee-ab6e-3ef2482e3e22@6.27.

Figure 6.18. Diagram of nasal spray application by BruceBlaus is used under a cc BY-SA 4.0 license.

Figure 6.19. Spray with MAR by author is licensed under a Creative Commons Attribution 4.0 International License.

6.6 Administering Inhaled Medications

Medications administered through inhalation are dispersed via an aerosol spray, mist, or powder that patients inhale into their airways. Although the primary effect of inhaled medications is respiratory, there are likely to be systemic effects as well. Most patients taking medication by inhaler have asthma or chronic respiratory disease and should learn how to administer these medications independently. A variety of inhalers are available, and specific manufacturers' instructions should always be followed to ensure appropriate dosing.

Administering Medication by Small-Volume Nebulizers

Nebulization is a process by which medications are added to inspired air and converted into a mist that is then inhaled by the patient into their respiratory system (Lilley et al., 2016; Perry et al., 2018). (See Figure 6.20 and 6.21) The air droplets are finer than those created by metered dose inhalers, and delivery of the nebulized medication is by face mask or a mouthpiece held between the patient's teeth.

Figure 6.20 Example of a small-volume nebulizer using mask for medication delivery

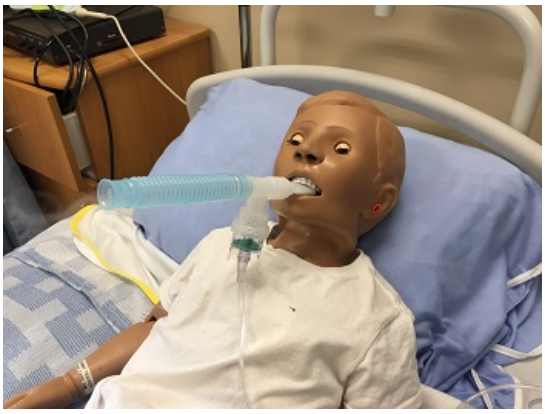


Figure 6.21 Hand held nebulizer

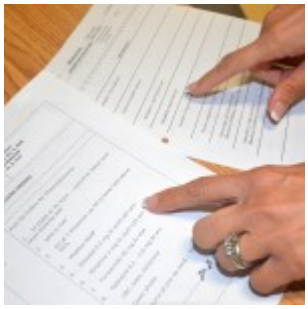
Checklist 52 outlines the steps for delivering medication through a small-volume nebulizer.

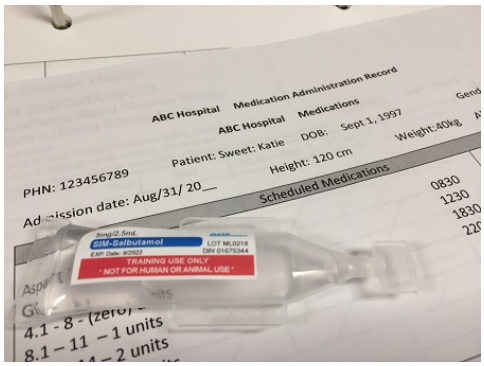
Checklist 52: Medication by Small-Volume Nebulizer

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Review everything in Table 6.1 Guidelines for Safer Medication Administration
- Encourage patient to sit upright during treatment to maximize lung expansion and to promote medication absorption.
- Rinse mouth following steroids to reduce risk of oral candida.
- Always assess the patient before, during, and after treatment to determine medication effectiveness and/or adverse side effects.
- Prime the unit prior to the initial dose or if the medication hasn't been used recently.
- Some patients are allergic to the propellant. Report any suspicions or concerns to the prescriber.
- Many MDIs don't have an automatic dose counter. Use of an empty inhaler could have serious consequences. Note the number of doses in the canister (on the label); note the number of doses per day and estimate when to refill. Likewise use a calendar.

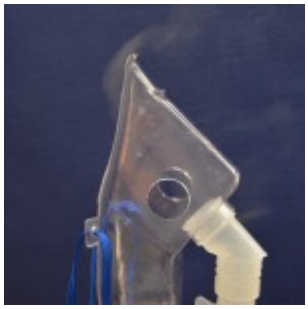
Steps	*Additional Information*
1. Perform hand hygiene before medication preparation. Check MAR to guide you to which medications you are preparing. Follow agency policy to ensure MARs are accurate and verified appropriately.	 *Comparing physician orders and MAR* A MAR that is checked by more than one healthcare professional provides a very reliable record for administering medications. Agencies may vary in relation to MAR verification processes.

2 a. As you are removing medications from the dispensing system, perform the SEVEN rights three times with each individual medication: • The right patient • The right medication (drug) • The right dose • The right route • The right time • The right reason • The right documentation	**The right patient**: Check that you have the correct patient using two patient identifiers (e.g., name and date of birth). **The right medication (drug)**: Check that you have the correct medication and that it is appropriate for the patient in the current context. **The right dose**: Check that the dose makes sense for the age, size, and condition of the patient. Different dosages may be indicated for different conditions. **The right route**: Check that the route is appropriate for the patient's current condition. **The right time**: Adhere to the prescribed dose and schedule. **The right reason**: Check that the patient is receiving the medication for the appropriate reason. **The right documentation**: Always verify any unclear or inaccurate documentation prior to administering medications.
2 b. The label on the medication must be checked for name, dose, and route, and compared with the MAR at three different times: 1. When the medication is taken out of the dispensing system or drawer. 2. Prior to the nebulizer being prepared. 3. After the nebulizer is prepared but PRIOR to the patient receiving the medication.	 *Figure 6.22 Check medications with MAR* Whenever possible, take the MARs to the bedside to complete the third check.
3. Assemble nebulizer apparatus as per manufacturer's instructions.	Assembly specific to manufacturer's instructions ensures proper delivery of medication.
4. Add medication as prescribed by pouring medication into the nebulizer cup. • Some medications may be mixed together if there are no contraindications. • Some medications may require the addition of saline per prescription for dilution.	This step ensures the proper delivery of medication. If reusing a nebulizer, discard any residual liquid from the previous dose.

<table>
<tr><td>5. Use a hand held nebulizer if the patient is able to hold it for approximately 10 minutes.

Use a mask if patient is unable to tolerate a mouthpiece.

Use an adaptor specific to tracheostomies if the patient has a tracheostomy.</td><td>This ensures the proper delivery of medication.
 
Figure 6.21</td></tr>
<tr><td>6. Position patient sitting up in a chair or in bed at greater than 45 degrees.</td><td>This position improves lung expansion and medication distribution.
  </td></tr>
<tr><td colspan="2">Note: Attach the nebulizer to compressed air if available; use oxygen if there is no compressed air.
If patient is receiving oxygen, do not turn it off. Continue to deliver oxygen through nasal prongs with the nebulizer. If using oxygen, consider oxygen safety guidelines (Table 5.5) and precautions and complications of oxygen therapy (Table 5.6).</td></tr>
</table>

7. Turn on air to nebulizer and ensure that a sufficient mist is visible exiting nebulizer chamber. A flow rate of 6 to 10 L should provide sufficient misting. Ensure that nebulizer chamber containing medication is securely fastened. Ensure that chamber is connected to face mask or mouthpiece, and that nebulizer tubing is connected to compressed air or oxygen flowmeter.	This process verifies that equipment is working properly.  *Check for misting*
8. If mouthpiece is being used, ensure lips are sealed around mouthpiece. Have patient take slow, deep, inspiratory breaths. Encourage a brief 2- to 3-second pause at the end of inspiration, and continue with passive exhalations.	Sealed lips ensure proper inhalation of medication. This maximizes effectiveness of medication.
9. Have patient repeat this breathing pattern until medication is complete and there is no visible misting. This process takes approximately 8 to 10 minutes.	This maximizes the effectiveness of the medication.
10. Tap nebulizer chamber occasionally and at the end of the treatment.	This action releases drops of medication that cling to the side of the chamber.  *Tap the nebulizer container*
11. Monitor patient's pulse rate during treatment, especially if beta-adrenergic bronchodilators are being used.	Beta-adrenergic bronchodilators have cardiac effects that should be monitored during treatment.
12. Once treatment is complete, turn flowmeter off and disconnect nebulizer.	This promotes patient comfort and safety.
13. Rinse, dry, and store nebulizer as per agency policy.	Proper care reduces the transfer of microorganisms.

14. If inhaled medication includes steroids, have patient rinse mouth and gargle with warm water after treatment.	Rinsing removes residual medication from mouth and throat, and helps prevent oral candidiasis related to steroid use.
15. Once treatment is complete, encourage patient to perform deep breathing and coughing exercises to help remove expectorate mucous.	Treatments are often prescribed specifically to encourage mucous expectoration.
16. Return patient to a comfortable and safe position.	This promotes patient comfort and safety.
17. Perform hand hygiene.	This step prevents the transfer of microorganisms.
18. Document treatment as per agency policy, and record and report any unusual events or findings to the appropriate healthcare provider.	Accurate and timely documentation and reporting promote patient safety.
Data sources: BCIT, 2015; Lilley et al., 2016; Perry et al., 2018	

Medication by Metered Dose Inhaler (MDI)

A metered dose inhaler (MDI) is a small handheld device that disperses medication into the airways via an aerosol spray or mist through the activation of a propellant. A measured dose of the drug is delivered with each push of a canister, and dosing is usually achieved with one or two puffs. Attached the MDI to a spacer or valved chamber optimizes medication delivery because the medication is held in the device until the patient inhales. Some MDIs have counters to inform the user how many doses have been administered,

Figure 6.23 MDI with spacer on the left

Figure 6.24 MDI administration – no spacer

Figure 6.25 MDI administration with spacer

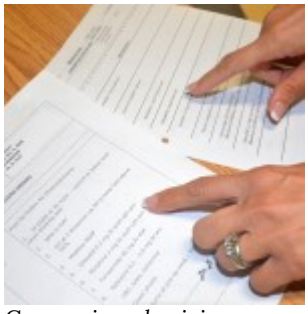
Checklist 53 lists the steps for administering medication by MDI.

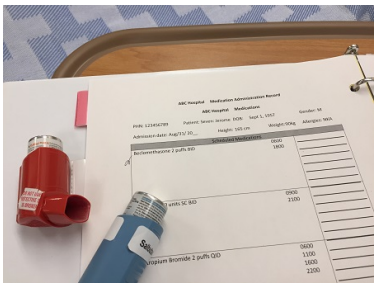
Checklist 53: Medication by Metered Dose Inhaler (MDI)

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Review everything in Table 6.1 Guidelines for Safer Medication Administration
- Shake the MDI prior to administration
- Use of a spacer assists to deliver complete dose to the patient.
- Exhale prior to inhaling the dose. Pause at the end of inspiraton, if able. Wait 1 to 2 minutes between puffs
- If a bronchodilator and a steroid are each ordered, administer the bronchodilator first to create bronchodilation that will allow the second medication to be delivered deeper into the lungs
- Rinse mouth following inhaled steroids to reduce risk of oral candida.
- Assess the patient before, during, and after the medication administration to determine medication effectiveness and/or adverse side effects.

Steps	*Additional Information*
1. Perform hand hygiene before medication preparation. Check MAR to guide you to which medications you are preparing. Follow agency policy to ensure MARs are accurate and verified appropriately.	 *Comparing physician orders and MAR* A MAR that is checked by more than one healthcare professional provides a very reliable record for administering medications. Agencies may vary in relation to MAR verification processes.

2 a. As you are removing medications from the dispensing system, perform the SEVEN rights three times with each individual medication: • The right patient • The right medication (drug) • The right dose • The right route • The right time • The right reason • The right documentation	**The right patient**: Check that you have the correct patient using two patient identifiers (e.g., name and date of birth). **The right medication (drug)**: Check that you have the correct medication and that it is appropriate for the patient in the current context. **The right dose**: Check that the dose makes sense for the age, size, and condition of the patient. Different dosages may be indicated for different conditions. **The right route**: Check that the route is appropriate for the patient's current condition. **The right time**: Adhere to the prescribed dose and schedule. **The right reason**: Check that the patient is receiving the medication for the appropriate reason. **The right documentation**: Always verify any unclear or inaccurate documentation prior to administering medications.
2 b. The label on the medication must be checked for name, dose, and route, and compared with the MAR at three different times: 1. When the medication is taken out of the dispensing system or drawer. 2. Prior to the MDI being prepared. 3. After the MDI is prepared and PRIOR to the medication being administered.	 *Figure 6.26 Check medications with MAR* Whenever possible, take the MARs to the bedside to complete the third check.

3. Assemble MDI as per manufacturer's instructions. If MDI has not been used for several days, give it a test spray into the air taking care not to inhale the medication.	Assembly specific to manufacturer's instructions ensures proper delivery of medication.  *Assemble MDI as per manufacturer's instructions*
4. Ensure that canister is securely inserted into the holder and remove the mouthpiece cover.	This ensures proper delivery of medication.
5. Shake canister well before delivery (5 or 6 shakes).	This ensures proper delivery of medication.
6. Position patient sitting up in a chair or in bed at greater than 45 degrees.	This position improves lung expansion and medication distribution.

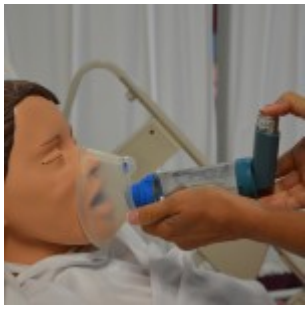
7. **Without spacer**:

- Hold inhaler in dominant hand.
- Place mouthpiece in mouth with opening toward back of mouth, and have patient close lips around mouthpiece.
- Ask patient to inhale deeply and exhale completely.
- Ask patient to hold inhaler between thumb at the base and index and middle fingers at the top.
- Ask patient to tilt head back slightly and inhale deeply and slowly through mouth, while simultaneously depressing inhaler canister.
- Ask patient to hold breath for about 10 seconds without exhaling medication.
- Remove MDI while exhaling through nose or pursed lips.

With spacer:

- Insert MDI into end of spacer device.
- Ask patient to place spacer mouthpiece in mouth and close lips around mouthpiece, avoiding any exhalation openings on spacer.
- Ask patient to breathe regularly.
- Have patient depress medication canister to spray one puff into spacer device.
- Ask patient to breathe in deeply and slowly for about 5 seconds and to then hold breath at the end of inspiration for about 10 seconds.
- **If one medication**: Have patient wait 20 to 30 seconds between inhalations
- **If more than one medication**: Have patient wait 2 to 5 minutes between inhalations.

This process ensures proper inhalation of medication.



Ask patient to breathe regularly

Depress medication canister to spray one puff into spacer device

Ask patient to breathe in deeply and slowly for about 5 seconds and to then hold breath at the end of inspiration for about 10 seconds

8. Have patient rinse mouth and gargle with warm water about 2 minutes after treatment.	Rinsing removes residual medication from mouth and throat, and helps prevent oral candida related to steroid use.
9. Return patient to a comfortable and safe position.	This promotes patient comfort and safety.
10. Perform hand hygiene.	This step prevents the transfer of microorganisms.
11. Document treatment as per agency policy, and record and report any unusual events or findings to the appropriate health care provider.	Accurate and timely documentation and reporting promote patient safety.
Data sources: BCIT, 2015; Lilley et al., 2016; Perry et al., 2018	

Medication by Dry Powder Inhaler (DPI)

Figure 6.27 One type of DPI device

Figure 6.28 Another type of DPI device

Dry powder inhalers (DPIs) were introduced to the market some time after pressurized MDI medications as an alternative for easier delivery of respiratory medications. DPIs don't require the same level dexterity and coordination as an MDI and thus are thought to result in improved medication adherence and disease management. Ramadan and Sarkis (2017) reviewed a number of studies to determine if in fact DPIs were superior to MDIs and found inconclusive evidence. A concerning finding was the significant number of patients using their device(s) incorrectly. However, those using DPIs demonstrated correct technique more often than those using pressurized MDIs. This data speaks to the importance of teaching clients correct technique when using an inhaled medication and, if necessary, the prescriber ordering medication with a device

that is easier for the patient to use. Checklist 54 describes the procedure for administering DPI medication.

Checklist 54: Medication by Dry Powder Inhaler (DPI)

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Review everything in Table 6.1 Guidelines for Safer Medication Administration
- Encourage patient to sit upright during treatment to maximize lung expansion and to promote medication absorption.
- Rinse mouth following steroids to reduce risk of oral candida.
- Always assess the patient before, during, and after treatment to determine medication effectiveness and/or adverse side effects.
- Prime the unit prior to the initial dose or if the medication hasn't been used recently.
- Some DPIs require insertion and piercing of a capsule, and some require rotation of a lever. Follow manufacturer's instructions.
- Exhale fully, place lips on the DPI mouthpiece. Inhale quickly and deeply. Hold breath momentarily. Do not exhale into the device.
- Medication can clump in humid environments.
- DPIs may or may not have an external counter to determine remaining doses.

Data sources: Lilley et al., 2016; Perry et al., 2018; The Lung Association of Saskatchewan, 2018; Ramadan & Sarkis, 2017

The Lung Association of Saskatchewan (2018) provides excellent inhaler demonstration videos and scripts for a number of respiratory medications including MDIs, DPIs, and spacers.

Critical Thinking Exercises

1. Your patient is receiving supplemental oxygen through nasal prongs, and needs to receive medication via

a nebulizer. Please describe whether or not you would remove the nasal prongs and your reasoning for making this decision.
2. Your patient complains that she can't seem to breathe in at the same time as she depresses her inhaler. What action should you take in this situation to ensure that your patient receives the appropriate dose of her medication by inhaler.
3. View the Lung Association of Saskatchewan resources and outline how you would explain use of a discus to a patient.

Attributions

Figure 6.21. Hand held nebulizer by author is licensed under a Creative Commons Attribution 4.0 International License.

Figure 6.22. Nebulizer medication with MAR by author is licensed under a Creative Commons Attribution 4.0 International License.

Figure 6.23 Assorted MDIs by author is licensed under a Creative Commons Attribution 4.0 International License.

Figure 6.24. Screenshot from Living With and Managing Asthma; an educational video by the Heart, Lung and Blood Institute by United States National Institutes of Health: Heart, Lung and Blood Institute is copyright free from the U.S. Department of Health & Human Services.

Figure 6.23. Baby using inhaler and spacer by Phyllis Buchanan is used under a CC BY-SA 2.0 generic license.

Figure 6.25. "Spiriva HandiHaler" brand dry powder inhaler (open) by RonEJ is in the public domain.

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Figure 6.27. Spiriva HandiHaler"-brand dry powder inhaler byRonEJ at English Wikipedia is in the public domain.

Figure 6.28. Image of Symbicort Inhaler by One Salient Oversight is in the public domain.

6.7 Administering Topical Medications

In this section we address how to administer topical medication by two delivery methods: transdermal patches, and creams, lotions, or ointments. Always wear gloves and maintain standard precautions when administering topical medications to the skin, mucous membranes, and tissues. Do not touch any preparations to your own skin. Always clean the skin or wound before applying a new dose of topical medication.

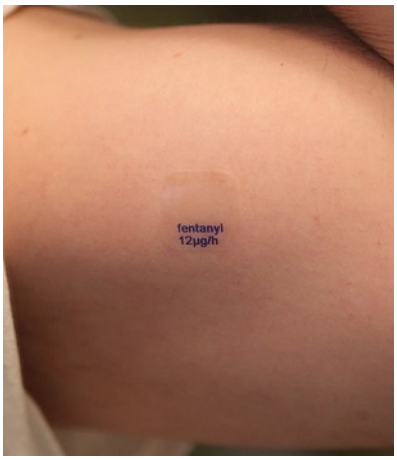


Figure 6.29 Fentanyl Patch

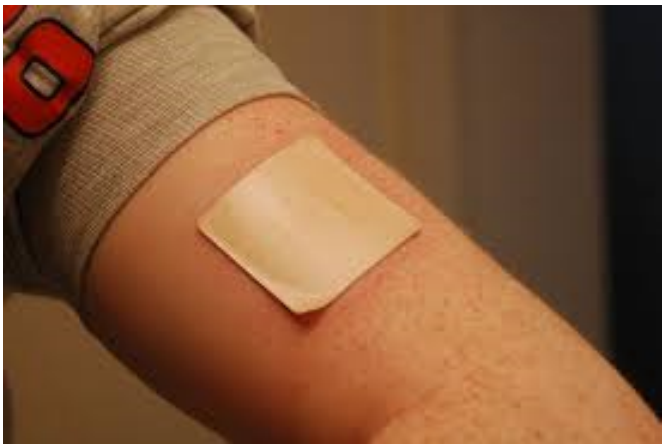


Figure 6.30 Nicotine patch

Checklist 55 lists the steps for applying a transdermal patch.

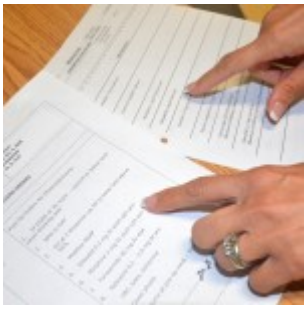
Checklist 55: Applying a Transdermal Patch

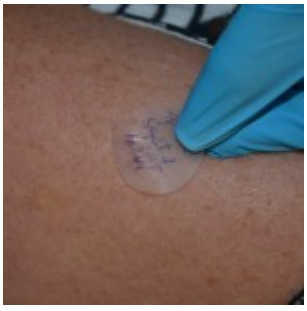
Disclaimer: Always review and follow your agency policy regarding this specific skill.

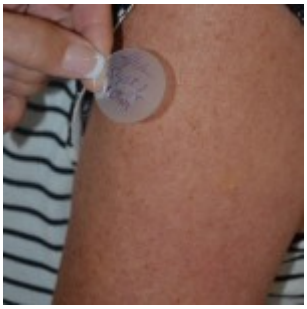
Safety considerations:

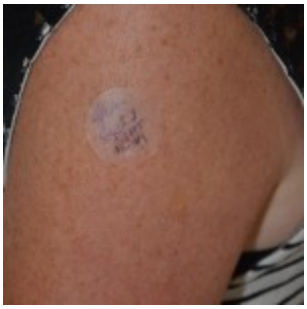
- Review everything in Table 6.1 Guidelines for Safer Medication Administration
- Do not apply new patch to previously used sites for at least one week to reduce the risk of skin irritation.
- Never cut patch in half; a change in dose requires a new transdermal patch.
- Never apply a heating pad over the patch, as it will affect the rate of absorption with potentially serious adverse effects.
- Choose an area free of hair, abrasions, or irritation.
- Use gloves when applying ointment, cream, and lotion to avoid absorption of the medication into your skin.
- After application, label the patch with date, time, and your initials.

Steps	*Additional Information*

1. Perform hand hygiene before medication preparation. Check MAR to guide you to which medication you are preparing. Follow agency policy to ensure MARs are accurate and verified appropriately.	 *Comparing physician orders and MAR* A MAR that is checked by more than one healthcare professional provides a very reliable record for administering medications. Agencies may vary in relation to MAR verification processes.
2 a. As you are removing medications from the dispensing system or drawer, perform the SEVEN rights three times with each individual medication: • The right patient • The right medication (drug) • The right dose • The right route • The right time • The right reason • The right documentation	**The right patient**: Check that you have the correct patient using two patient identifiers (e.g., name and date of birth). **The right medication (drug)**: Check that you have the correct medication and that it is appropriate for the patient in the current context. **The right dose**: Check that the dose makes sense for the age, size, and condition of the patient. Different dosages may be indicated for different conditions. **The right route**: Check that the route is appropriate for the patient's current condition. **The right time**: Adhere to the prescribed dose and schedule. **The right reason**: Check that the patient is receiving the medication for the appropriate reason. **The right documentation**: Always verify any unclear or inaccurate documentation prior to administering medications.

2 b. The label on the medication must be checked for name, dose, and route, and compared with the MAR at three different times: 1. When the medication is taken out of the drawer. 2. Prior to the medication being prepared. 3. After the medication is prepared but PRIOR to the patient receiving the medication.	 *Transdermal patch* Whenever possible, take the MAR to the bedside.
3. Before applying a transdermal patch, remove the old patch if it is still in place. Clean area thoroughly. Observe for signs of skin irritation at old patch and document as per agency policy.	Not removing the previous patch may result in overdose of the medication. Check between skin folds for old patch(es).  *Remove previous patch*
4. Dispose of old patch as per agency policy (usually in a biohazard trash bag) by folding in half with sticky sides together and wrapping it in a glove, or cutting it before disposal.	This prevents accidental exposure to the medication. Discarded fentanyl patches are considered a controlled substance. Many facilities require a witness for discard of these.

5. Use a felt tip or soft tip pen to write the date, time, and your initials on the outside of the new patch. DO NOT use a ballpoint pen. Find a new site that is clear, dry, hairless, and free of skin irritations.	Initialing the patch communicates application date and time to other healthcare providers.  *Write the date, time and your initials on the transdermal patch* Ballpoint pen can damage patch and thus affect medication delivery. If it is necessary to remove hair, clip the hair instead of shaving to avoid skin irritation. A consistent surface ensures even medication distribution.
Note: For some medications (i.e. nitroglycerine) it is normal to have a "patch-free period" (also called a wash out time) of 10 to 12 hours when the patch is removed, because tolerance to the medication may develop if the patch is worn 24 hours/day. Follow the prescriber's order.	
6. Carefully remove the backing from the patch, taking care to hold it at the edges and not touch the medication with your fingers.	This prevents interference with medication and maintains stickiness of patch.

7. Apply patch by holding one hand firmly over the patch for 10 seconds, then press around the edges to make sure that the patch is securely attached to the skin.	This prevents loss of patch and ensures effectiveness of medication delivery.  *Apply new transdermal patch*
8. Perform hand hygiene.	This prevents the transfer of microorganisms.
9. Document as per agency policy, making sure to include site of administration on the MAR.	Accurate and timely documentation improves patient safety.
Data source: BCIT, 2015; Lilley et al., 2016; Perry et al., 2018	

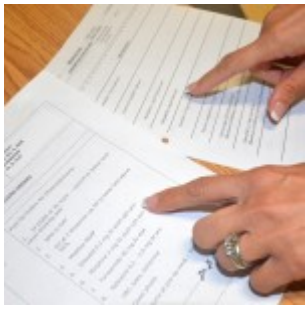
Checklist 56 lists the steps for applying topical medications as creams, lotions, and ointments.

Checklist 56: Applying Topical Creams, Lotions, and Ointments

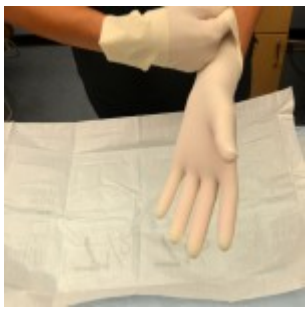
Disclaimer: Always review and follow your agency policy regarding this specific skill.

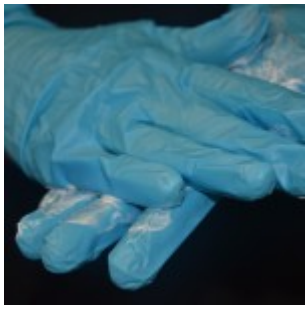
Safety considerations:

- Review everything in Table 6.1 Guidelines for Safer Medication Administration
- Wear gloves to prevent absorption of the medication into your skin
- Apply according to guidelines. Sometimes this means a "thin layer"; sometimes this means "apply generously".

Steps	*Additional Information*
1. Perform hand hygiene before medication preparation. Check MAR to guide you to which medication you are preparing. Follow agency policy to ensure MARs are accurate and verified appropriately.	 *Comparing physician orders and MAR* An MAR that is checked by more than one healthcare professional provides a very reliable record for administering medications. Agencies may vary in relation to MAR verification processes.

2 a. As you are removing medications from the dispensing system or drawer, perform the SEVEN rights three times with each individual medication: • The right patient • The right medication (drug) • The right dose • The right route • The right time • The right reason • The right documentation	**The right patient**: Check that you have the correct patient using two patient identifiers (e.g., name and date of birth). **The right medication (drug)**: Check that you have the correct medication and that it is appropriate for the patient in the current context. **The right dose**: Check that the dose makes sense for the age, size, and condition of the patient. Different dosages may be indicated for different conditions. **The right route**: Check that the route is appropriate for the patient's current condition. **The right time**: Adhere to the prescribed dose and schedule. **The right reason**: Check that the patient is receiving the medication for the appropriate reason. **The right documentation**: Always verify any unclear or inaccurate documentation prior to administering medications.
2 b. The label on the medication must be checked for name, dose, and route, and compared with the MAR at three different times: 1. When the medication is taken out of the drawer. 2. Prior to the medication being prepared. 3. After the medication is prepared but PRIOR to the patient receiving the medication.	 *Figure 6.31 Check medication with MAR* Whenever possible, take the MAR to the bedside to complete the third check.

3. Consider where the lotion, cream, or ointment is to be applied. A cotton tipped applicator might suffice. If applying to a large area of skin, apply non-sterile gloves unless skin is broken; then apply sterile gloves.	Using gloves protects healthcare provider from contact with medication.  *Apply non-sterile gloves* If skin is broken, sterile gloves will prevent introduction of new microorganisms from the health care provider's hands.
4. Wash, rinse, and dry the affected area with water and a clean cloth.	This removes previous topical medications.
5. If skin is very dry and flaking, apply topical medication while skin is still damp.	Applying while skin is damp helps to retain moisture within skin layers.
6. Change gloves, performing hand hygiene in between.	 *Apply sterile gloves if patient has open lesions (for added protection for the HCP)*

7. Place required amount of medication in palm of hands and soften by rubbing palms together. Likewise, if using a cotton tipped applicator, apply ointment, lotion, or cream to it.	Softening makes topical medication easier to spread.  *Rub medication in hands to soften and warm* If having to go back into the container, use a sterile tongue depressor or cotton tipped applicator so as not to contaminate the medication.
8. Let patient know that initial application may feel cold. Apply medication using long even strokes that follow the direction of the hair. Do not rub vigorously.	This prevents irritation of hair follicles.
9. Let patient know that skin may feel greasy after application.	Some topical medications contain oils.
10. Document as per agency policy, making sure to include site of administration on the MAR.	Accurate and timely documentation improves patient safety.
11. Perform hand hygiene.	This step prevents the transfer of microorganisms.
Data sources: BCIT, 2015; Lilley et al., 2016; Perry et al., 2018.	

Critical Thinking Exercises

1. Your patient's MAR states that their Nitro-Patch should be removed at night. Please explain why this is considered safe practice.
2. Discuss the steps you would take to administer a lotion for a patient with a rash that has several open lesions.

Attributions

Figure 6.29. Fentanyl patch by DanielTahar is used under a CC BY-SA 4.0 international license.

Figure 6.30. Nicoderm [patch] by RegBarc is used under a CC BY 2.5 generic license.

Figure 6.31. Topical cream with MAR by author is licensed under a Creative Commons Attribution 4.0 International License.

6.8 Summary

Nurses play an essential role in medical reconciliation; preparing, administering, monitoring, evaluating, teaching patients; and documenting responses to medications. Medication administration requires good decision-making skills and clinical judgment, and the nurse is responsible for ensuring full understanding of medication administration and its implications for patient safety.

This chapter discusses guidelines to follow for mitigating medication errors and adverse drug events (ADEs). Non-parenteral routes of medication administration are discussed, and the steps for following each of these processes safely is outlined.

Key Takeaways

- Safe and accurate medication administration is a key nursing responsibility.
- Medication administration is a complex process that requires the full attention of the nurse to avoid medication errors and adverse drug events.
- Nurses can reduce errors by following guidelines, knowing the types of medication errors that are most likely to occur and strategies for their prevention, and understanding the implications of the medication being given.
- There are several routes for medication administration. Knowing when it is appropriate to use each route, and knowing the process for medication administration via that route, will help to mitigate medication errors.
- The SEVEN rights and three checks provide a process for safe drug administration and are a collaborative effort of the nurse, the pharmacist, and the physician.
- Accurate and timely documentation of medication administration and the effect of the medication on the patient is an important responsibility of the nurse and promotes patient safety.
- Patient education is an extremely important factor in medication adherence and proper self-administration and is an important nursing responsibility.

Suggested Online Resources

1. Canadian Patient Safety Institute's (CPSI) *Medication Safety*. This resource explains how to reduce adverse drug events by following the medication reconciliation process.

2. Centers for Disease Control and Prevention's Medication Safety Basics. This website outlines medication safety basics and provides several medication safety fact sheets.

3. Institute for Safe Medication Practices Canada (ISMP). This is the website for an independent, national, not-for-profit organization committed to the advancement of medication safety in all healthcare settings.

4. Institute for Safe Medication Practices Canada's (ISMP) Medication Reconciliation. This website provides a definition of medication reconciliation and resources to complete the medication reconciliation process to ensure safe and effective communication for all healthcare providers regarding use of all medications.

References

Agency for Healthcare Research and Quality. (2014). *Checklists*. Retrieved from http://psnet.ahrq.gov/primer.aspx?primerID=14.

Agrawal, A. (2009). Medication errors: Prevention using information technology systems. *Br J Clin Pharmacol*, 67(6), 681.

Baker, G. R., Norton, P., G., Flintoft, V., Blais, R., Brown, A., Cox, J., . . . Tamblyn, R. (2004). The Canadian adverse events study: The incidence of adverse events among hospital patients in Canada. *CMAJ*, 170(11), 1678-1686. https://doi.org/10.1503/cmaj.1040498

Bell, C. M., Brener, S. S., Gunraj, N., Huo, C., Bierman, A. S., Scales, D. C., . . . Urbach, D. R. (2011). Association of ICU or hospital admission with unintentional discontinuation of medications for chronic diseases. *Journal of American Medical Association*, 306(8), 840-847. http://dx.doi.org/10.1001/jama.2011.1206.

Boullata, J. (2009). Drug administration through an enteral feeding tube: The rationale behind the guidelines. *American Journal of Nursing*, 109(10), 34-42. Retrieved from https://www.nursingcenter.com/wkhlrp/Handlers/articleContent.pdf?key=pdf_00000446-200910000-00027.

British Columbia Institue of Technology)(BCIT). (2015). In, NURS 1020: *Clinical techniques*. Vancouver, BC: BCIT

Butt, A. R. (2010). Medical error in Canada: Issues related to reporting of medical error and methods to increase reporting. *McMaster University Medical Journal*, 7(1), 15-18. Retrieved from https://sghrp.ca/reports/open-report.php?id=23.

Canadian Institute for Health Information (CIHI). (2013, March). *Adverse drug reaction—Related hospitalizations among seniors, 2006 to 2011*. Retrieved from https://secure.cihi.ca/free_products/Hospitalizations%20for%20ADR-ENweb.pdf.

Canadian Patient Safety Institute. (2012). *Canadian incident analysis framework*. Retrieved from http://www.patientsafetyinstitute.ca/en/toolsResources/IncidentAnalysis/Documents/Canadian%20Incident%20Analysis%20Framework.PDF#search=canadian%20analysis%20incident%20framework.

Centers for Disease Control and Prevention. (2018). *Medication safety basics*. Retrieved from https://www.cdc.gov/medicationsafety/basics.html.

Debono, D. S., Greenfield, D., Travaglia, J. F., Long, J. C., Black, D., Johnson, J., & Braithwaite, J. (2013). Nurses' workarounds in acute healthcare settings: A scoping review. *BMC Health Services Research*, 13(175). https://doi.org/10.1186/1472-6963-13-175.

Institute for Healthcare Improvement. (2015). *High-alert medication safety*. Retrieved from http://www.ihi.org/topics/highalertmedicationsafety/pages/default.aspx.

Institute for Safe Medication Practices (ISMP). (2011). *Guidelines for timely administration of scheduled medications (acute)*. Retrieved from https://www.ismp.org/guidelines/timely-administration-scheduled-medications-acute.

Institute for Safe Medication Practices (ISMP). (2017a). *List of error prone abbreviations*. Retrieved from https://www.ismp.org/recommendations/error-prone-abbreviations-list.

Institute for Safe Medication Practices (ISMP). (2017b). *High-alert medications in long-term care (LTC) settings*. Retrieved from https://www.ismp.org/recommendations/high-alert-medications-long-term-care-list.

Institute for Safe Medication Practices (ISMP). (2018). *High-alert medications in acute care settings*. Retrieved from https://www.ismp.org/recommendations/high-alert-medications-acute-list.

Lilley, L. L., Rainforth Collins, S., Snyder, J. S., & Swart, B. (2016). *Pharmacology for Canadian health care practice* (3rd ed.). Toronto, ON: Elsevier Canada.

Lung Association of Saskatchewan. (2018). *Inhalers*. Retrieved from https://sk.lung.ca/lung-diseases/inhalers.

Lynn, P. (2011). *Photo atlas of medication administration* (4th ed.). Philadelphia, PA: Lippincott Williams & Wilkins.

Martindale Pharma. (n.d.) *Bisacodyl*. Retrieved from https://www.medicines.org.uk/emc/product/3298/smpc.

Munden, J. (Ed.). (2007). Nursing: Perfecting clinical procedures. Philadelphia, PA: Wolters Kluwer: Lippincott, Williams & Wilkins.

National Patient Safety Agency. (2009). *Safety in doses. Improving the use of medication in NHS*. Retrieved from http://www.nrls.npsa.nhs.uk/resources/?entryid45=61625.

National Priority Partnership. (2010). *Preventing medical errors: A $21 billion opportunity*. Retrieved from http://psnet.ahrq.gov/resource.aspx?resourceID=20529.

Perry, A., Potter, P., & Ostendorf, W. (2018). *Clinical skills and nursing techniques* (9th ed.). St. Louis, MO: Elsevier-Mosby.

Poon, E. G., Keohane, C. A., Yoon, C. S., Ditmore, M., Bane, A., Levtzion-Korach, O., . . . Gandhi, T. K. (2010). Effect of bar-code technology on the safety of medication administration. *New England Journal of Medicine*, 362(18), 1698-1707. https://doi.org/10.1056/NEJMsa0907115.

Prakash, V., Koczmara, C., Savage, P., Trip, K., Stewart, J., McCurdie, T., . . . Trbovich, P. (2014). Mitigating errors caused by interruptions during medication verification and administration: Interventions in a simulated ambulatory chemotherapy setting. *BMJ Quality and Safety*, 23(11). https://doi.org/10.1136/bmjqs-2013-002484.

Ramadan, W. H., & Sarkis, A. T. (2017). Patterns of use of dry powder inhalers versus pressurized metered-dose inhalers devices in adult patients with chronic obstructive pulmonary disease or asthma: An observational comparative study. *Chronic Respiratory Disease*, 14(3). https://dx.doi.org/10.1177%2F1479972316687209.

Royal Children's Hospital Melbourne (RCH). (2017). *Enteral feeding and medication administration*. Retrieved from https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Enteral_feeding_and_medication_administration/.

Saskatoon Health Region. (2017). *Enteral tube feeding: Adult* [Number 1020]. Retrieved from https://www.saskatoonhealthregion.ca/about/NursingManual/1020.pdf.

The Joint Commission (TJC). (2012). *National patient safety goals*. Retrieved from http://www.jointcommission.org/standards_information/npsgs.aspx.

CHAPTER 7. PARENTERAL MEDICATION ADMINISTRATION

7.1 Introduction

Parenteral medications are medications administered directly into body tissue or the circulatory system (according to Merriam-Webster, "parenteral" is a term taken from Greek meaning "to avoid the intestines"). They are synonymous with "injectables," as syringes and needles are used to administer these medications by subcutaneous, intradermal, intramuscular, and intravenous routes. Injections are a direct and reliable way to deliver medication for fast absorption. However, parenteral medications pose a greater risk of harm and adverse reactions than nonparenteral medications. Parenteral medications require special equipment and a specific skill set to ensure that the medication is prepared correctly to have the right therapeutic effect, and to avoid complications (Perry et al., 2018).

Learning Outcomes

- Describe the advantages and disadvantages of administering medications by each parenteral route (ID, SC, IM, IV).
- Identify two strategies to reduce risk of needle-stick injuries.
- Accurately read a variety of syringes.
- Identify three strategies to prevent infection associated with parenteral medication administration.
- Demonstrate preparing meds from vials and ampules following principles of asepsis.
- Describe three strategies to help minimize patient discomfort during an injection.
- Landmark IM injection sites: deltoid, vastus lateralis, ventrogluteal.
- Identify rational for choice of an IM injection site.
- Discuss factors related to needle and syringe selection associated with subcutaneous and intramuscular route of medication administration.
- Discuss the aspirate versus don't aspirate debate in relation to IM injections.
- Demonstrate safe subcutaneous and intramuscular injections.
- Describe three nursing considerations associated with the use of an indwelling subcutaneous device.
- Demonstrate safe administration of medication given IV direct via a PVAD short saline lock.
- Demonstrate safe administration of medication given IV direct into an infusing PVAD short with both compatible and incompatible solutions.
- Demonstrate safe administration of IV medication through a minibag and secondary IV set.
- Describe how to manage adverse reactions to IV medications.
- Explain three complications associated with intravenous medications.
- Summarize how to manage and report medication errors in the health care setting.

7.2 Preparing Medications from Ampules and Vials

Parenteral refers to the path by which medication comes in contact with the body. **Parenteral medications** enter the body by injection through the tissue and circulatory system. Injected medications are absorbed more quickly than oral and are used with patients who are nauseated, vomiting, restricted from taking oral fluids, or unable to swallow. Parenteral medications can be effective and safe when prepared and administered correctly. However, because they are invasive, and absorbed readily and quickly into the body, there are numerous risks associated with administering them (Perry, Potter, & Ostendorf, 2014).

There are four routes for parenteral medications (also see Figure 7.1). Each type of injection requires a specific skill set to ensure the medication is prepared properly and administered into the correct location (Perry et al., 2014). The four types of injections are:

1. **Subcutaneous (SC)**: This injection places medication/solution into the loose connective tissue just under the dermis.
2. **Intradermal (ID)**: This injection places the medication into the dermis just under the epidermis.
3. **Intramuscular (IM)**: This injection places the medication into the body of a muscle.
4. **Intravenous (IV)**: This injection places the medication/solution into a vein through an existing IV line or a short venous access device (saline lock). Medications given by the intravenous route can be given as an IV bolus, as an intermittent (piggyback) medication, or in a large volume continuous infusion.

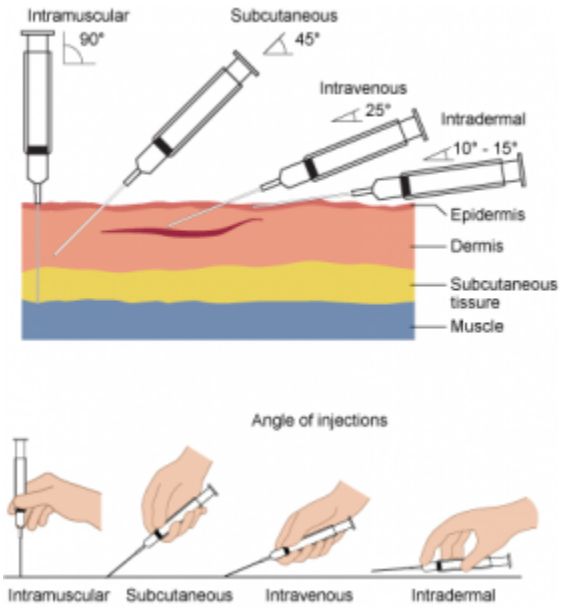


Figure 7.1: Needle insertion angles

To administer parenteral medications safely, it is imperative to understand how to prevent an infection, prevent medication errors, prevent a needle-stick injury, and prevent discomfort to the patient. Tables 7.1 to 7.4 address specific practices to eliminate safety hazards to patients and health care workers.

Preventing Infection During an Injection

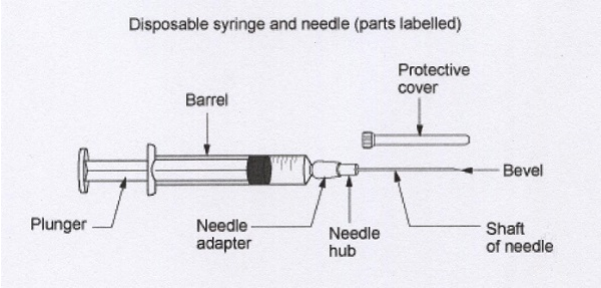
According to Seigel, Rhinehart, Jackson, and Chiarello (2007), research has shown that unsafe injection practices have resulted in patient exposure to infections leading to outbreaks of infectious diseases. These unnecessary exposures were the result of deficient health care practices. Injectable medications must be given in a safe manner to maintain sterility of equipment and prevent the transmission of infectious diseases between patients and health care workers. Table 7.1 summarizes how to prevent an infection during an injection.

Table 7.1 Preventing Infection During an Injection

Safety consideration:

- Always follow the principles of asepsis when preparing injections.

Principle	*Additional Information*
Perform hand hygiene.	Always perform hand hygiene before administration and after removing gloves. For hand hygiene with ABHR, use 1 to 2 pumps of product; this volume requires a minimum of 15 seconds for hands to dry.  *Hand hygiene with ABHR*

Prevent needle/syringe contamination.	Keep sterile parts of the needle and syringe sterile. Avoid letting the needle touch unsterile surfaces such as the outer edges of the ampule or vial, surface of the needle cap, or counter. Always keep the needle covered with a cap when not in use, and use the scoop-cap method to avoid needle-stick injuries. Avoid touching the length of the plunger. Keep the tip of the syringe sterile by covering with a cap or needle.  *Figure 7.2 Parts of a needle*
Prepare patient's skin.	Wash the patient's skin with soap and water if it is soiled with dirt, drainage, or fecal matter/urine. Follow agency policy for skin preparation. When using an alcohol swab, use a circular motion to rub the area for 15 seconds, and then let the area dry for 30 seconds. If cleaning a site, move from the centre of the site outward in a 5 cm (2 in) radius using friction.
Prevent contamination of solution.	Use single-dose vials/ampules whenever possible. Do not keep multi-dose vials in patient treatment area. Discard if sterility is compromised or questionable. Do not combine and administer medications from single-dose vials or ampules for later use. Ampules should not sit open and should be used immediately, then discarded appropriately.
Use new, sterile equipment with each injection.	Single use syringe and needle must be used with each patient. Always inspect packaging for intactness; inspect for dryness, rips, torn corners, and expiry date. If single use equipment is not available, use syringes and needles designed for steam sterilization.
Data source: CDC, 2015; Hutin et al., 2003; Perry et al., 2014; Provincial Infectious Disease Advisory Committee, 2014; Siegel et al., 2007.	

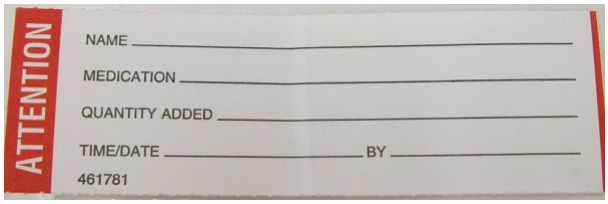
Safer Medication Administration

Medication errors have a substantial impact on health care in Canada (Butt, 2010). When preparing and administering medication, and assessing patients after receiving medication, always follow agency policy to ensure safe practice. The following table is from Chapter 6. Please review it for guidelines for safer medication administration.

Guidelines for Safer Medication Administration

Safety consideration:

- Always receive the required training on the use of each agency's medication system to avoid preventable errors. Agency policy on medication administration and on the medication administration record (MAR) may vary.
- The Institute for Safe Medication Practices (ISMP) provides important safety information and guidelines around medication administration

Principle	*Additional Information*
Be vigilant when preparing medications.	Avoid distractions. Some agencies have a no-interruption zone (NIZ), where health care providers can prepare medications without interruptions.
Check for allergies.	Always ask patient about allergies, types of reactions, and severity of reactions.
Use two patient identifiers at all times. Always follow agency policy for patient identification.	Use at least two patient identifiers before administration AND compare against the medication administration record (MAR). Whenever possible, MARs and eMARs should be taken to the bedside.
Label all meds prepared away from the bedside.	Label should include 2 patient identifiers, drug, dose, time prepared, initials of the nurse who prepared it. Be confident that you know what you are administering.  *Figure 7.3 Medication label sample*

Assessment comes before and after medication administration.	All medications require an assessment (review of lab values, pain, respiratory or cardiac assessment, etc.) prior to medication administration to ensure the patient is receiving the correct medication for the correct reason. Assessment after medication administration helps to determine if the medication is having its intended effect and to determine possible adverse reactions
Be diligent in all medication calculations.	Errors in medication calculations have contributed to dosage errors, especially when adjusting or titrating dosages. If in doubt, ask a colleague for an independent double check.
Avoid reliance on memory; use checklists and memory aids.	Slips in memory are caused by lack of attention, fatigue, and distractions. Mistakes are often referred to as attentional behaviours, and they account for most errors in health care. If possible, follow a standard list of steps for every patient.
Communicate with your patient before, during, and after administration.	Provide information to patient about the medication before administering it. Answer questions regarding usage, dose, and special considerations. Give the patient the opportunity to ask questions. Include family members if appropriate.
Avoid workarounds.	A workaround is a process that bypasses a procedure, policy, or problem in a system. For example, nurses may "borrow" a medication from another patient while waiting for an order to be filled by the pharmacy. These workarounds fail to follow agency policies that ensure safe medication practices.
Ensure medication has not expired.	Medication may be inactive if expired.
Always clarify an order or procedure that is unclear.	Always ask for help whenever you are uncertain or unclear about an order. Consult with the pharmacist, charge nurse, or other health care providers and be sure to resolve all questions before proceeding with medication administration.
Use available technology to administer medications.	Technology has the potential to help decrease errors. Use technology that is available to you when administering medications, but be aware of technology-induced errors.
Report all near misses, errors, and adverse reactions.	Reporting allows for analysis and identification of potential errors, which can lead to improvements and sharing of information for safer patient care.
Be alert to error-prone situations and high-alert medications.	High-alert medications are those that are most likely to cause significant harm, even when used as intended. The most common high-alert medications are anticoagulants, narcotics and opiates, insulins, and sedatives. The types of harm most commonly associated with these medications include hypotension, respiratory depression, delirium, bleeding, hypoglycemia, bradycardia, and lethargy. High alert situations include: frequent dosing to the same patient (i.e., q4h insulin sliding scale; q1h morphine IV) , multiple meds (i.e., having to administer meds to multiple patients and each have multiple medications), high stress environments, noisy environments, and multiple distractions during medication preparation.

Independent double checks.	Two clinicians independently check each high-alert medication in relation to prescribing, dispensing, and administration (i.e., insulin, anticoagulants, IV direct medications). Note: some agencies require an independent double check for every medication given to a neonate, all IV medications for pediatrics, and with all new medication orders
Open medications at the bedside	Doing so gives you time to think about the rights of safe medications within each patient context and allows the patient an opportunity to ask questions.
If a patient questions or expresses concern regarding a medication, stop and do not administer it.	If a patient questions a medication, stop and explore the patient's concerns, review the physician's order, and, if necessary, notify the practitioner in charge of the patient.
Data source: Agency for Healthcare Research and Quality, 2014; Canadian Patient Safety Institute, 2012; Debono et al., 2013; Institute for Healthcare Improvement, 2015; Institute for Safe Medication Practices, 2018; National Patient Safety Agency, 2009; National Priority Partnership, 2010; Prakash et al., 2014; Shah et al., 2016.	

Promoting Safety and Comfort of a Patient During an Injection

Injections can be given safely and effectively, and harm can be prevented if proper injection technique is used. Most complications related to injections are associated with intramuscular injections, but may occur with any route. Complications can occur when an incorrect site is used, or with an inappropriate depth or rate of injection (Malkin, 2008). To promote patient safety and comfort during an injection, review the guidelines in Table 7.2.

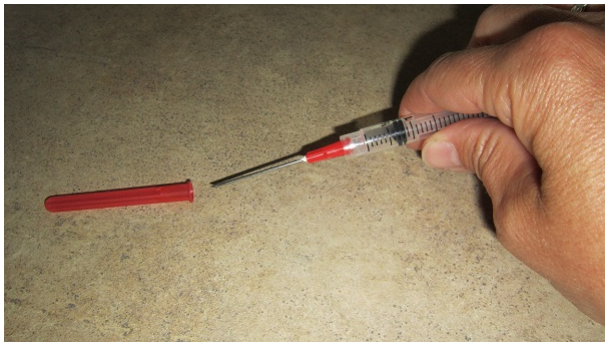
Table 7.2 Promoting Patient Safety and Comfort During an Injection	
Principle	*Additional Information*
Correct needle / syringe	For injections, use a sharp, beveled needle. Correct needle length allows for correct delivery of medication into the correct site and can reduce complications such as abscesses, pain, and bruising. Needle selection should be based on the route ordered, the size of patient, the injection site, and the amount of medication injected. Women tend to have more adipose tissue around the buttocks and deltoid fat pad, which means many injections given do not reach the proper IM depths in women (Davidson & Rourke, 2013). Large bore needles have been found to reduce pain, swelling, and redness after an injection, as less pressure is required to depress the plunger.
Proper angle of insertion and removal (see Figure 7.1)	Inserting the needle at the proper angle (depending on the type of injection) and entering the skin smoothly and quickly can reduce pain during injection. Hold the syringe steady once the needle is in the tissue to prevent tissue damage. Withdraw the needle at the same angle used for insertion. The angle for an IM injection is 90 degrees. Holding the syringe like a dart prevents the medication from being injected during insertion of needle. To prevent pain and discomfort caused by residue on the needle, prepare medication with blunt fill and blunt fill filters and switch to the correct needle for administration.
Patient position	The patient's position may affect their perception of pain. Proper position will also facilitate proper landmarking of the site. For IM injections, for example, the ventrogluteal site has the greatest muscle thickness and is free of nerves and blood vessels, with a small layer of fat.
Relaxation technique and distraction methods	Position the patient's limb in a relaxed, comfortable position to reduce muscle tension. For example, lying prone may help a patient relax prior to an IM injection. If giving a deltoid IM injection, have the patient relax the arm by placing the hand in the lap. If a patient is receiving an IM injection in the vastus lateralis or ventrogluteal site, encourage the patient to gently point toes outwards to relax the muscle. A skilled health care provider can help decrease the patient's anxiety-heightened pain by diverting the patient's attention away from the injection procedure.
Pre-medication, if required	To decrease pain upon insertion, a vapocoolant spray, topical anesthetic, or wrapped ice may be placed on the insertion site for a minute prior to injection. For IM injections, two studies found that applying pressure to the injection site for 10 seconds before the injection reduced pain (Ozturk et al., 2017). This data supports the gate theory of pain control.

Z-track method for IM injections	Some research shows that the Z-track technique results in reduced pain and complications, and fewer injection lesions. However, other research shows that Z-track injections result in more pain and bleeding at the injection site. (See Section 7.4 Intramuscular Injections for more on the Z-track method.)
Administration rate	Research has found that administrating medications at 10 seconds per ml is an effective rate for IM injections. Increasing the rate to 20 seconds per ml did not show any reduction in pain. Always review drug administration rate as per pharmacy or manufacturer's recommendations.
Rotate injection sites	Rotate IM injection sites to prevent the development of indurations and abscesses.
Aspiration with IM injections	Review the latest research regarding the utility of aspirating IM injections. There is lack of strong evidence to support the technique of aspiration with IM injections. Refer to your agency policy regarding aspiration with IM injections
Data source: Ağac & Günes, 2011; Astle & Duggleby, 2019; Canadian Agency for Drugs and Technologies in Health, 2014; Cocoman & Murray, 2008; Davidson & Rourke, 2013; Greenway, 2014; Hunter, 2008; Malkin, 2008; Mitchell & Whitney, 2001; Nisbet, 2006; Ogston-Tuck, 2014a; Öztürk, Baykara, Karadag, & Eyikara, 2017; Perry et al., 2014; Rodgers & King, 2000; Sisson, 2015; Workman, 1999	

Preventing Needle-Stick Injuries

Health care providers can be at risk for needle-stick injuries in any health care setting. The most common places for needle-stick injuries to occur are in the operating room and patient rooms. Tasks that place the health care provider at risk include recapping needles and mishandling IV lines. Table 7.3 provides guidelines to prevent needle-stick injuries.

Table 7.3 Recommendations for Prevention of Needle-Stick Injuries

Principle	*Additional Information*
Avoid recapping needles.	 *Figure 7.4 Scoop method of recapping* Recapping needles has led to the transmission of infection. If possible, always use devices with safety features (i.e., safety shield) and engage the needle's safety system. If absolutely necessary, use the scoop method of recapping.
Dispose of the needle immediately after injection.	Immediately dispose of used needles in a sharps disposal container (puncture-proof and leak-proof) to avoid unsafe disposal of a sharp.
Reduce or eliminate all hazards related to needles.	Avoid using needles if possible. Use a needle only when performing an SC, ID, or IM injection (i.e., blunt fill and blunt fill filters). Use a needleless system and engineered safety devices for prevention of needle-stick injuries.
Plan disposal of sharps before injection.	Plan the safe handling and disposal of needles before beginning a procedure that requires a sharp needle. Bring sharps container close to the bedside prior to injection. Sharps containers should be at eye level and within arm's reach.
Follow all standard policies related to prevention / treatment of injury.	Follow all agency policies regarding infection control, hand hygiene, standard and additional precautions, and blood and body fluid exposure management.
Report all injuries.	Report all needle-stick injuries and sharp-related injuries immediately. Data collected regarding the nature of injuries help guide needle-stick prevention strategies for new practices and devices. Review how to manage needle-stick injuries and follow agency policy regarding exposure to blood-borne pathogens. Policies help decrease the risk of contracting a blood-borne illness.

Participate in required training and education.	Attend training on injury-prevention strategies related to needles and safety devices as per agency policy. Participate in and evaluate the selection of safety devices, and report known needle-stick hazards to managers.
Data source: American Nurses Association, 2002; Centers for Disease Control, 2012; National Institute for Occupational Safety and Health, 1999; Perry et al., 2014; Pratt et al., 2007; Wilburn, 2004; Wilburn & Eijkemans, 2004	

Preparing Medications from Ampules and Vials

Specific equipment, such as syringes and needles, is required to prepare and administer parenteral medications. The selection of the syringe and needle is based on the type and location of injection; amount, quality, and type of medication; and the body size of the patient. Some syringes come prefilled with a needle attached. Most times you will need to select your equipment from your agency's stock. For safety, choose needless systems whenever possible and choose needles with safety shields to prevent injuries (Perry et al., 2014). Aseptic technique is paramount to the preparation and administration of these medications.

A **syringe** is a sterile, single-use device. Syringes come in various sizes from 0.5 ml to 60 ml (see Figure 7.5). Most syringes have a Luer lock (see Figure 7.6). Because syringes vary and the increments of measurement vary, it is important to know how to read the syringe correctly (Lynn, 2011). When preparing injections, the nurse should select a syringe size close to the volume to be injected. To determine the volume of medication in the syringe, read it from the top of the plunger (see Figure 7.7)

Figure 7.4 Syringes of varying sizes

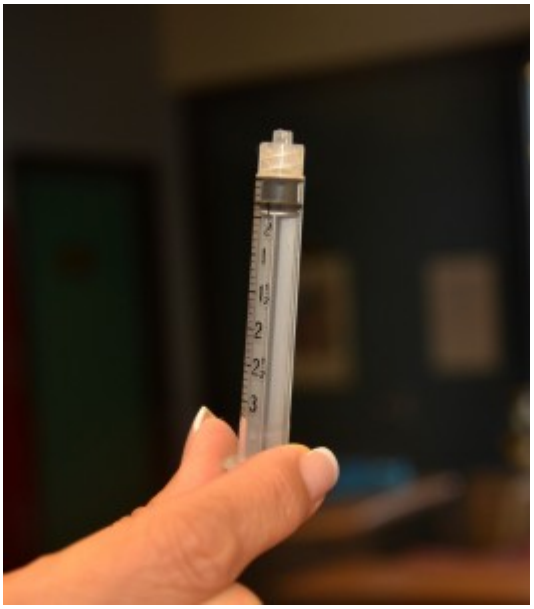


Figure 7.5 Syringe with Luer lock

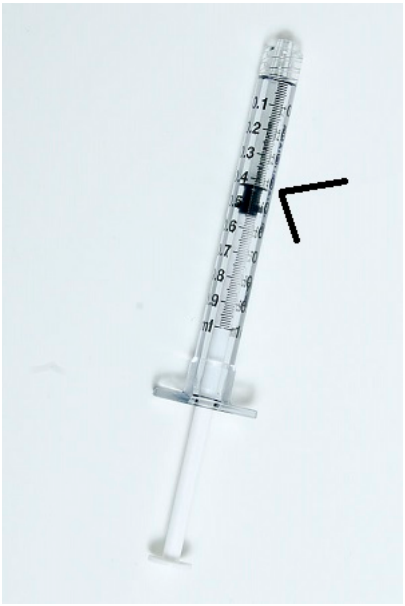


Figure 7.6 Read the volume of medication from the top of the plunger

It is important to use the correct syringe and needle for each injection. Unless given by pen or pump, insulin should only be given using an insulin syringe (see Figure 7.8). Insulin is ordered in units.

Figure 7.7 Insulin syringe with safety shield mechanism. Note the orange cap, as it is OFTEN associated with an insulin syringe / needle and thus has unit increments

Needles are made of stainless steel. They are sterile, disposable, and they come in various lengths and sizes. The needle is made up of the hub, shaft, and bevel (see Figure 7.2). The bevel is the tip of the needle that is slanted to create a slit into the skin. The shaft is the length of the needle. The hub fits onto the tip of the syringe (usually Luer locked). All three parts must remain sterile at all times. The length of the needle will vary from 1/8 in to 3 in, depending on the injection route. The **gauge of a needle** is the diameter of the needle. Gauges can vary from very small diameter (25 to 29

gauge) to large diameter (18 to 22 gauge). A needle will have its gauge and length marked on the outer packaging; choose the correct gauge and length for the injection ordered (Lynn, 2011). Blunt fill and blunt fill filter needles are used to prepare medications (Figure 7.8). They have a large gauge to make medication preparation easier. To reduce risk of needle stick injury, the nurse should use a needleless systems to prepare meds whenever possible (i.e., blunt fill and blunt fill filters) and choose needles with safety mechanisms attached.

Variety of needles with different gauges and lengths. Note only two of these have safety system technology as part of their structure.

Syringe with needle attached. Note the safety mechanism attached to the needle.

Figure: 7.9 Blunt fill and blunt fill filter needles are used for preparing meds ***NOT*** *for injecting into people*

Parenteral medications are supplied in sterile vials, ampules, and prefilled syringes. **Ampules** are glass containers in 1 ml to 10 ml sizes that hold a single dose of medication in liquid form. They are made of glass and have a scored neck to indicate where to break the ampule. Because there is

risk of being cut by glass when opening a glass ampule, the nurse should use an ampule breaker or wrap an alcohol swab package around the neck of the ampule for protection (See Figure 7.10, 7.11). A blunt fill needle with filter must be used when withdrawing medication to prevent glass particles from being drawn up into the syringe. Never use a filter needle to inject medication directly into a patient (Perry et al., 2018).

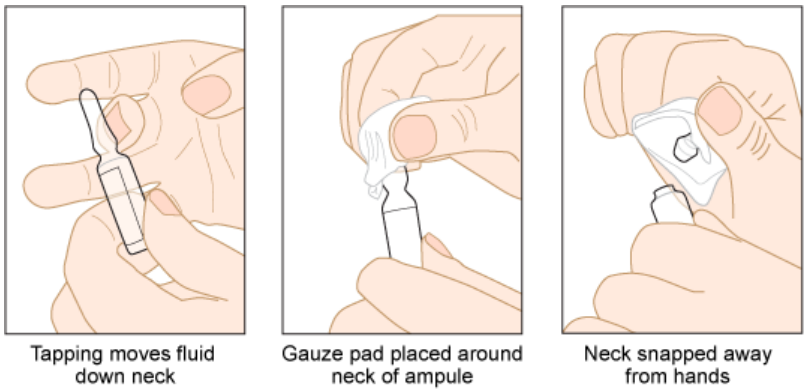
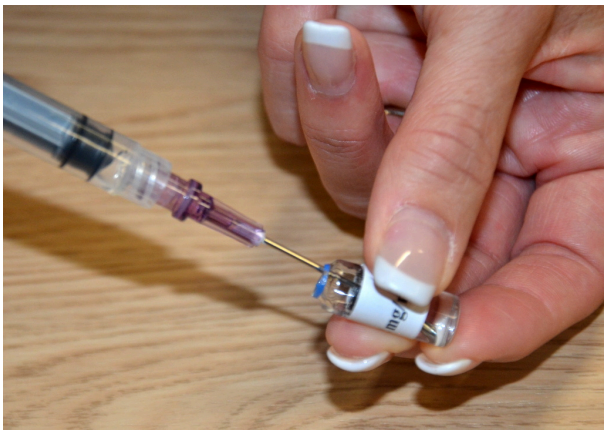


Figure 7.10 Breaking open an ampule with alcohol swab package around the neck of the ampule

Figure 7.11 Opening an ampule with an ampule breaker



Using a blunt fill filter needle to withdraw medication from an ampule

To better understand how to prepare medication from an ampule, watch the following video.

Watch the video *Preparing a Medication from an Ampule* developed by Renée Anderson and Wendy McKenzie Thompson Rivers University School of Nursing (2018).

A **vial** is a single- or multi-dose plastic container with a rubber seal top, covered by a metal or plastic cap (see Figure 7.12). A single-use vial must be discarded after one use; a multi-dose vial must be labelled with the date it was opened. Check hospital policy to see how long an open vial may be used. The vial is a closed system, and air must be injected into the vial to permit the removal of the solution (Perry et al., 2018) (see Figure 7.13).

Figure 7.12 Vial

Figure 7.13 Using a blunt fill needle to withdraw medication from a vial

Watch the video *Preparing Medications from a Vial* developed by Renée Anderson and Wendy McKenzie Thompson Rivers University School of Nursing (2018).

Reconstituting Medications

Some medications are supplied in powder form and require reconstitution before administration.

Watch the video *Reconstitution of Powdered* IV *Medication* & Administration via Mini – Bag by Renée

Anderson and Wendy McKenzie Thompson Rivers University School of Nursing (2018)

Critical Thinking Exercises

1. Describe three strategies the nurse might do to reduce distractions while preparing medication.
2. Identify three strategies the nurse should do to prevent infection associated with parenteral medication administration.
3. Identify five principles of safe medication administration.
4. Describe two strategies to prevent needle-stick injuries.

Attributions

Figure 7.1. Needle insertion angles for the 4 types of parenteral administration of medication: intramuscular, subcutaneous, intravenous and intradermal injection by BCIT is used under a CC BY 4.0 International license.

Figure 7.2. Disposable syringe and needle with parts labelled: plunger, barrel, needle adaptor, needle hub, needle bevel, needle shaft by BCIT is used under a CC BY 4.0 International license.

Figure 7.3. Medication label sample by author is licensed under a Creative Commons Attribution 4.0 International License.

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Figure 7.10. Opening an ampule with alcohol swab by BCIT is used under a CC BY 4.0 International license.

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Figure 7.12. A vial of the paralytic agent suxamethonium chloride by James Heilman is used under a CC BY-SA 3.0 unported license.

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7.3 Intradermal Injections

Intradermal injections (ID) are injections administered into the dermis, just below the epidermis. The ID injection route has the longest absorption time of all parenteral routes. These types of injections are used for sensitivity tests, such as TB (see Figure 7.14), allergy, and local anesthesia tests. The advantage of these tests is that the body reaction is easy to visualize, and the degree of reaction can be assessed. The most common sites used are the inner surface of the forearm and the upper back, under the scapula. Choose an injection site that is free from lesions, rashes, moles, or scars, which may alter the visual inspection of the test results (Lynn, 2011).

Equipment used for ID injections is a tuberculin syringe calibrated in tenths and hundredths of a millilitre, and a 1/4 to 1/2 in, 26 or 27 gauge needle. The dosage of an ID injection is usually under 0.5 ml. The angle of administration for an ID injection is 5 to 15 degrees. Once the ID injection is completed, a bleb (small blister) should appear under the skin. Checklist 57 outlines the steps to administer an intradermal injection.

Figure 7.14 TB syringe Note: this is a 1 ml syringe

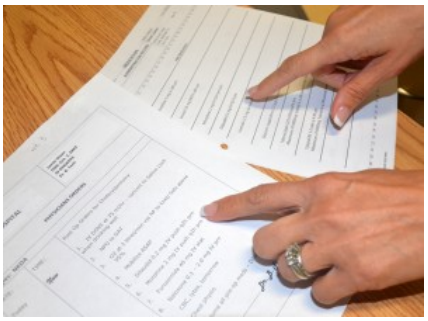
Checklist 57: Administering an Intradermal (ID) Injection

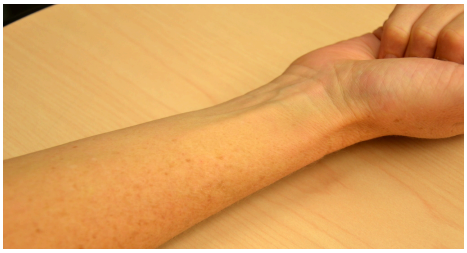
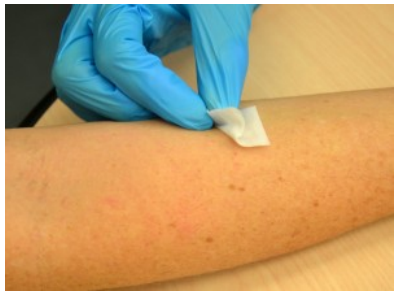
Disclaimer: Always review and follow your agency policy regarding this specific skill.

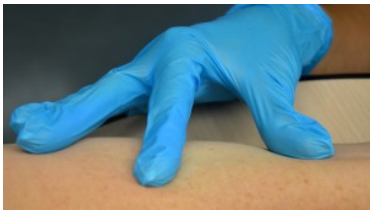
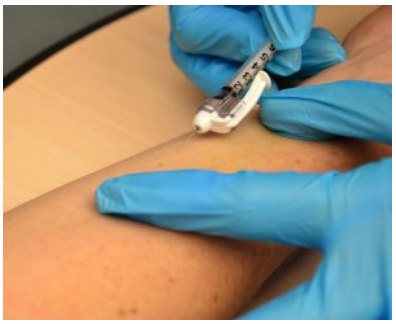
Safety Considerations:

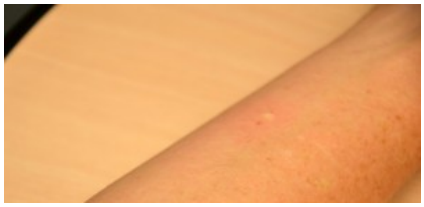
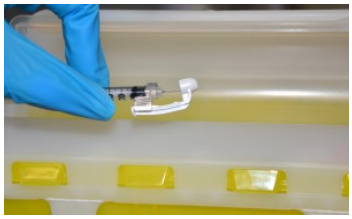
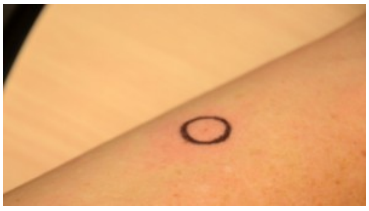
- Use your knowledge about pharmacokinetics and pharmacodynamics to determine the appropriateness of the ordered medication, dose, and route.
- Perform a point of care risk assessment for PPE.
- Always take steps to eliminate interruptions and distractions during medication preparation.
- Never leave medication unsupervised once prepared.
- If the patient expresses concerns about the medication or procedure, stop and explore the concerns. Re-verify order with physician if appropriate.
- Do not aspirate. It is not necessary to aspirate because the dermis is relatively without vessels.
- Whenever possible, choose needleless systems to prepare injectable medication.
- NEVER recap needles after giving an injection. Engage the needle's safety system and dispose in the closest sharps container.

Steps	*Additional Information*
1. Perform hand hygiene; gather supplies.	Supplies include: medication syringe & needle, non-sterile gloves, alcohol swab and sterile gauze, Band-Aid (if required).  *Required supplies*

2. Prepare medication or solution as per agency policy. This may include: • Checking physician orders and MAR to validate medication order. • Checking your agency's *Parenteral Drug Therapy Manual* (PDTM) about guidelines for administration. • Independent double check by a colleague.	Properly identifying medication decreases risk of inadvertently administering the wrong medication. Preparing medications correctly decreases risks to the patient.  *Comparing physician orders and MAR*
3. Enter room and introduce yourself, explain procedure and the medication, and allow patient time to ask questions.	Explaining rationale increases the patient's knowledge and reduces their anxiety.
4. Close the door or pull the bedside curtains.	This provides patient privacy.
5. Identify patient using at least two patient identifiers. Confirm with MAR; confirm allergies; explain procedure and the medication; allow the patient time to ask questions.	This ensures accuracy of the correct medication to the correct patient. Two patient identifiers used most often are patient name and date of birth.  *Compare MAR with patient wristband*
6. Reassess patient for any contraindications to the medications.	Assessment is a prerequisite for every medication given.

7. Select appropriate site for administration. Assist the patient to the appropriate position as required.	Site should be free from lesions, rashes, and moles. Selecting the correct site allows for accurate reading of the test site at the appropriate time.  *Assess site for ID injection*
8. Perform hand hygiene and apply non-sterile gloves.	Gloves help prevent exposure to BBF.  *Apply non-sterile gloves*
9. Clean the site with an alcohol swab or antiseptic swab. Use a firm, circular motion. Allow the site to dry.	The needle poke opens the skin allowing pathogens to enter. Cleaning the skin reduces pathogens. Allowing the antiseptic to dry renders it effective. In addition, wet alcohol on the skin during injection can be irritating and uncomfortable.  *Clean injection site*

10. Remove needle from cap by pulling it off in a straight motion.	This decreases risk of accidental needle-stick injury.  *Remove needle from cap*
11. Using non-dominant hand, spread the skin taut over the injection site.	Taut skin provides easy entrance for the needle.  *Hold skin taut prior to injection*
12. Hold the syringe in the dominant hand between the thumb and forefinger, with the bevel of the needle up.	This allows for easy handling of the syringe.  *Hold needle with bevel up*
13. Hold syringe at a 5- to 15-degree angle from the site. Place the needle almost flat against the patient's skin, bevel side up, and insert needle into the skin. Insert the needle only about 1/4 in, with the entire bevel under the skin.	Keeping the bevel side up allows for smooth piercing of the skin and induction of the medication into the dermis.

14. Once syringe is in place, slowly inject the solution while watching for a small weal or bleb to appear.	The presence of the weal or bleb indicates that the medication is in the dermis.  *Presence of a bleb (white raised circle)*
15. Withdraw the needle at the same angle as insertion, engage safety shield or needle guard, and discard in a sharps container. Do not massage area after injection.	Withdrawing at the same angle as insertion minimizes discomfort to the patient and damage to the tissue. Proper needle disposal prevents needle-stick injuries.  *Discard syringe in sharps container* Massaging the area may spread the solution to the underlying subcutaneous tissue. Gently pat with sterile gauze if blood is present.
16. If injection is a TB skin test, circle the area around the injection site to allow for easy identification of site in three days.	 *Draw circle around injection site*

17. Discard remaining supplies, remove gloves, and perform hand hygiene.	This prevents the spread of microorganisms.  *Hand hygiene with ABHR*
18. Document the procedure and findings according to agency policy.	Proper documentation helps ensure patient safety. Document time, date, location, and type of medication injected.
19. Evaluate the patient response to injection within appropriate time frame.	The patient will need to be evaluated for therapeutic and adverse effects of the medication or solution.
Data source: Berman & Snyder, 2016; Brookside Associates, 2015a; Clayton, Stock, & Cooper, 2010; Perry et al., 2018	

7.4 Subcutaneous Injections

Subcutaneous (SC) injections are administered into the adipose tissue layer just below the epidermis and dermis. This tissue has few blood vessels, so drugs administered by this route have a slow, sustained rate of absorption. Sites for SC injections include the outer aspect of the upper arm, the abdomen (from below the costal margin to the iliac crest) within one inch of the belly button, anteriolateral aspects of the thighs, and upper ventral gluteal area (Lynn, 2011) (see Figure 7.15).

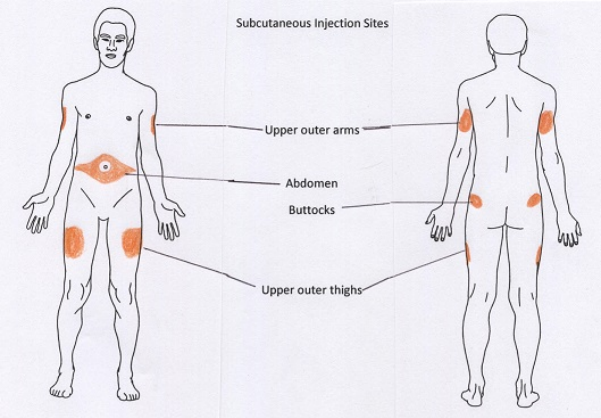


Figure 7.15 Subcutaneous injection sites

Choose a site that is free of skin lesions and bony prominences. Rotate sites for most SC medications (see note about insulin below) to prevent the formation of lipohypertrophy or lipoatrophy in the skin. Physical exercise or application of hot or cold compresses influences the rate of drug absorption by altering local blood flow to the tissues. Any condition that impairs that blood flow to the subcutaneous tissue contradicts the use of subcutaneous injections. Examples of subcutaneous medications include insulin, opioids, heparin, epinephrine, and allergy medication (Perry et al., 2018).

To administer an SC injection, a 25 to 30 gauge, 3/8 in to 5/8 in needle is used. Some subcutaneous injections come prefilled with the syringe attached. Always confirm that the right-size needle is appropriate for the patient before use. Subcutaneous injections are usually given at a 45- to 90-degree angle. The angle is based on the amount of subcutaneous tissue present. Generally, give shorter needles at a 90-degree angle and longer needles at a 45-degree angle (Lynn, 2011). SC injections do not need to be aspirated, as the likelihood of injecting into a blood vessel is small. Lynne (2011) suggests that no more than 1 ml of medication is given subcutaneously, as larger amounts may cause discomfort to the patient and may not be absorbed appropriately. Other sources suggest up to 1.5 ml can be injected at once (Perry et al, 2018). Given that, the nurse will have to judge each individual situation.

There are varying opinions on whether to pinch the skin during administration. Pinching is advised for thinner patients in order to lift the adipose tissue up and away from the underlying muscle and tissue. If pinching is used, release the pinch when the needle is inserted to avoid injecting into compressed tissue. Note, too, that elevating or pinching the skin has been found to increase the risk of injury, as the needle may pierce the opposite side of the skin fold and enter the skin of the health care worker (Black, 2013). The abdomen is the best location for an SC injection if a patient

has little peripheral SC tissue. If patient is obese, use a needle that is long enough to insert through the tissue at the base of the skin fold (Perry et al., 2018).

Insulin SC Injections

Insulin is considered a high-risk medication, and special care must be taken to ensure the correct amount of medication and type of insulin is administered at the correct time. As well, safety checks related to a patient receiving SC insulin should be carried out (Ellis & Parush, 2012). Table 7.4 lists specific guidelines for administering insulin.

Table 7.4 Guidelines for Administering SC Insulin	
Insulin	*Additional Information*
Insulin is considered a high-risk medication.	Special care must be taken to ensure the correct amount of medication and type of insulin is administered, at the correct time. It is highly recommended to always have an independent double check prior to insulin administration. Always follow the standard for medication preparation at your agency.
There are specific syringes for insulin	Insulin syringes have a needle attached. Insulin is always ordered and administered in units, based on a blood sugar reading and a diabetic insulin protocol (or sliding scale). Some hospitals have preprinted physician orders, and some hospitals have handwritten orders. Insulin syringes can come in 30-, 50-, or 100-unit measurements. Always read the increments (calibration) carefully.

Insulin can also be administered via other devices

Figure 7.16 Insulin delivery devices

Insulin pens are one method for insulin administration. The pen consists of a syringe (pen), needle, and prefilled cartridge of insulin. It is essential that patients be taught how to use injection pens so they understand the technology. One pen per person to avoid risk of BBF exposure. The needle has to be primed prior to administration. In hospital settings, needles with safety systems must be used. Due to the expense, persons using insulin pens at home can opt for a less expensive needle that doesn't have the safety system in place.

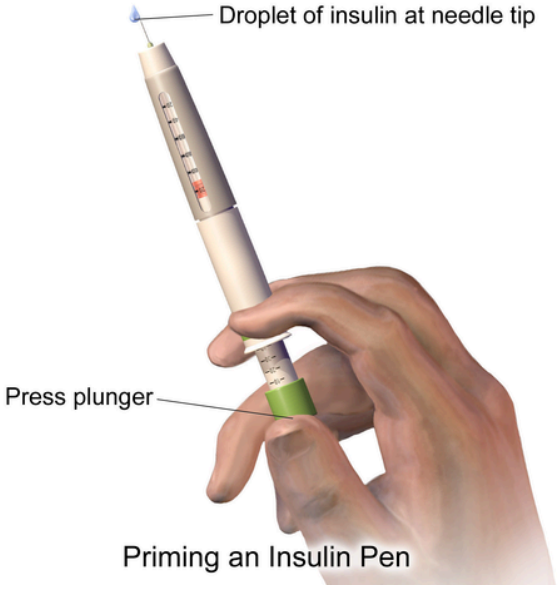
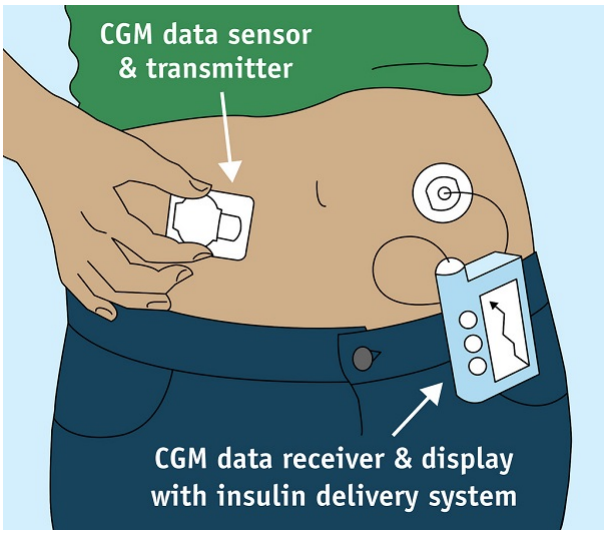


Figure 7.17 Priming an insulin pen.

A **mini-infusion pump** is a battery-operated machine that delivers medications in very small amounts to patients with controlled infusion times. The most common types of mini-infusion sets are insulin pumps or subcutaneous infusion devices. For more information on mini-infusion sets and volume-controlled sets, see Suggested Online Resources in section 7.9.

	 *Figure 7.18 Insulin pump and continual glucose monitoring (CMG) device*
There are different types of insulin.	There are rapid-, short-, intermediate-, mixed-, and long-acting insulins. For each type of insulin, it is important to know how the insulin works and the onset, peak, and duration of the insulin. Recognizing and responding to hypoglycemia is essential.
Administering two different types of Insulin.	If a patient is ordered two types of insulin, some insulins may be mixed together in one syringe. Many insulins MAY NOT be mixed together. Do not mix Lantus (Glargine) or Levemir (Determir). If administering cloudy insulin preparations (Humulin – N), gently roll the vial between the palms of your hands to re-suspend the medication. To get into good habit, always draw up the short acting (clear) insulin before the cloudy insulin. You cannot contaminate either vial. If too much insulin is drawn up from the second vial, discard syringe and start again. Insulin orders may change daily and even throughout the day. Always ensure the most current orders are being followed.
Know about rotating injection sites.	Injection site rotation is no longer necessary, as newer insulins have a lower risk for hypertrophy of the skin. Typically, a patient will pick one anatomic area (e.g., upper arm) and rotate the injection sites within that region to maintain consistent insulin absorption from day to day. Insulin absorption rates vary from site to site. The abdomen absorbs the fastest, followed by the arms, thighs, and buttocks.
Know when to administer insulin.	Insulin dosing is often based on blood glucose levels. Knowing the onset, peak, and duration of insulin is critical to helping the patient to maintain normoglycemic levels. If giving insulin, always ensure the patient is not nauseated, is able to eat, and that food is arriving before the insulin starts working. Typically, short- or rapid-acting insulin is given 10 to 15 minutes before meals. Intermediate- or long-acting insulin may be given twice daily, at breakfast and dinner or breakfast and bedtime.

Measure blood sugar levels and food intake.	Insulin injections are based on blood sugar values and on when the patient will eat. The timing of an insulin injection is critical to ensure the patient maintains normal blood glucose levels.
Data source: Canadian Diabetes Association, 2013; Perry et al., 2018	

Special considerations:

- Insulin is stored in the refrigerator. When a vial is in use, it should be at room temperature. Do not administer cold insulin. Check agency policy for how long a vial can be used after being opened. It is usually 30 days.
- Patients who take insulin should monitor their blood sugar (glucose) levels as prescribed by their health care provider.
- Vials of insulin should be inspected prior to use. Any change in appearance may indicate a change in potency.
- Use the type of insulin prescribed. Do not change the type unless ordered by a health care provider.
- Allow patient to choose site for injection. A patient may self-administer insulin if it's determined to be safe and in the patient's best interest.
- All health care providers should be aware of the signs and symptoms of hypoglycemia. Signs and symptoms include fruity breath, restlessness, agitation, confusion, slurring of words, clammy skin, inability to concentrate or follow commands, hunger, and nausea. The patient may complain of blurred or double vision. Late signs include unconsciousness. Hypoglycemia is a medical emergency. Always have an emergency diabetic kit available. If a conscious diabetic patient appears to be hypoglycemic or has a blood sugar (glucose) reading of 4 mmol/L or lower, give glucose, such as sucrose tablets, solution, or juice. Follow agency policy regarding hypoglycemic reactions.

Heparin SC Injections

Heparin is an anticoagulant used to reduce the risk of thrombosis formation by suppressing clot formation (Perry et al., 2018). Heparin is also considered a high-alert medication (ISMP, 2014).

Table 7.5 provides specific guidelines to consider before and after administering heparin.

Table 7.5 Guidelines for Administering SC Heparin	
Heparin	*Additional Information*
Heparin is considered a high-risk medication.	Heparin is available in vials and prefilled syringes in a variety of concentrations. Because of the dangerous adverse effects of the medication, it is considered a high-risk medication. Always follow agency policy regarding the preparation and administration of heparin.
Rotate heparin injection sites.	It is important to rotate heparin sites to avoid bruising in one location. To minimize bruising and pain associated with heparin injections, they can be given in the abdominal area, at least 5 cm away from the belly button.
Know the risks associated with heparin.	There are many risks associated with the administration of heparin, including bleeding, hematuria, hematemesis, bleeding gums, and melena.
Review lab values.	Review lab values (PTT and aPTT) before and after heparin administration.
Use prepackaged heparin syringes.	Many agencies use prepackaged heparin syringes. Always follow the standards for safe medication administration when using prefilled syringes. Low molecular weight heparin (LMWH) is more effective in some patients.
Assess patient conditions prior to administration.	Some conditions increase the risk for hemorrhage (bleeding), such as recent childbirth, severe diabetes, severe kidney and liver disease, severe traumas, cerebral or aortic aneurysm, cerebral vascular accidents (CVA), blood dyscrasias, and severe hypotension.
Assess medications prior to administration.	Over-the-counter (OTC) herbal medications, such as garlic, ginger, and horse chestnut, may interact with heparin. Additional medications that may interact include Aspirin, NSAIDS, cephalosporins, anti-thyroid agents, thrombolytics, and probenecids.
Data source: Clayton et al., 2010; Ogston-Tuck, 2014b; Perry et al., 2018	

Checklist 58 provides the steps to complete a subcutaneous injection.

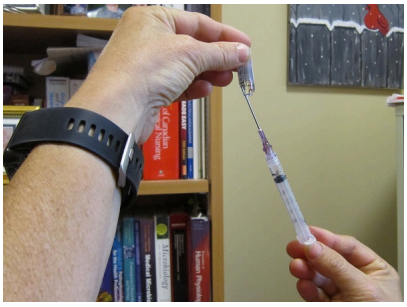
Checklist 58: Administering a Subcutaneous Injection

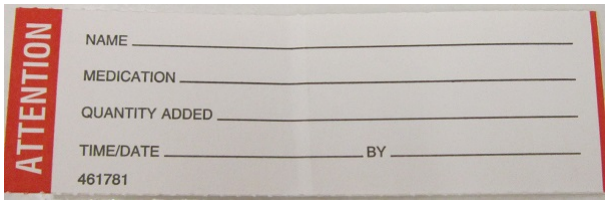
Disclaimer: Always review and follow your agency policy regarding this specific skill.

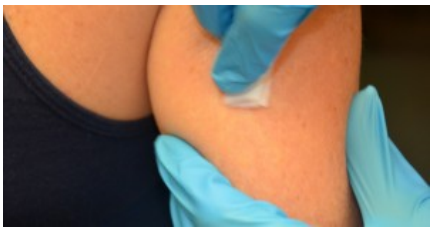
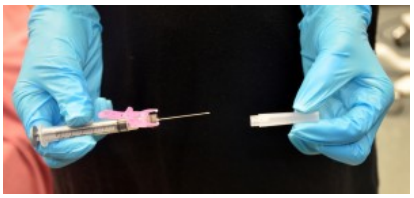
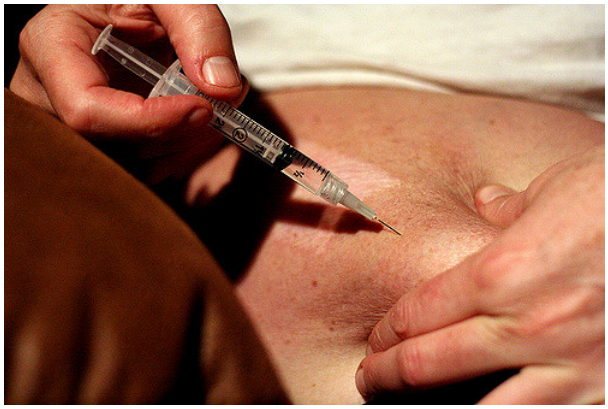
Safety considerations:

- Use your knowledge about pharmacokinetics and pharmacodynamics to determine the appropriateness of the ordered medication , dose and route.
- Perform a point of care risk assessment for PPE.
- Take all necessary steps to avoid interruptions and distractions when preparing and administering medications.
- Never leave the medication unsupervised once prepared.
- Whenever possible choose needleless systems to prepare injectable medications.
- If the patient expresses concern or questions the medication, always stop and explore the patient's concerns and verify the order if necessary
- Do not aspirate (pull back on the plunger) prior to injection.
- Review lab values and assessment data prior to injection.
- Avoid sites that are bruised, tender, hard, or swollen.
- Be vigilant when preparing and administering high-alert medications.
- Never recap needles after giving an injection. Engage the needle's safety system and dispose in the nearest sharps container.

Steps	*Additional Information*
1. Perform hand hygiene; gather supplies.	Supplies include: medication, syringe, injection needle, blunt fill or blunt fill filter needle, injection needle with safety system attached, alcohol swabs, ampule breaker (if necessary), MAR

2. Prepare medication as per agency policy. This may include: • Check physician orders and MAR to validate medication order. • Verify MAR (patient, medication, dose, route, last time of administration). • Check your agency's *Parenteral Drug Therapy Manual* (PDTM) about guidelines for administration. • Independent double check by a colleague. • Label the syringe.	 *Figure 7.19 Preparing a SC injection from an ampule* Properly identifying the medication decreases risk of med error. Agency protocols are in place to increase patient safety. Follow principles of asepsis to reduce risk of contaminating medication.
3. Check expiry date and check for particulates, discoloration, or loss of integrity (sterility).	Discolored or outdated medication may be harmful. If a medication is discolored or cloudy, always check manufacturer's specification for the medication.
4. Prepare the medication from the ampule or vial.	Re-watch the videos: *Preparing Medications from a Vial*; *Preparing Medications from an Ampule* developed by Renée Anderson and Wendy McKenzie (2018) of TRU School of Nursing. If you have more than 1.5 ml to administer , give via 2 separate injections. Consider consulting the pharmacy for a different concentration that may allow a smaller volume to be administered in one injection.

5. Label the syringe.	Medication prepared away from the bedside must be labelled with two patient identifiers, medication, dose, date and time of preparation, and initials of the nurse to decrease the risk of med error.  *Medication label sample*
6. Perform hand hygiene. Enter room and introduce yourself. Identify patient using two acceptable identifiers, explain procedure and the medication, and allow patient time to ask questions.	Hand hygiene reduces transmission of microorganisms. Confirming patient identity reduces risk of med error. Explaining rationale increases the patient's knowledge and may reduce any anxiety. Let the patient know there may be mild temporary burning at the injection site.
7. Close the door or pull the bedside curtains.	This provides patient privacy.
8. Reassess patient for any contraindications for the medications.	Assessment is a prerequisite to the administration of any medication.
9. Wear non-sterile gloves (if appropriate).	Gloves prevent exposure to BBF.
10. Select appropriate site for administration. Assist the patient to the appropriate position as required.	Site should be free from lesions, rashes, and moles. Choosing the correct site allows for accurate reading of the test site at the appropriate time.

11. Clean the site with an alcohol swab or antiseptic swab (according to agency policy). Use a firm, circular motion. Allow the site to dry.	 *Clean site with alcohol* Allowing the site to dry renders the antiseptic effective and prevents stinging during the injection.
12. Remove needle cap by pulling it straight off the needle. Hold the syringe between thumb and forefinger on dominant hand, pulling it straight off.	This technique lessens the risk of an accidental needle-stick injury.  *Pulling cap off of needle*
13. Grasp or pinch the area surrounding the injection site to create a skin fold if there is little adipose tissue.	The decision to create a skin fold is based on the nurse's assessment of the patient and the needle length used. Pinching is advised for thinner patients.  *Figure 7.20 Subcutaneous injection site abdomen*

14. Hold the syringe in the dominant hand between the thumb and forefinger. Insert the needle quickly at a 45- to 90-degree angle.	Inserting quickly causes less pain to the patient. Subcutaneous tissue is abundant in well-nourished, well-hydrated people. For patients with little subcutaneous tissue, it is best to insert the needle at a 45-degree angle.
15. After the needle is in place, release the tissue. Move your non-dominant hand to steady and lower the end of the needle. With your dominant hand, inject the medication at a rate of 10 seconds per ml. Avoid moving the syringe.	Keeping the needle steady helps keep the needle in place. With practice, you will likely be able to manage just using your dominant hand for injecting and holding the needle steady simultaneously.
16. Withdraw the needle quickly at the same angle at which it was inserted, while supporting the surrounding tissue with your non-dominant hand. Engage the needle's safety system immediately.	Withdrawing at the same angle prevents tissue damage and increased pain at the injection site. Engaging the safety system immediately reduces risk of needle stick injury and exposure to BBF.
17. Using an alcohol swab or sterile gauze, apply gentle pressure at the site after the needle is withdrawn. Do not massage the site.	Massage is not necessary and can damage underlying tissue. Massaging after a heparin injection can contribute to the formation of a hematoma.
18. Dispose of supplies; remove gloves and perform hand hygiene.	This reduces the risk of infection and the spread of microorganisms.  *Hand hygiene with* ABHR
19. Document procedure and findings according to agency policy.	Timely documentation ensures patient safety.
20. Evaluate patient response to medication.	It is important to evaluate the therapeutic effect of the medication and assess for adverse effects.
Data source: Berman & Snyder, 2016; Brookside Associates, 2015b; Clayton et al., 2010; National Institute of Health Clinical Center, 2015; Ogston-Tuck, 2014b; Perry et al., 2018	

Watch the video *Administering a Subcutaneous Injection* developed by Renée Anderson and Wendy McKenzie (2018) of TRU School of Nursing.

Indwelling Subcutaneous Devices

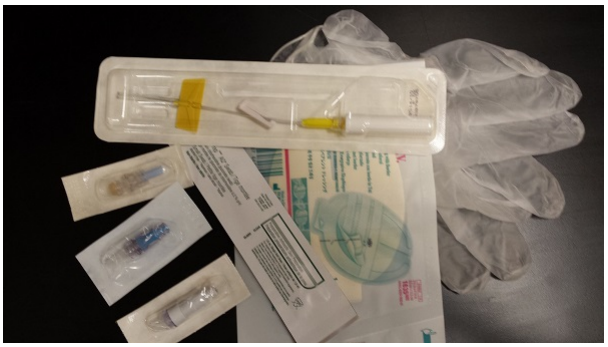


Figure 7.21 Indwelling SC device supplies

If a patient requires frequent SC injections, inserting a device that remains in place can significantly reduce the number of needle pokes (thus discomfort for the patient). Likewise a SC infusion of IV fluids and/or medications may require the placement of an indwelling device.

Different brands of indwelling SC devices are on the market. Check your agency for specific directions about insertion, time between changes, and medication administration via an indwelling device.

Some general considerations for SC indwelling devices include:

- They can promote patient comfort by reducing the number of needle pokes.
- They reduce risk of needle sticks / exposure to BBF by the health care professional (Dawkins et al., 2000, as cited in Becton, Dickinson, 2013).
- They are inserted following principles of asepsis, and the sites dressed according to agency protocol. A semi-permeable transparent dressing allows frequent and accurate assessment of the insertion site.
- How long an indwelling SC device remains in situ will depend on many factors including patient characteristics, volume of fluid infused, medication, and integrity of the site.
- Sites should be rotated to prevent tissue damage. This includes:
    - every 7 days and as needed for intermittent medication administration. Some sites advise up to 14 days (RCH, 2014). Check your agency protocol.
    - every 24 to 48 hours or after 1.5 to 2 litres of solution has infused (Saskatchewan Health Authority, 2018).
- Sites that are red, tender, edematous, bruised, bleeding, burning, leaking, have blood in the tubing and/or have a displaced cannula need to be removed and re-established.
- Each site is designated for one particular purpose (i.e., one medication only per site).
- When used for intermittent medication administration, because there is a small volume associated with the device called the dead space, the initial dose must include a larger volume to account for the volume in the dead space after the first dose is administered. Check your agency protocols to determine this volume (Saskatchewan Health Authority,

2018; RCH, 2014)

- Each site is labelled with the date it was initiated, the medication name and concentration used, and the nurse's initials
- If necessary, change the end cap to one that can be accessed without needles.

Watch the video *Insertion of an Indwelling Subcutaneous Device* developed by Renée Anderson and Wendy McKenzie (2018) of TRU School of Nursing.

Critical Thinking Exercises

1. Name four nursing considerations specific to SC insulin administration.
2. Describe two situations where an indwelling subcutaneous device is warranted.
3. Name four safety considerations associated with giving meds via an indwelling subcutaneous device.

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7.5 Intramuscular Injections

Intramuscular (IM) injections deposit medications into the muscle. The rich blood supply, allows medications to be absorbed faster through muscle fibres than through the subcutaneous route (Malkin, 2008; Ogston-Tuck, 2014a; Perry et al., 2018). The IM site is used for medications that require a quick absorption rate but also a reasonably prolonged action (Rodgers & King, 2000). Due to their rich blood supply, IM injection sites can absorb larger volumes of solution, which means a range of medications, such as sedatives, anti-emetics, hormonal therapies, analgesics, and immunizations, can be administered. In addition, muscle tissue is less sensitive than subcutaneous tissue to irritating solutions and concentrated and viscous medications (Greenway, 2014; Perry et al., 2018; Rodgers & King, 2000).

The technique of IM injections has changed over the past years due to evidence-based research and changes in equipment available for the procedure. An IM site is chosen based on the age and condition of the patient, and the volume and type of medication injected. When choosing a needle size, factors to be considered include the weight of the patient, age, amount of adipose tissue, medication viscosity, and injection site (Hunter, 2008; Perry et al., 2018; Workman, 1999).

Intramuscular injections must be done carefully to avoid complications. Complications with IM include muscle atrophy, injury to bone, cellulitis, sterile abscesses, pain, and nerve injury (Hunter, 2008; Ogston-Tuck, 2014a). With IMs, there is slight risk of injecting the medication directly into the patient's bloodstream. In addition, any factors that impair blood flow to the local tissue will affect the rate and extent of drug absorption. Because of the adverse and documented effects of pain associated with IM injections, nurses are encouraged to consider other routes first and use the IM route of administration as a last alternative (Perry et al., 2018).

Sites for intramuscular injections include the ventrogluteal, vastus lateralis, and the deltoid site. Literature shows inconsistency in the selection of sites for deep muscular injections: selection may be based on familiarity and confidence rather than on "best practice" (Ogston-Tuck, 2014a). However, there is sufficient evidence that the ventrogluteal IM site is the preferred site whenever possible, and it is an acceptable site for oily and irritating medications. The ventrogluteal site is free from blood vessels and nerves, and it has the greatest thickness of muscle when compared to other sites (Cocoman & Murray, 2008; Malkin, 2008; Ogston-Tuck, 2014a).

A longer needle with a larger gauge is required to penetrate deep muscle tissue. The needle is inserted at a 90-degree angle perpendicular to the patient's body, or at as close to a 90-degree angle as possible. Use a quick, darting motion when inserting the needle.

Aspiration refers to the action of pulling back on the plunger for five seconds prior to injecting

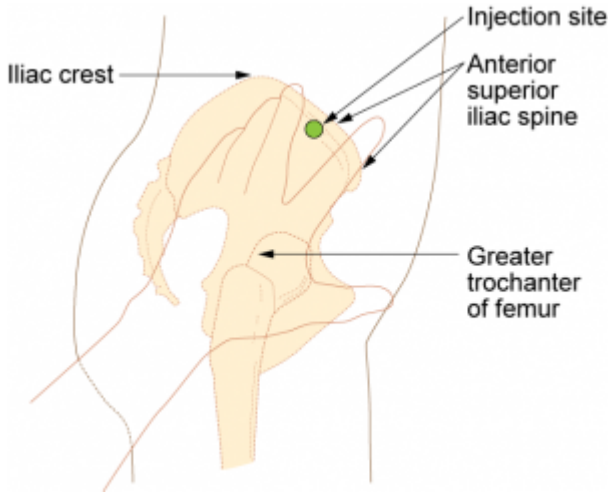
medication (Ipp, Sam, & Parkin, 2006). Lack of blood in the syringe confirms that the needle is in the muscle and not in a blood vessel. If blood is aspirated, remove the needle, discard it appropriately, and re-prepare and administer the medications (Perry et al., 2014). While aspirating during IM injections is a widespread practice, recent research has found that there is no evidence to support the practice of aspiration (Canadian Agency for Drugs and Technologies in Health, 2014; Greenway, 2014; Sepah, Samad, Altaf, Rajagopalan, & Khan, 2014; Sisson, 2015). This research has not become widespread, and as such nurses are encouraged to consult their agency policy about aspirating when giving an IM injection. Vaccinations and immunizations given by IM injections are never aspirated (Centers for Disease Control, 2015).

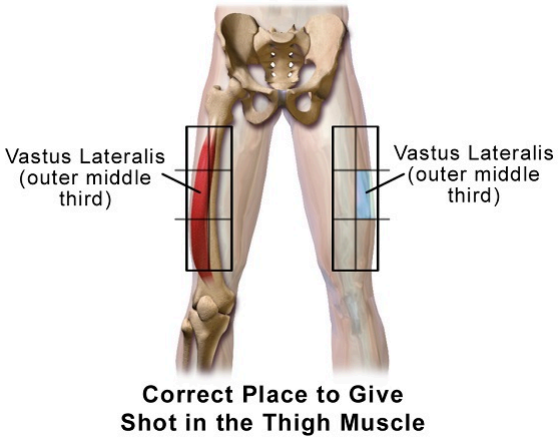
The **Z-track method** is a method of administrating an IM injection that prevents the medication being tracked through the subcutaneous tissue, sealing the medication in the muscle and minimizing irritation from the medication. Using the Z-track technique, the skin is pulled laterally, away from the injection site, before the injection; then the medication is injected, the needle is withdrawn, and the skin is released (Lynn, 2011).

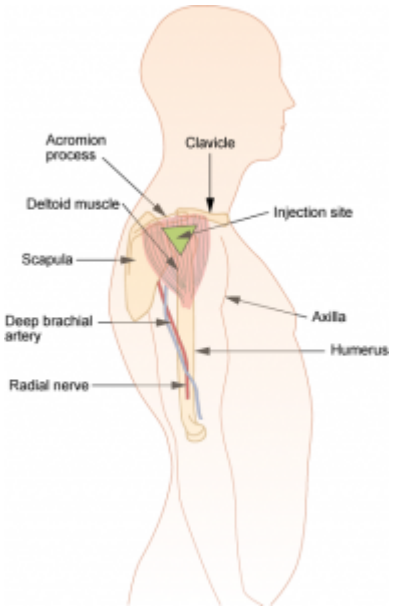
IM Injection Sites

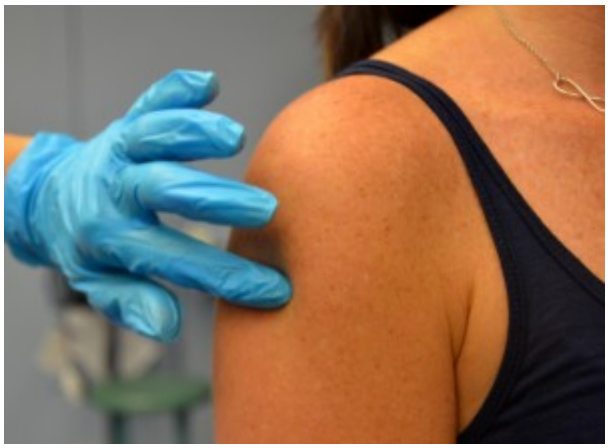
Table 7.6 describes the three injection sites for IM injections.

Table 7.6 Intramuscular Injection Sites	
Site	*Additional Information*

Ventrogluteal	The site involves the gluteus medius and minimus muscle and is the safest injection site for adults and children. The site provides the greatest thickness of gluteal muscles, is free from penetrating nerves and blood vessels, and has a thin layer of fat. To locate the ventrogluteal site, place the patient in a supine or lateral position (on their side). The right hand is used for the left hip, and the left hand is used for the right hip. Place the heel or palm of your hand on the greater trochanter, with the thumb pointed toward the belly button. Extend your index finger to the anterior superior iliac spine and spread your middle finger pointing towards the iliac crest. Insert the needle into the V formed between your index and middle fingers. This is the preferred site for all oily and irritating solutions for patients of any age. Needle gauge is determined by the solution. An aqueous solution can be given with a 20 to 25 gauge needle. Viscous or oil-based solutions can be given with 18 to 21 gauge needles. The needle length is based on patient weight and body mass index. A thin adult may require a 16 mm to 25 mm (5/8 to 1 in) needle, while an average adult may require a 25 mm (1 in) needle, and a larger adult (over 70 kg) may require a 25 mm to 38 mm (1 to 1 1/2 in) needle. Children and infants will require shorter needles. Refer to the agency policies regarding needle length for infants, children, and adolescents. For the ventrogluteal muscle of an average adult, give up to 3 ml of medication.  *Figure 7.22 Ventrogluteal intramuscular injection site*

Vastus lateralis	The vastus lateralis is commonly used for immunizations in children from infants through to toddlers. The muscle is thick and well developed. This muscle is located on the anterior lateral aspect of the thigh and extends from one hand's breadth above the knee to one hand's breadth below the greater trochanter. The middle third of the muscle is used for injections. The width of the muscle used extends from the mid-line of the thigh to the mid-line of the outer thigh. To help relax the patient, ask the patient to lie flat with knees slightly bent, or have the patient in a sitting position. The length of the needle is based on the patient's age, weight, and body mass index. In general, the recommended needle length for an adult is 25 mm to 38 mm (1 to 1 1/2 in). The gauge of the needle is determined by the type of medication administered. Aqueous solutions can be given with a 20 to 25 gauge needle; oily or viscous medication should be administered with 18 to 21 gauge needles. A smaller gauge needle (22 to 25 gauge) should be used with children. The length will be shorter for infants and children; see agency guidelines.  *Figure 7.23 Vastus lateralis IM injection site* The maximum amount of medication for a regular sized adult single injection is 3 ml.

Deltoid muscle	The deltoid muscle has a triangular shape and is easy to locate and access, but is commonly underdeveloped in adults. Begin by having the patient relax the arm. The patient can be standing, sitting, or lying down. To locate the landmark for the deltoid muscle, expose the upper arm and find the acromion process by palpating the bony prominence. The injection site is in the middle of the deltoid muscle, about 2.5 to 5 cm (1 to 2 in) below the acromion process. To locate this area, lay three fingers across the deltoid muscle and below the acromion process. The injection site is generally three finger widths below, in the middle of the muscle. Select needle length based on age, weight, and body mass. In general, for an adult male weighing 60 to 118 kg (130 to 260 lbs), a 25 mm (1 in) needle is sufficient. For women under 60 kg (130 lbs), a 16 mm (5/8 in) needle is sufficient, while for women between 60 and 90 kg (130 to 200 lbs), a 25 mm (1 in) needle is required. A 38mm (1.5 in) length needle may be required for women over 90 kg (200 lbs) for a deltoid IM injection. Refer to agency policy regarding specifications for infants, children, adolescents, and immunizations. The maximum amount of medication for a single injection is generally 1-2 ml but you have to take into account the size of the muscle mass. For immunizations, a smaller 22 to 25 gauge needle should be used.  *Figure 7.24 Deltoid intramuscular injection site*

	 *Deltoid IM injection site*
Data source: Berman & Snyder, 2016; Davidson & Rourke, 2014; Ogston-Tuck, 2014a; Perry et al., 2018	

Special considerations:

- Avoid muscles that are emaciated or atrophied; they will absorb medications poorly.
- IM injection sites should be rotated to decrease the risk of hypertrophy.
- Older adults and thin patients may only tolerate up to 1 ml in a single injection.
- Choose a site that is free from pain, infection, abrasions, or necrosis.
- NEVER give an IM injection in the dorsogluteal muscle. If a needle hits the sciatic nerve, the patient may experience partial or permanent paralysis of the leg.

IM Injections

Consider the type of medication and the volume to be injected, the client's age, general health condition, and size when selecting an IM site. Rotate IM sites to avoid complications. Potential complications include lingering pain, tissue necrosis, abscesses, and injury to blood vessels, bones, or nerves. If administering a vaccination, always refer to the vaccination guidelines for site selection. The Z-track method is recommended to administer IM injections as a way to reduce

local tissue irritation (Astle & Duggleby, 2019). It involves displacing the top tissue layers 2.5 to 3.5 cm laterally prior to inserting the needle. After the injection is given, the needle removed and the skin released, the zig-zag path seals the needle track thus preventing the medication from leaking out and irritating tissues. Checklist 59 outlines the steps to perform a Z-track IM injection.

Checklist 59: Administering a Z -Track Intramuscular Injection

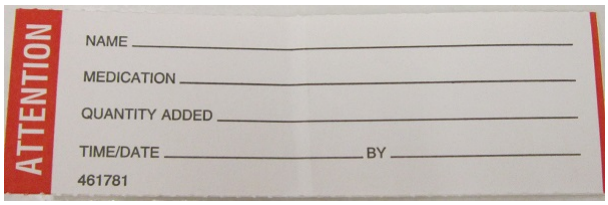
Disclaimer: Always review and follow your agency policy regarding this specific skill.

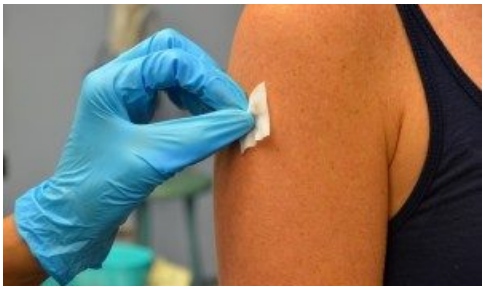
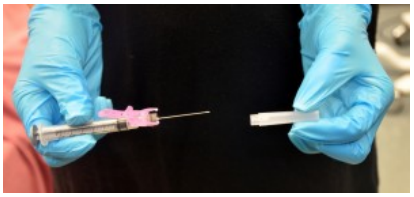
Safety considerations:

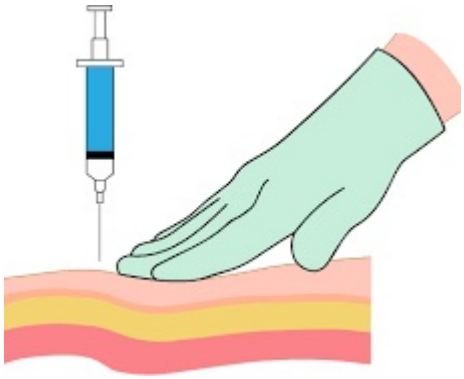
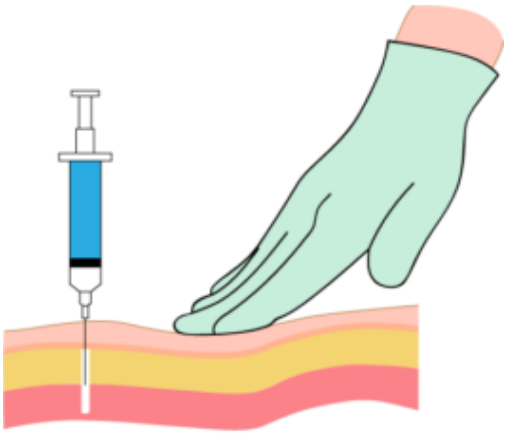
- Use your knowledge about pharmacokinetics and pharmacodynamics to determine the appropriateness of the ordered medication, dose, and route.
- Ensure there are no contraindications for this particular patient to receive an IM injection (e.g., circulatory shock, bleeding disorders, anticoagulants).
- Perform a point of care risk assessment. Always wear gloves to administer IM injections, as there is potential for contact with blood and body fluids.
- Take all necessary steps to avoid interruptions and distractions when preparing and administering medications.
- Never leave the medication unsupervised once prepared.
- If a patient expresses concern or questions the medication, always stop and explore the patient's concerns and verifying the order if necessary.
- If required by agency policy, aspirate for blood prior to administering an IM medication.
- Upon injection, if a patient complains of radiating pain, burning, or a tingling sensation, remove the needle and discard.
- Whenever possible, chose needleless systems to prepare injectable medication.
- NEVER recap needles after giving an injection. Engage the needle's safety system and dispose in the closest sharps container.

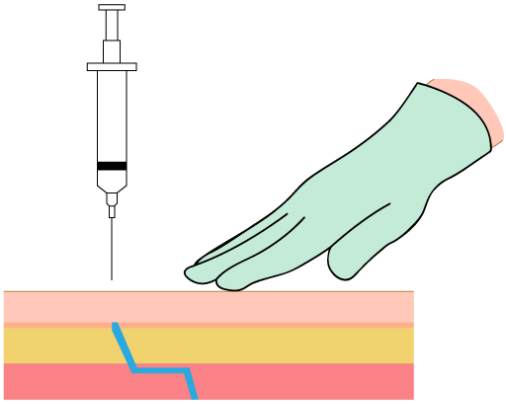
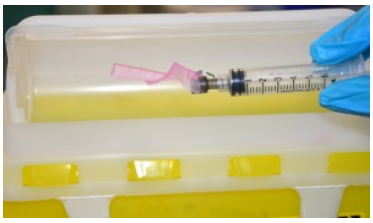
Steps	*Additional Information*

1. Perform hand hygiene. Gather supplies.	Supplies include: medication syringe, blunt or blunt fill needle, injection needle with safety system attached, alcohol swab, ampule breaker (if necessary), MAR  *Figure 7.25 Supplies for IM injection (vial)*
2. Prepare medication as per agency policy. This may include: • Check physician orders and MAR to verify medication order. • Verify MAR (patient, medication, dose, route, last time of administration). • Check your agency's *Parenteral Drug Therapy Manual* (PDTM) about guidelines for administration. • Independent double check by colleague • Verify compatibility if administering two drugs mixed in the same syringe.	Properly identifying medication decreases risk of med error. Agency protocols are in place to increase patient safety. Follow principles of asepsis to reduce risk of exposing patient to microorganisms. Meds that are incompatible or whose compatibility cannot be verified cannot be given simultaneously from the same syringe.
3. Check expiry date and check for particulates, discoloration, or loss of integrity (sterility).	Discolored or outdated medication may be harmful. If a medication is discolored or cloudy, always check manufacturer's specification for the medication.
4. Prepare the medication from the ampule or vial.	Re-watch the videos: *Preparing Medications from a Vial*; *Preparing Medications from an Ampule* developed by Renée Anderson and Wendy McKenzie (2018) of TRU School of Nursing.

5. Label the syringe.	Medications prepared away from the bedside must be labelled with two patient identifiers, medication, dose, date and time of preparation, and initials of the nurse to decrease risk of med error.  *Medication label sample*
6. Perform hand hygiene. Enter room and introduce yourself. Identify patient using two acceptable identifiers; confirm with MAR; confirm allergies; explain procedure and the medication. Allow the patient time to ask questions.	Hand hygiene reduces transmission of microorganisms.  *Compare MAR to patient using two patient identifiers. Verify allergies.* Confirming patient identity reduces risk of med error. Explaining rationale increases the patient's knowledge and may reduce any anxiety. Let the patient know there may be mild temporary burning at the injection site.
7. Close curtains or door.	This creates privacy for the patient.
8. Reassess patient for any contraindications for the medications	Assessment is a prerequisite to the administration of medications.

9. Wear non-sterile gloves.	Gloves help prevent exposure to BBF.  *Wear non-sterile gloves*
10. Select an appropriate site for administration. Prepare the patient in the correct position. Ensure a sharp disposal container is close by for disposal of needle after administration.	Site should be free of lesions, rashes, and moles. Choose deltoid, ventrogluteal, or vastus lateralis depending on medication, volume to be injected, and muscle mass.
11. Locate correct site using landmarks, and clean area with alcohol or antiseptic swab (according to agency policy). Use a firm, circular motion. Allow site to dry.	Allowing the site to dry renders the antiseptic effective and prevents stinging during injection. 
12. Remove needle cap by pulling it straight off the needle. Hold syringe between thumb and forefinger on dominant hand as if holding a dart.	This prevents needle from touching side of the cap, prevents contamination, and reduces risk of accidental needle stick injury.  *Pull cap off of needle*

13. Displace skin in a Z-track manner by pulling the skin down or to one side about 2 cm (1 in) with your non-dominant hand.	The Z-track method creates a zig-zag path to prevent medication from leaking into the subcutaneous tissue. This method may be used for all injections, or it may be specified by the medication.  *Figure 7.26 Displace the skin 2-3 cm with the non-dominant hand*
14. With skin held to one side, quickly insert needle at a 90-degree angle (STAB). After needle pierces skin, continue pulling on skin with non-dominant hand, and at the same time grasp lower end of syringe barrel with fingers of non-dominant hand to stabilize it (GRAB). Move dominant hand to end of plunger. If required by agency policy, ASPIRATE for blood. If no blood appears, inject the medication slowly.	A quick injection is less painful. Inject medication at approx. 10 seconds/ml. Because the injection sites recommended for immunizations do not contain large blood vessels, aspiration is not necessary when giving vaccines.  *Figure 7.27* After cleaning the site, inject the needle into the tissue at a 90 degree angle and aspirate for blood return. If no blood return, slowly inject the medication.
15. Once medication is given (INJECT), leave the needle in place for 10 seconds. Avoid moving the syringe.	Leaving the needle in place allows the medication to be displaced into the tissues. Movement of the needle can cause additional discomfort for the patient.

16. Once medication is completely injected, remove the needle using a smooth, steady motion. Then release the skin.	Using a smooth motion prevents any unnecessary pain to the patient.  *Figure 7.28*
17. Engage the needle's safety system immediately. Cover injection site with sterile gauze / alcohol swab, using gentle pressure. Apply Band-Aid if required. Do not massage site.	Engaging the safety system helps to reduce risk of needle poke and exposure to BBF. Massage to the site after an IM injection can cause damage to underlying tissue
18. Discard syringe in appropriate sharps container and other supplies in appropriate garbage.	Placing sharps in appropriate puncture-proof and leak-proof receptacles prevents accidental needle-stick injuries.  *Dispose of syringe in sharps container*

19. Perform hand hygiene.	This step prevents the spread of microorganisms.  *Hand hygiene with* ABHR
20. Document procedure as per agency policy.	Document the medication, time, route, site, date of administration, and effect of the medication; any adverse effects; unexpected outcomes; and any interventions applied.
21. Assess patient's response to the medication after the appropriate time frame.	Assess for effectiveness of the medication (onset, peak, and duration). Assess injection site for pain, bruising, burning, or tingling.
Data source: Centers for Disease Control, 2013, 2015; Perry et al., 2018	

Watch the following videos, which were developed by Renée Anderson and Wendy McKenzie Thomspon Rivers University School of Nursing (2018)

Landmarking—Deltoid Administering an IM Injection— Using Z-track

Landmarking—Ventrogluteal Administering an IM Injection—Using Z-track

Landmarking— Vastus Lateralus Administering IM Injection—Using Z-track

Critical Thinking Exercises

1. When giving an IM injection, how can you avoid injury to a patient who is very thin?
2. Your client has two fractured femurs and a fractured right humerus. Discuss which site(s) are appropriate for IM injection. Discuss other options for pain control.

Attributions

Figure 7.22. Ventrogluteal site for IM injection by British Columbia Institute of Technology (BCIT) is licensed under a Creative Commons Attribution 4.0 International License.

Figure 7.23.A medical illustration depicting intramuscular injection sites on an adult's thigh by BruceBlaus is used under a CC BY-SA 4.0 international license.

Figure 7.24. IM deltoid by British Columbia Institute of Technology (BCIT) is licensed under a Creative Commons Attribution 4.0 International License.

Figure 7.25. Supplies for IM injection (vial) by author is licensed under a Creative Commons Attribution 4.0 International License.

Figure 7.26 – 7.28 Z track from Opentextbc https://opentextbc.ca/clinicalskills/chapter/6-8-iv-push-medications-and-saline-lock-flush/

7.6 Intravenous Medications by Direct IV (Formerly IV Push)

In the past, IV medications given as described above were referred to as IV bolus or IV push medications. It is recommended that these terms NOT be used, as they can be mistakenly interpreted as meaning the drugs are to be pushed quickly, in less than a minute (ISMP, 2003). To administer IV medications safely and effectively, nurses must follow all agency policies and use PDTM guidelines to determine which medications can be given intravenously and any specific instructions about administration (Alberta Health Services, 2009).

Intravenous (IV) is a route for administering concentrated medications (diluted or undiluted) directly into the vein. Depending on the medication and the purpose, meds given IV may be through continuous infusions, mini-bags, or more quickly by what is referred to as direct IV. The IV direct route refers to the administration of a small volume of fluid / medication (max. 20 ml) pushed manually into the patient using a syringe Leur locked to a needleless port. Medications given by direct IV are usually administered intermittently to treat emergent concerns. Medications administered by direct IV route are given very slowly over at least one minute (Perry et al., 2014). The nurse must consult drug monographs and / or Parenteral Drug Therapy Manual (PDTM) for specifics about each medication. Administering a medication intravenously eliminates the process of drug first pass by depositing the medication directly into the blood. This results in the immediate elevation of serum drug levels and high drug concentrations in vital organs, such as the heart, brain and kidneys. Both therapeutic and adverse effects can occur quickly with IV direct administration (Alberta Health Services, 2009).

There are many advantages and disadvantages to administering medications via the intravenous injection method—see Table 7.7.

Table 7.7 Advantages and Disadvantages of Intravenous Medications

Advantages	*Disadvantages*
Intravenous medications can deliver an immediate, fast-acting therapeutic effect, which is important in emergent situations such as cardiac arrest or narcotic overdose. They are useful to manage pain and nausea by quickly achieving therapeutic levels, and they are more consistently and completely absorbed compared with medications given by other routes of injection.	Once an intravenous medication is delivered, it cannot be retrieved. When giving IV medications, there is very little opportunity to stop an injection if an adverse reaction or error occurs. IV medications, if given too quickly or incorrectly, can cause significant harm or death.
Doses of short-acting medication can be titrated according to patient responses to drug therapy. Medication can be prepared quickly, and given over a shorter period of time compared to the IV piggyback route.	Any toxic or adverse reaction will occur immediately and may be exacerbated by a rapidly injected medication.
Minimal dilution is required for some medications, which is desirable for patient's own fluid restrictions.	Extravasation of certain medications into surrounding tissues can cause tissue damage, nerve damage, and scarring.
There is minimal or no discomfort for the patient in comparison to SC and IM injections.	Not all medications can be given via the direct IV route.
They provide an alternative to the oral route for drugs that may not be absorbed by the GI tract, and they are ideal for patients with GI dysfunction or malabsorption, and patients who are NPO (nothing by mouth) or unconscious.	There is a high risk for infusion reactions, mild to severe, because most IV medications peak rapidly (i.e., they have a quick onset of effect). A hypersensitivity reaction can occur immediately or be delayed, and requires supportive measures.
IV direct route provides a more accurate dose of medication because none is left in the intravenous tubing.	Route for administering medications may damage surrounding tissues. There is an increased risk of phlebitis with highly concentrated medication, especially with small peripheral veins or a short venous access device.
Data source: Albert Health Services, 2009; Lynn, 2011; Perry et al., 2018	

Intravenous medications are always prepared using the SEVEN rights and THREE checks as per

agency policy. Because of the high risk associated with direct intravenous medications, additional guidelines are required. A PDTM or drug monograph provides additional information to help the nurse make decisions about administering IV medications. Some medications can be given either IV direct or piggyback, in which case the nurse must use their knowledge about the patient to determine which of these is preferred. Some medications may only be given in large-volume IV solutions; some medications have to be diluted; some medications have to be administered over specific time frames (i.e., over 1 or 2 minutes). In addition, information regarding indications, contraindications, dosage (age dependent), administration/dilution guidelines, adverse effects, clinical indications (e.g., specialized monitoring required, must be on an IV pump), compatibility and incompatibility in relation to reconstitution and primary IV solution is specified (Alberta Health Services, 2009).

The Institute for Safe Medication Practices (ISMP) (2014) has created a list of high-alert medications that bear the heightened risk of significant harm when they are used in error. Special safeguards for these medications can be found in the PDTM. It is vital to understand which medications are considered high risk prior to administration. A link to the list of high-risk medications can be found under Suggested Online Resources at the end of this chapter. Review the steps shown in Table 7.8 to prepare a medication by direct IV route. The PDTM must be consulted every time an IV medication is given, as memory-based errors are common (World Health Organization, 2012).

Table 7.8 Preparation Questions for Intravenous Medications

Safety considerations:

- Be diligent and follow all policies related to medication calculations, preparation, and thorough assessment of patient status before and after an injection. Medication errors are the most common preventable errors in health care.
- Use a blunt filter needle or blunt needle when preparing injections. Never use a needle when injecting IV medication. Always use a needleless system.
- After preparing the medication, always label the medication syringe with two patient identifiers, date, time, medication, dose, and your initials. Never leave the syringe unattended.
- Correctly identify the VAD, and use agency flushing and locking protocols for correct administration.
- Always administer the post-saline lock flush at the SAME RATE as the IV medication.
- Always assess the patient's symptoms and need for IV medication prior to administration.
- Always assess the patient's understanding of the medication.

Principle	*Additional Information*
Verify qualifications for administration.	Are you qualified to give this medication? What supervision is required? What resources must you consult?
Review route of administration and IV site.	Can this medication be given by the IV route? Is the route of administration (needle insertion site) free from redness, swelling, and discomfort?
Review preparation and how to administer the medication.	How is this medication given by the IV route (diluted or undiluted)? Describe the safest way to prepare the medication. Consider the selection of medication. Always use less-concentrated solutions whenever possible. Does the medication require dilution? If diluting the medication, ALWAYS discard (that is, waste) the unused portion before going to the bedside. • Preparation and supplies: is a pre-flush required? • Patient identification: any allergies? • Administration rate: what is the correct rate of administration (over 1 minute, 5 minutes)?
Identify when a medication starts to work.	What is the onset, peak, and duration of the medication?
Assess dose and range (e.g., 5 to 10 mg).	Is the ordered dose safe? When did the patient last receive this medication? What was the effect of the medication on the patient?

Understand the therapeutic effect.	What is the expected therapeutic effect of the medication? What assessment is necessary to determine if the medication is correct for the patient?
Know adverse effects.	What are the potential adverse effects of the medications? How would you manage these adverse effects? Is there an antidote?
Know potential incompatibilities.	Are there any potential incompatibilities with existing IV solutions? How would you manage these issues? Is a secondary medication currently running? Are there additives to the IV solution?
Know how to complete the procedure.	How do you complete this procedure? Is a post-saline lock flush required?
Document procedure.	How and where do you chart this medication: pain assessment sheet, MAR, etc.?
Data source: BCIT, 2015; Berman & Snyder, 2016; Clayton et al., 2010; WHO, 2012	

Before giving an intravenous medication, always assess the IV insertion site for patency and for signs of infiltration or phlebitis. Start a new IV site if current site is red, swollen, or painful when flushing. Intravenous medications by direct IV route can be given three ways:

- Through an IV that is capped / locked.
- Through an IV that has an infusion running and the medication is compatible with the IV solution.
- Through an IV that has an infusion running and the medication is incompatible with the IV solution.

Checklist 60 reviews the steps to administer a medication IV direct into a locked / capped IV. Review the preparation questions for intravenous medication in Table 7.8 prior to administering medication.

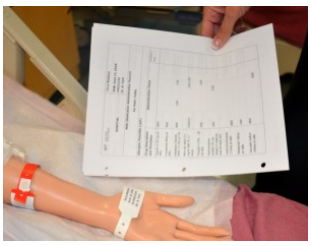
Checklist 60: Administering Medications IV Direct into a Locked / Capped IV (PVAD Short, Midline, PICC, Percutaneous Non-Hemodialysis CVC)

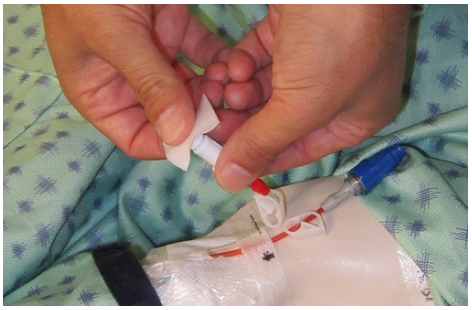
Disclaimer: Always review and follow your agency policy regarding this specific skill.

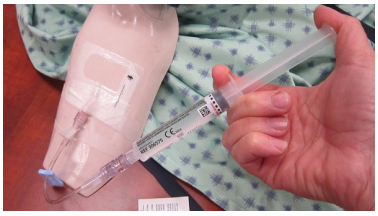
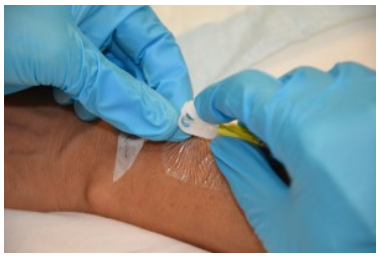
Safety considerations:

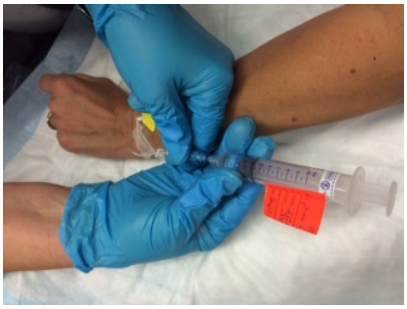
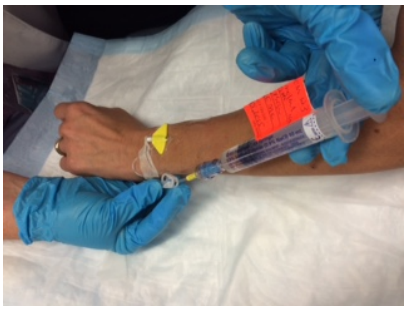
- Review the advantages and disadvantages of IV medications.
- Be able to answer the preparation questions for intravenous medication in Table 7.9 before administering the medication.
- If the medication has been diluted and there is wastage, always discard unused diluted portion of the prepared IV medication before going to the bedside.
- Always label the IV syringe with two patient identifiers, date, time, medication, dose, and your initials. Once the medication is prepared, never leave it unattended.
- Never administer an IV medication into an IV line that isn't patent.
- Central venous catheters (percutaneous non-hemodialysis lines, PICC lines) and midline catheters may require special pre- and post-flushing procedures and specialized training.
- Always follow agency policies and guidelines when preparing and administering medications.
- CVCs require at minimum a 10 ml syringe to decrease risk of catheter fracture.
- If using prefilled saline syringes, remove air prior.
- You will need a clock . watch / timer to time the rate of administration.
- Perform hand hygiene before preparing medications.

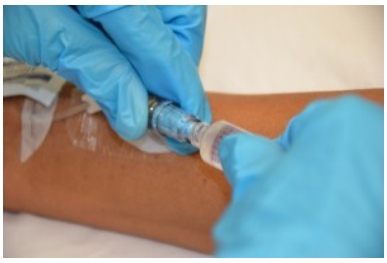
Steps	*Additional Information*

1. Prepare one medication for one patient at the correct time as per agency policy. Review the physician's order, PDTM, and MAR for the correct order and guidelines. Math calculations may be required to determine the correct dose to prepare the medication.	Always apply the SEVEN rights and THREE checks of medication administration. Review the agency policy if a medication is a stat, given for the first time, a loading dose, or a one-time dose. Some agencies require that high-alert medications be double-checked by a second health care provider. Always follow agency policies. For a list of high-alert medications, see Suggested Online Resources. After preparing the medication, always label the medication syringe with two patient identifiers (name & date of birth), date, time, medication, dose (ie. 2 mg), and your initials. Never leave the medication syringe unattended.
2. Create privacy if possible.	This provides comfort to patient.
3. Confirm patient ID using two patient identifiers (e.g., name and date of birth) AND compare the MAR with the patient's wristband to confirm patient ID.	This ensures you have the correct patient and complies with agency standard for patient identification.  *Compare MAR with patient wristband*

4. Check allergy band for any allergies, and ask patient about type and severity of reaction.	This ensures allergy status is correct on the MAR and on patient's allergy band.
5. Discuss purpose, action, and possible side effects of the medication. Provide patient an opportunity to ask questions. Encourage patient to report discomfort at the IV site (pain, swelling, or burning).	Keeping the patient informed of what is being administered helps decrease anxiety.
6. Perform hand hygiene	Hand hygiene prevents the transmission of microorganisms.
7. Assess IV insertion site for complications. See Checklist 65. Clean access port / needleless cap using alcohol and friction for 15 seconds. Allow to dry.	Alcohol and friction sanitizes. Allowing alcohol to dry renders the antiseptic properties effective. Cleaning access ports before each syringe is attached and after each syringe is detached reduces risk of infection.  *Figure 7.29 Clean access port*

8. Luer lock 10 ml saline filled syringe onto needleless cap. Release clamp on extension tubing if present.	10 ml syringes for flushing reduces risk of fracturing the IV cannula.  *Figure 7.30 Luer lock saline syringe onto needleless cap*  *Release clamp if present* Refer to agency guidelines for VAD flushing & locking protocols.
9. Verify **patency** of the line. **PVAD short:** • You can aspirate…or not. • Forward flush normal saline (follow agency flushing protocol—usually 2 to 5 ml turbulent flush). **Midline, CVC (PICC / percutaneous non-hemodialysis line):** • Aspirate for blood return. When blood flashback present in tubing forward flush using turbulent technique (follow agency flushing protocol—usually 10 ml 0.9%NS). • Do not force if resistance is felt. Remove syringe.	PVAD short: if swelling, pain, or redness exists, remove IV cannula and reestablish new IV site. Tenderness is the first sign of phlebitis. Aspirating on a PVAD short often does not reveal blood flashback despite the site being patent. Assess for patency of PVAD short during the flush by assessing for resistance, pain, and leaking. If you suspect the line is not patent, STOP. DO NOT forward flush. Remove the PVAD short and reestablish a new one. Turbulent flush is a stop start vigorous motion intended to clean the inside lumen of the VAD. Aspirating on a PICC, midline, and percutaneous non-hemodialysis CVC should reveal blood flashback. If you suspect the line is not patent, or partially occluded, follow agency guidelines (this usually involves trouble shooting and / or consulting the IV team / PICC nurse for declotting). If possible, aspirate only until flashback of blood is into the catheter. Flashback into syringe creates more risk for occlusion if not flushed correctly.

10. Clean access port with alcohol and friction for 15 seconds. Luer lock medication syringe to needleless cap.	Cleaning access ports before each syringe is attached and after each syringe is detached reduces risk of infection. Using a needleless system prevents needle-stick injuries. Use 10 ml syringe (minimum) to reduce risk of catheter fracture.  *Luer lock medication filled syringe to the needleless cap*
11. Use a timer / watch / clock to inject medication at the correct rate according to agency policy. Administer the medication slowly and steadily. Attempt to have half of the syringe emptied in half of the recommended infusion time.	Timing of the administration promotes safer medication administration. Rapid injection of IV medications can have serious consequences for the patient.  *Inject medication into the venous access device*

12. Remove empty medication syringe. Clean access port using alcohol and friction for 15 seconds. Luer lock 10 ml saline filled syringe to the needleless cap. Flush with volume directed by agency 's flushing protocol at the SAME rate as the medication delivery, according to guidelines found in the PDTM. (See Rationale for Flushing with NS after Administering an IV Medication) Ensure the final flush is done in a way that ensures **positive pressure** is achieved. This will depend on what kind of needleless cap and what kind of saline filled syringe is available to you. See Positive Pressure.	Cleaning access ports before each syringe is attached and after each syringe is detached reduces risk of infection. Check agency flushing protocol for flushing volume. Flushing the IV line at the same rate as medication delivery ensures that any medication remaining within the IV line is delivered at the correct rate, and avoids the patient receiving an accidental bolus of the medication.  *Flush extension tubing with NS at the same rate as medication delivery* Flushing the extension tubing clears the medication from the device.  *Figure 7.31 When flushing is complete, detach syringe from needleless cap. Apply clamp on extension tubing.* Note: If a patient has a central venous catheter, follow agency protocols for accessing and flushing and locking. Always assess IV sites before and after administration of IV medications.

13. Dispose of all syringes, blunt fill needles, blunt fill filter needles according to agency policy.	This prevents accidental needle-stick injuries.
14. Perform hand hygiene.	This reduces transmission of microorganisms.
15. Document as per agency protocol.	Document the time, reason, drug, dose, effect, and any adverse reactions.
16. Observe for expected therapeutic effect and for adverse effects.	The patient needs to be evaluated and monitored, especially for high-alert medications. IV medications act rapidly.
Data source: Canadian Institute for Health Information, 2009; Clayton et al., 2010; Goossens, 2015; Perry et al., 2018	

Watch the video: *Administering Medications: Direct IV – Into a Locked IV (PVAD short)* by Renée Anderson & Wendy McKenzie Thompson Rivers University

Special considerations when giving meds IV:

- Top contributing factors to medication errors include calculation errors, drug preparation

errors, human error, and transcription inaccuracy.
- The elderly and the young may be more sensitive to adverse effects.
- With certain medications, creatinine clearance must be assessed prior to administering. Patients with liver disease may require a reduction in dosages.
- When a medication dose is ordered with a range (e.g., morphine 2 mg IV q 2-4 hours p.r.n.), always start with the lowest dose and titrate up. Always assess when the last dose was given and its effectiveness.

Considerations for Saline Flushes after IV Medication Administration

- The normal saline flush after IV meds are administered serves a few purposes: 1) to deliver any medication left in the tubing in to the patient; 2) to reduce risk of residue – medications / IV solutions / fibrin- build up in the lumen of the IV cannula (Gossens, 2015); and 3) to establish an environment within the IV cannula to prevent reflux of blood and / or clotting of the VAD if it is to remain locked
- When meds are given IV direct, some medication remains in the tubing between the access port and the end of the IV cannula. As such care must be taken to complete the flush in a way that does not result in a bolus of medication being administered too quickly. Sudden boluses of some medications may cause mild to severe adverse effects, such as hypotension and toxicity (Clayton et al., 2010).
- The flushing solution must be compatible with other IV solutions / meds
- Turbulent flush is a stop start motion intended to cleanse the inside lumen of the IV cannula.
- High PSI (pounds per square inch) can fracture an IV cannula. Always use the manufacturers guidelines for choosing the syringe size (usually 10 ml).
- Refer to flushing protocols. Open ended CVADs require heparin after the saline flush to reduce risk of clotting.

Here are some examples of clearing IV medication from the extension tubing on a PVAD short saline lock.

1. If morphine (1 mg) is administered over one minute, the subsequent saline flush will be given in this manner: the *first 1 ml* of a 5 ml saline flush will be delivered over one minute to clear the medication from the tubing, and the remaining 4 ml will be the turbulent flush.
2. If furosemide (40 mg) is given in a 4 ml volume and administered over two minutes, the subsequent saline flush will be given in this manner: the *first 1 ml* of a 5 ml saline flush will be delivered over 30 seconds, and the remaining 4 ml will be the turbulent flush.

Checklist 61 lists the steps to administering an IV medication through an existing IV line with compatible IV solution. Review the preparation questions for intravenous medication in Table 7.8 prior to the medication administration.

Checklist 61: Administering medications IV direct into an infusing IV – with **compatible** solution (PVAD short, midline, PICC, percutaneous non-hemodialysis CVC)

Disclaimer: Always review and follow your agency policy regarding this specific skill.

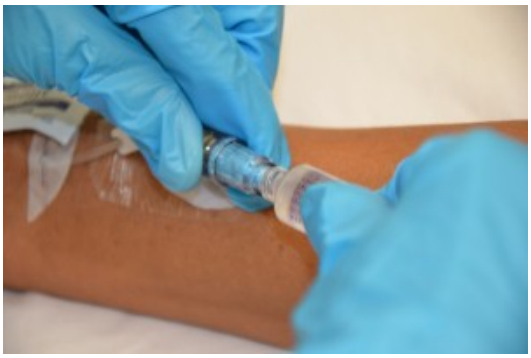
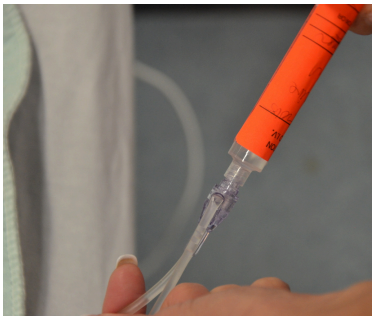
Safety considerations:

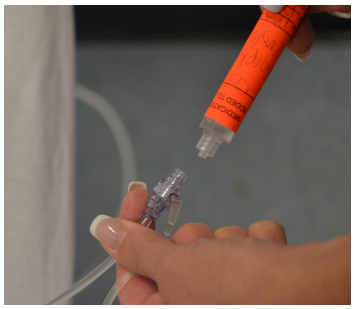
- Review the advantages and disadvantages of IV medications (Table 7.7)
- Be able to answer the preparation questions for intravenous medication in Table 7.9 before administering the medication.
- If the medication has been diluted and there is wastage, always discard unused diluted portion of the prepared IV medication before going to the bedside.
- Always follow agency policies and guidelines when preparing and administering medications
- Always label the syringe with 2 patient identifiers, date, time, medication, concentration of the dose, dose, and your initials. Once the medication is prepared, never leave it unattended.
- NEVER administer an IV medication through an IV line that is infusing blood, blood products, heparin IV, insulin IV, cytotoxic medications, or parenteral nutrition solutions.
- Never administer an IV medication into an IV line that isn't patent.
- Check compatibilities of the medication to with other medications / solutions in the same line
- Central venous catheters (midlines, percutaneous non-hemodialysis lines, PICC lines) may require special pre- and post-flushing procedures and specialized training.
- CVCs require at minimum a 10 ml syringe to decrease risk of catheter fracture.
- You will need a clock / timer/ watch to time the rate of administration.
- Perform hand hygiene before preparing medications.

Steps	*Additional Information*

1. Prepare one medication for one patient at the correct time as per agency policy. Review the physician's order, PDTM, and MAR for the correct order and guidelines. Math calculations may be required to determine the correct dose to prepare the medication. Determine compatibilities of the medication to be given with the primary IV solution. If the primary solution contains medication that should not be stopped (e.g., heparin, morphine, pantoprazole, insulin, or blood or blood products), **do not use this line.** In this case establish another IV access.	Always apply the SEVEN rights and THREE checks of medication administration. Review the agency policy if a medication is a stat, first-time, loading dose, or a one-time dose. Some agencies require high-alert medications to be double-checked by a second health care provider. Always follow agency policies. After preparing the medication, always label the medication syringe with two patient identifiers, date, time, medication, dose (e.g., morphine 2 mg), and your initials. Never leave the syringe unattended. If medications given simultaneously are incompatible, the mixing of these can create precipitates in the IV tubing which can initiate emboli formation in the blood. Stopping infusions that containing medications interrupts delivery of that medication. Blood and blood products are NOT compatible with ANY medication.
2. Create privacy if possible.	This provides comfort to patient.
3. Confirm patient ID using two patient identifiers (e.g., name and date of birth) AND compare the MAR printout with the patient's wristband to confirm patient ID.	This ensures you have the correct patient and complies with agency standard for patient identification.  *Compare MAR to patient wristband*

4. Check allergy band for any allergies, and ask patient about type and severity of reaction.	This ensures allergy status is correct on the MAR and on patient allergy band.
5. Discuss purpose, action, and possible side effects of the medication. Provide patient an opportunity to ask questions. Encourage patient to report discomfort at the IV site (pain, swelling, or burning).	Keeping patient informed of what is being administered helps decrease anxiety.
6. Perform hand hygiene	Prevents the transmission of microorganisms.
7. Assess IV insertion site. See Checklist 65.	Redness, swelling and leaking suggest complications.
8. Select IV access port closest to the patient. Clean access port using friction with an alcohol swab for 15 seconds. Allow to dry.  *Clean port with an alcohol swab*	The closest port allows the medication to reach the blood stream quickly. Cleaning access ports before each syringe is attached and after each syringe is detached reduces risk of infection. Alcohol and friction sanitizes. Allowing alcohol to dry renders the antiseptic properties effective. Refer to agency guidelines for VAD flushing & locking protocols.

9. Stop the infusion.	Stopping the infusion for an IV run by gravity involves clamping a slide clamp distal to the access port or rolling the roller clamp to the closed position OR folding the tubing on itself and pinching it. Stopping the infusion for an IV run by an EID / pump simply involves stopping the machine.
10. Verify site patency. Luer lock a 10 ml saline filled syringe to the access port closest to the patient. Aspirate and assess for blood flashback in the line. Forward flush 10 ml normal saline syringe using turbulent technique. THIS IS THE FLUSH PRIOR. 	**Checking patency of PVAD short**: you can aspirate… or not. Likely you can assess patency through observation of the site with an infusing IV. PVAD short sites that are not patent may be edematous (suggests infiltration), may not be infusing (observe for drops in the drip chamber) or the EIDs / IV pumps alerts presence of an occlusion. **Checking patency of midline, CVC (PICC / non-hemodialysis line)**: aspirate for blood return. When blood flashback present in tubing, forward flush using turbulent technique. If there is no blood return, trouble shoot according to agency protocol and / or contact the IV team / PICC nurse for further assessment. Using a needleless system prevents needle-stick injuries. New recommendations include flushing before AND after medication administration. 10 ml syringes decrease risk of catheter fracture. Flushing the line clears aspirated blood and reduces risk of clotting and occlusion. Turbulent flush cleans IV lumen of medication residue and fibrin. DO NOT force if resistance is felt.
11. Remove syringe. Clean IV access port for 15 seconds with alcohol and friction. Allow to dry. Luer lock medication syringe to the access port.	Cleaning access ports before each syringe is attached and after each syringe is detached reduces risk of infection. 

12. Inject medication at the recommended rate according to PDTM. Use a timer / watch / clock to monitor time. Administer the medication slow and steady. Attempt to have half of the syringe emptied in half of the recommended infusion time.	Timing of the administration promotes safer medication delivery. Rapid injection of IV medications can have serious consequences for the patient
13. Remove empty medication syringe. Clean port using alcohol and friction. Luer lock a 10 ml saline filled syringe to the access port. Flush with volume directed by agency flushing protocol at the SAME rate as the medication delivery, according to guidelines found in the PDTM. (See Rationale for Flushing with NS after Administering an IV Medication.) THIS IS THE FLUSH AFTER. Resume the infusion.	 *Remove medication syringe* Alcohol and friction sanitizes. Allowing alcohol to dry renders the antiseptic properties effective. Cleaning access ports before each syringe is attached and after each syringe is detached reduces risk of infection. The final flush does NOT have to ensure positive pressure is achieved because the infusion will be resumed. Always assess IV sites before and after administration of IV medications.
14. Dispose of all syringes, and blunt fills and blunt fill filters as per agency protocol.	Blunt fill and blunt fill filters are disposed of in sharps containers to prevent accidental needle-stick injury.
15. Perform hand hygiene.	This reduces transmission of microorganisms.

16. Document as per agency protocol.	Document time, reason, drug, dose, therapeutic effect, and any adverse reactions.
17. Evaluate the patient for therapeutic effect and adverse reactions according to appropriate time frame (onset and peak of medication).	Observations provide additional safety measures, especially for high-alert medications. IV medications act rapidly.
Data source: Berman & Snyder, 2016; Canadian Institute for Health Information, 2009; Clayton et al., 2010; Perry et al., 2018; Workers Compensation Act, 2015	

Watch the video: *Administering Medications: Direct IV – Into an IV with an Infusion* by Renée Anderson & Wendy McKenzie Thompson Rivers University

Checklist 62 reviews the steps to administer an IV medication through an existing IV line with incompatible IV solution. Review the preparation questions for intravenous medication in Table 7.8 prior to the medication administration.

Checklist 62: Administering Medications IV Direct into an Infusing IV with **Incompatible** IV Solution (PVAD Short, Midline, PICC, Percutaneous Non-Hemodialysis CVC)

Disclaimer: Always review and follow your agency policy regarding this specific skill.

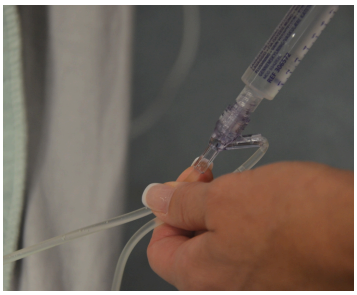
Safety considerations:

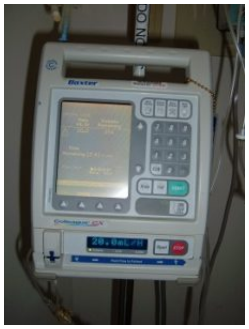
- Review the advantages and disadvantages of IV medications (Table 7.8).
- Be able to answer the preparation questions for intravenous medication in Table 7.8 before administering the medication.
- If the medication has been diluted and there is wastage, always discard unused diluted portion of the prepared IV medication before going to the bedside.
- Always follow agency policies and guidelines when preparing and administering medications.
- Always label the syringe with 2 patient identifiers, date, time, medication, concentration of the dose, dose, and your initials. Once the medication is prepared, never leave it unattended.
- NEVER administer an IV medication through an IV line that is infusing blood, blood products, heparin IV, insulin IV, cytotoxic medications, or parenteral nutrition solutions.
- Never administer an IV medication into an IV line that isn't patent.
- Check compatibilities of the medication to the primary solution.
- Central venous catheters (midlines, percutaneous non-hemodialysis lines, PICC lines) may require special pre- and post-flushing procedures and specialized training.
- CVCs require at minimum a 10 ml syringe to decrease risk of catheter fracture.
- You will need a clock / watch timer to time the rate of administration.
- Perform hand hygiene before preparing medications.

Steps	*Additional Information*

1. Prepare one medication for one patient at the correct time as per agency policy. Review the physician orders, PDTM, and MAR for the correct order and guidelines. Math calculations may be required to determine the correct dose to prepare the medication. Always check agency policy to ensure an IV solution or medication can be stopped temporarily (i.e., longer than it takes to check patency). Some IV solutions (i.e., those with medications in the primary solution—insulin, heparin) can not be stopped. If unable to temporarily stop an IV solution or IV medication, establish a new IV access at a different site.	Always apply the SEVEN rights THREE checks of medication administration. Review the agency policy if a medication is a stat, first-time, loading dose, or a one-time dose. Some agencies require that high-alert medications be double-checked by a second health care provider. Always follow agency policies. After preparing the medication, always label the medication syringe with two patient identifiers, date, time, medication and dose (e.g., morphine 2 mg), dose, and your initials. Never leave the syringe unattended.
2. Create privacy if possible.	This provides comfort to patient.
3. Confirm patient ID using two patient identifiers (e.g., name and date of birth) AND compare the MAR printout with the patient's wristband to confirm patient ID.	This ensures you have the correct patient and complies with agency standard for patient identification.  *Compare MAR to patient wristband*
4. Check allergy band for any allergies, and ask patient about type and severity of reaction.	This ensures allergy status is correct on the MAR and on patient allergy band.

5. Discuss purpose, action, and possible side effects of the medication. Provide patient an opportunity to ask questions. Encourage patient to report discomfort at the IV site (pain, swelling, or burning).	Keeping patient informed of what is being administered helps decrease anxiety.
6. Perform hand hygiene	Hand hygiene prevents the transmission of microorganisms.
7. Assess IV insertion site. See Checklist 65	Redness, swelling and leaking suggest complications.
8. Select IV access port closest to the patient. Clean access port using friction with an alcohol swab for 15 seconds. Allow to dry.  *Clean port with an alcohol swab*	The closest port allows the medication to reach the blood stream quickly. Cleaning access ports before each syringe is attached and after each syringe is detached reduces risk of infection. Alcohol and friction sanitizes. Allowing alcohol to dry renders the antiseptic properties effective. Refer to agency guidelines for VAD flushing & locking protocols.

9. Stop the infusion.	Stopping the infusion for an IV run by gravity involves clamping a slide clamp distal to the access port or rolling the roller clamp to the closed position OR fold the tubing on itself and pinch Stopping the infusion for an IV run by an EID / pump simply involves stopping the machine.
10. Verify site patency Luer lock a 10 ml saline filled syringe to the access port closest to the patient. Aspirate and assess for blood flashback in the line. Forward flush 10 ml syringe using turbulent technique. THIS FLUSH WILL CLEAR THE LINE OF THE INCOMPATIBLE MEDICATION. 	**Checking patency of PVAD short**: you can aspirate… or not. Likely you can assess patency through observation of the site with an infusing IV. PVAD short sites that are not patent may be edematous (suggests infiltration) or not infusing (observe for drops in the drip chamber); or the IV pump indicates occlusion. **Checking patency of midline, CVC (PICC / non-hemodialysis line)**: aspirate for blood return. When blood flashback is present in tubing, forward flush using turbulent technique. If there is no blood return, trouble shoot according to agency protocol and / or contact the IV team / PICC nurse for further assessment. Using a needleless system prevents needle-stick injuries. 10 ml syringes decrease risk of catheter fracture. Flushing the line clears aspirated blood and reduces risk of clotting and occlusion and it clears the line of incompatible medication. Turbulent flush cleans IV lumen of medication residue and fibrin. DO NOT force if resistance is felt.
11. Remove syringe. Clean IV access port for 15 seconds with alcohol and friction. Allow to dry.	Cleaning access ports before each syringe is attached and after each syringe is detached reduces risk of infection. The IV line must remain clamped (shut off) to avoid accidental mixing of incompatible IV solution and the medication.

12. Leur lock the medication syringe to the access port. Inject medication at the recommended rate according to PDTM. Use a timer / watch / clock to monitor time. Administer the medication slow and steady. Attempt to have half of the syringe emptied in half of the recommended infusion time. Remove empty syringe. Clean port for 15 seconds using alcohol and friction. Attach a 10 ml normal saline syringe. Flush with volume directed by agency flushing protocol at the SAME rate as the medication delivery, according to guidelines found in the PDTM. (See Rationale for Flushing with NS after Administering an IV Medication.) THIS FLUSH REMOVES MEDICATION FROM THE TUBING.	This ensures safe medication administration at the correct rate. Rapid injection of IV medications can have serious consequences for the patient Always assess IV sites before and after administration of IV medications. This step delivers the medication that remains in the IV tubing at the same rate, and prevents patient from accidentally receiving a bolus of the medication. It also clears the IV line to prevent any mixing of incompatible medication with the IV solution. The IV line must remain clamped to avoid accidental mixing of incompatible IV solution and the medication.
13. Resume the IV infusion • Gravity infusion: Unclamp IV line and regulate the rate using the roller clamp. • EID / pump infusion: Restart IV infusion device. Assess the IV site.	  Resume the IV infusion
14. Dispose of all syringes and blunt fills and blunt fill filters as per agency protocol. Perform hand hygiene.	Blunt fill and blunt fill filters are disposed of in sharps containers to prevent accidental needle-stick injury. This reduces the transmission of microorganisms.
15. Evaluate the patient's response to the medication in the appropriate time frame. Document according to agency protocol	Observe patient for expected therapeutic effects and adverse reactions. Observations provide additional safety measures, especially for high-alert medications. IV medications act rapidly.

Data source: Berman & Snyder, 2016; Canadian Institute for Health Information, 2009; Clayton et al., 2010; Perry et al., 2014

Critical Thinking Exercises

1. Find a resource that will advise you about onset, peak, and duration of morphine IV.
2. What information should be on the label of an IV medication syringe after it is prepared?

Attributions

7.7 Administering IV Medication via Mini-Bag (Secondary Line) or Continuous Infusion

Intravenous intermittent infusion is an infusion of a volume of fluid / medication over a set period of time at prescribed intervals and then stopped until the next dose is required. An intermittent IV medication is also called a piggyback medication, a secondary medication, or a mini-bag medication (see Figure 7.33). Intravenous medications may be given in small volumes of sterile IV solution (25 to 250 ml) and infused over a desired amount of time (given for 30 minutes every four hours) or as a single dose. Many medications must be given slowly to prevent harm to the patient, and this method of administration reduces the risk of rapid infusion. Always check the *Parenteral Drug Therapy Manual* (PDTM) to ensure the correct guidelines are followed for each specific IV medication. The PDTM provides guidelines on how to mix the IV medication, the amount and type of solution, and the rate of infusion (Perry et al., 2018).

An intermittent medication may be administered by gravity or on an electronic infusion device (EID), also known as an infusion (IV) pump. Many piggyback IV medications must be delivered using an IV pump programmed specifically to that medication. The IV infusion pumps provide hard- and soft-dose limits and safety practice guidelines to aid in safe medication administration (Lynn, 2011). IV medications may also be given by gravity infusion, in which case the health care provider must calculate the infusion rate for drops per minute.

Figure 7.33 Secondary medication (upper IV mini-bag) set up with primary infusion set (lower IV bag)

At times, a volume-controlled (intermittent infusion) set may be used to deliver medication for children, older adults, or critically ill patients where fluid volume is a concern. A **volume-controlled intermittent set** is a small device attached below the primary infusion to regulate the mini-bag. The medication can be added to a small amount of IV solution in the device and administered (Lynn, 2011).

Intravenous medications are always prepared using the SEVEN rights and THREE checks as per agency policy. IV medications have a high-risk of adverse events associated with them. As such nurses must follow specific guidelines when administering IV medications. A PDTM or drug monograph provides additional information including: the generic & brand names, classification of the drug, what routes the medication can be administered, indications for use, contraindications, dosage (age dependent), administration/dilution guidelines, adverse effects, administration guidelines (e.g., specialized monitoring required, must be on an IV pump / controller, given over a specific time frame), compatibility and incompatibility (Alberta Health Services, 2009). Some medications may only be given via a piggyback method; others through large-volume IV solutions; other IV medications require dilution and administration over a specific time frame.

The Institute for Safe Medication Practices (2014) has created a list of high-alert medications that bear the heightened risk of significant harm when they are used in error. Specific safeguards for these medications can be found in the PDTM. It is vital to understand which medications are considered high risk prior to administration. A link to the list of high-alert medications can be

found under Suggested Online Resources at the end of this chapter. In addition to the SEVEN rights × 3 for medication preparation, readers are referred back to Table 7.8

Checklist 63 lists the steps to administering an intermittent IV medication by gravity or an IV infusion pump.

Checklist 63: Administering an Intermittent IV Medication by a Mini-Bag (Initial Dose)

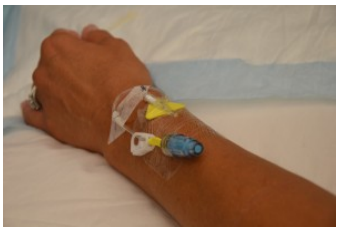
Disclaimer: Always review and follow your agency policy regarding this specific skill.

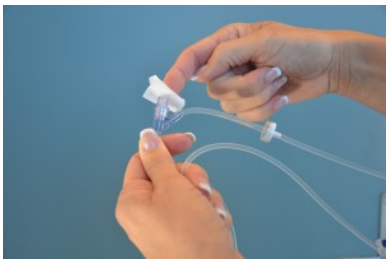
Safety considerations:

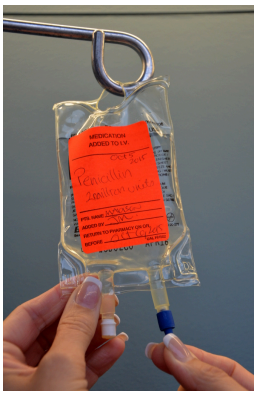
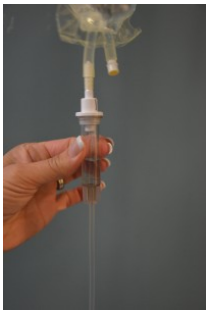
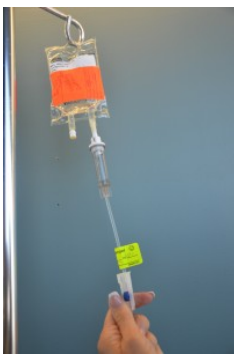
- Review the advantages and disadvantages of IV medications (Table 7.7)
- Be able to answer the preparation questions for intravenous medication in Table 7.8 before administering the medication.
- If the medication has been diluted and there is wastage, always discard unused diluted portion of the prepared IV medication before going to the bedside.
- Always label the IV bag containing medication with two patient identifiers, date, time, medication, dose, and your initials. Once the medication is prepared, never leave it unattended.
- Never administer an IV medication into an IV line that isn't patent.
- Central venous catheters (percutaneous non-hemodialysis lines, PICC lines) and midline catheters may require special pre- and post-flushing procedures and specialized training.
- Always follow agency policies and guidelines when preparing and administering medications.
- If using prefilled saline syringes, remove air prior.
- You will need a clock / watch / timer to time the rate of administration if infusing via gravity.
- Perform hand hygiene before preparing medications.

Steps	*Additional Information*
1. Prepare one medication for one patient at the correct time as per agency policy. Always check the physician orders, PDTM, and MAR. Mathematical calculations may be required to determine the correct dose to prepare.	Always apply the SEVEN rights of medication administration. Review the agency policy and the PDTM. If a medication is a stat, first-time, loading, or one-time dose, be extra diligent in reviewing the PDTM. Memory slips are a common source of error with medication administration. Complete all assessments (vital signs), and check laboratory values that may influence the medication administration. Premixed bags may require refrigeration. Premixed bags still require the nurse who is administering to add a label with two patient identifiers, nurse initials, and date / time of administration. Some health agencies require a second independent check with high-alert medications. Always follow agency policy. Ensure the mini-bag medication & solution are compatible with the primary solution and any additives.

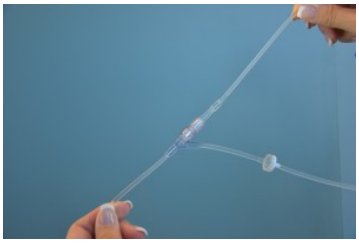
2. Perform hand hygiene and bring medication and MAR to bedside. Create privacy if possible.	Additional equipment required includes secondary tubing, a metal or plastic extension hanger, an alcohol swab, and a timer with a second hand (if running the mini-bag via gravity). Creating privacy provides comfort to the patient.
3. Compare the MAR with the patient's wristband, and use two patient identifiers (name and birth date), according to agency policy, to confirm patient ID.	This ensures you have the correct patient and complies with agency standard for patient identification.  *Compare MAR with patient's wristband*
4. Ask about allergies.	This ensures allergy status is correct on the MAR and the patient's allergy band.

5. Discuss purpose, action, and possible side effects of the medication. Provide patient an opportunity to ask questions. Encourage patient to report discomfort at the IV site (pain, swelling, or burning).	Keeping the patient informed of what is being administered helps decrease anxiety.
6. Assess IV site for patency and other complications (see checklist 65). Assess for medication specific medication criteria.	Is the site patent? Ensure IV site is free from redness, swelling, and pain prior to administering the medication.  *Assess IV site prior* IV medications may require assessment of vital signs and lab values prior to administration.
7. If required, flush the VAD according to agency protocol.	Flushing protocols contribute to the safety of VADs in particular VADs which remain insitu for an extended period. Flushing clears the lumen of the VAD to promote patency of the line by reducing residue build up in the lumen

7. Select the access port on the primary IV tubing closest to the primary bag. Clean the upper access port with an alcohol swab and friction for 15 seconds. Allow the alcohol to dry.	Secondary tubing is generally short. Accessing a port above the IV pump allows you to use the safety features of the pump in relation to IV medication administration.  *Cleanse the access port on the primary IV tubing closest to the primary bag.*

8. Prime secondary tubing. Luer lock the secondary tubing into the primary tubing.	Remove secondary tubing from packaging and close the clamp. Hang the medication IV bag on the IV pole.  Remove the sterile blue cap from the IV bag  Remove the protective cover of the spike on the IV tubing. Spike the minibag.  Fill the drip chamber 1/2 to 1/3 full. 

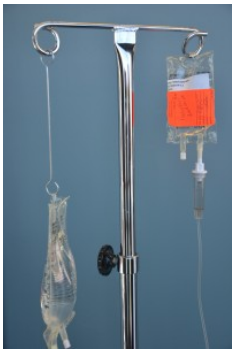
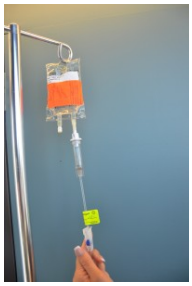
Open the roller clamp slowly and prime the tubing



Remove the cap on the distal end of the secondary tubing and Luer lock it to the upper access port of the primary tubing.

Label the secondary tubing with date and time.

Another way to prime the secondary tubing is to spike the mini-bag. Luer lock the secondary tubing into the primary tubing. Lower the mini-bag below the primary bag, open the roller clamp until the drip chamber is 1/2 to 1/3 full.

9. Lower the primary IV solution bag, and hang it on the extension hook.	Ensure the secondary bag (mini-bag) is hung above the primary IV solution bag. The position of the IV solutions influence the flow of the IV fluid into the patient. The setup is the same if the medication is given by gravity or through an IV infusion pump. Always follow manufacturer's directions for infusion pumps.  *Set up for secondary IV medication*
10. Ensure clamp on secondary tubing is open.	This prevents the patient from missing a dose of medication.  *Open clamp on secondary IV line*

Set the infusion rate according to PDTM. 11a. If using gravity infusion, use the roller clamp on the primary set to regulate the rate. The rate will need to be calculated for gtts/mins. 11b. If using an IV infusion pump, program the rate and volume of the secondary infusion. Most infusion pumps automatically restart the primary infusion at the previously established rate.	 *Regulate infusion with primary IV line roller clamp* If the medication is administered via gravity, remember to return to the patient when the mini-bag is infused and readjust the rate for the primary IV infusion. The primary IV solution will resume infusing at the rate of the secondary infusion, which could lead to rapid infusion of the primary solution. If medication is being given for the first time, stay with the patient for the first five minutes to monitor for any potential adverse effects. Encourage the patient to notify the health care provider if IV site becomes red, painful, or swollen, or if patient notices any adverse effects from the medication.
12. Leave secondary IV mini-bag and tubing in place for future drug administration. Check agency policy to verify if this practice is acceptable.	Repeated changes in IV tubing increase risk for infection transmission. Secondary IV tubing should be changed as per agency policy (usually every 24 hours).

13. Perform hand hygiene.	Hand hygiene reduces the transmission of microorganisms.
14. Document administration of the IV mini-bag on MAR. If the patient requires monitoring of fluid balance, record on the fluid balance documents (as per agency policy).	Document time, therapeutic effect (if appropriate), and any adverse reactions. Prompt documentation avoids the possibility of accidentally repeating the administration of the drug. If the drug was omitted or refused, record this appropriately and notify the primary health care provider.
Data source: Berman & Snyder, 2016; Goossens, 2015; Lynn, 2011; Perry et al., 2018; WHO, 2012	

Checklist 63 lists the steps to administer an intermittent IV medication using an existing secondary line, by gravity or an IV infusion pump.

Checklist 63: Administering an Intermittent IV Medication by a Mini-Bag Using Existing Secondary Line

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Review the advantages and disadvantages of IV medications (Table 7.7).
- Be able to answer the preparation questions for intravenous medication in Table 7.8 before administering the medication.
- If the medication has been diluted and there is wastage, always discard unused diluted portion of the prepared IV medication before going to the bedside.
- Always label the IV bag containing medication with two patient identifiers, date, time, medication, dose, and your initials. Once the medication is prepared, never leave it unattended.
- Never administer an IV medication into an IV line that isn't patent.
- Central venous catheters (percutaneous non-hemodialysis lines, PICC lines) and midline catheters may require special pre- and post-flushing procedures and specialized training.
- Always follow agency policies and guidelines when preparing and administering medications
- If using prefilled saline syringes, remove air prior.
- You will need a clock / watch / timer to time the rate of administration if infusing via gravity.
- Perform hand hygiene before preparing medications.

Steps	*Additional Information*
1. Prepare one medication for one patient at the correct time as per agency policy. Always check the physician's order, PDTM, and MAR. Mathematical calculations may be required to determine the correct dose to prepare.	Always apply the SEVEN rights and THREE checks of medication administration. Review the agency policy and the PDTM. If a medication is a stat, first-time, loading, or one-time dose, be extra diligent in reviewing the PDTM. Memory slips are a common source of error with medication administration. Complete all assessments and laboratory values that may influence the medication administration. If piggyback (secondary) medication is made up by the pharmacist, ensure the medication label on the mini-bag includes the medication, date and time the medication was mixed, dose and concentration, and expiry time. Premixed bags may require refrigeration. Premixed bags still require the nurse who is administering to add a label with two patient identifiers, nurse initials, and date / time of administration. Some health agencies require a second independent check with high-alert medications. Always follow agency policy.

2. Bring medication and MAR to bedside. Create privacy if possible.	Additional equipment required includes secondary tubing, a metal or plastic extension hanger, an alcohol swab, and a timer with a second hand (if running the mini-bag via gravity). Creating privacy provides comfort to the patient.
3. Compare the MAR with the patient's wristband, and use two patient identifiers (name and birth date), according to agency policy, to confirm patient ID.	This ensures you have the correct patient and complies with agency standard for patient identification.  *Compare MAR with patient's wristband*
4. Ask about allergies.	This ensures allergy status is correct on the MAR and the patient's allergy band.

5. Discuss purpose, action, and possible side effects of the medication. Provide patient an opportunity to ask questions. Encourage patient to report discomfort at the IV site (pain, swelling, or burning).	Keeping patient informed of what is being administered helps decrease anxiety.
6. Perform hand hygiene.	Hand hygiene prevents the transmission of microorganisms.
7. Assess IV site for patency and other complications (see checklist 65). Assess for medication specific criteria. Complete necessary assessments as required. Assess IV site for patency. If required flush the VAD according to agency protocol.	IV medications may require assessment of vital signs and lab values prior to administration. IV site must be patent prior to use. IV access devices such as PICCS and central lines which remain in situ for long periods have the potential for medication residue to build up in the lumen of the catheter posing a risk for occlusion and reaction with non compatible medications. Turbulent flushing clears the lumen of these.

8. Besides knowing compatibility of the primary solution with the mini-bag medication, ensure the new medication to be hung is compatible with the medication in the previous mini-bag.

- If they are compatible, simply hang the new bag.
- If they aren't compatible, either change the secondary line or back flush / back fill. Back flush or back fill by opening the clamp on the secondary IV line and lowering the mini-bag below the primary IV line. This will cause IV solution from the primary IV bag to enter the old mini-bag and clear out the secondary IV line. Allow approximately 25 ml of IV solution to enter the used mini-bag.

Close the clamp on the secondary IV line.

Empty the drip chamber into the mini-bag.

Remove the old mini-bag from the secondary IV tubing.

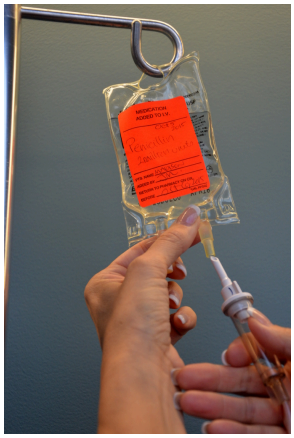
Hang the new mini-bag onto the IV pole.

Remove sterile blue cover on new medication bag, and insert the spike of the secondary IV tubing into it.

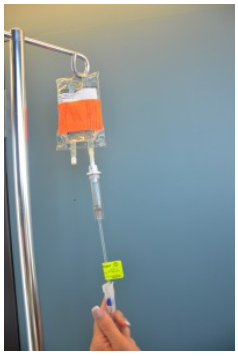
Check expiration date on secondary IV tubing.

Lower secondary IV bag below primary and open clamp to flush out secondary IV line

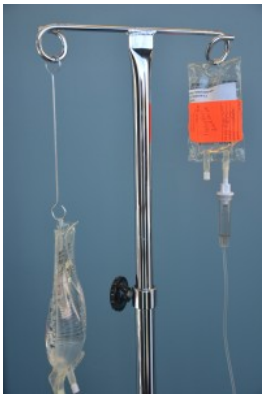
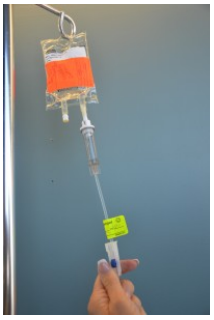
Follow principles of asepsis. Do not contaminate any connections.



Insert spike into secondary IV bag



Open clamp on secondary IV line

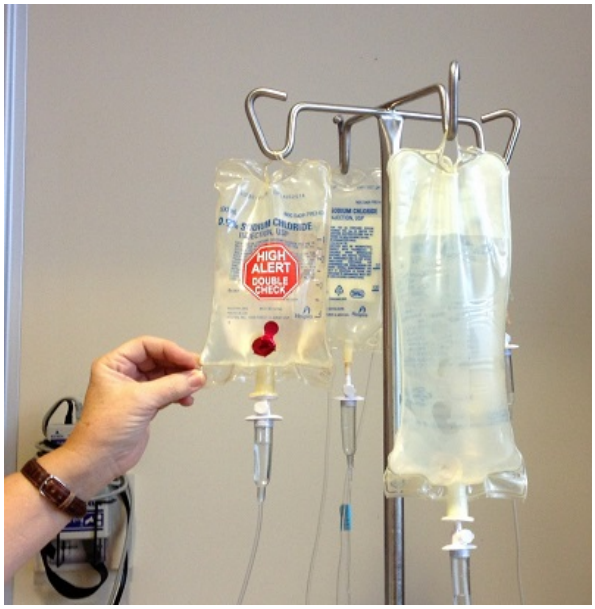
9. Ensure piggyback mini-bag is hung above the primary IV solution bag.	Position of the IV solutions influences the flow of the IV fluid into the patient. The setup is the same if the medication is given by gravity or through an IV infusion pump. Always follow manufacturer's directions for infusion pumps. 
10. Ensure clamp on secondary tubing is open.	This prevents the patient from missing a dose of medication.  *Open clamp on secondary IV tubing*

Set the infusion rate according to PDTM. 11a. If using gravity infusion, use the roller clamp on the primary set to regulate the rate. The rate will need to be calculated for gtts/mins. 11b. If using an IV infusion pump, program the rate and volume of the secondary infusion. Most infusion pumps automatically restart the primary infusion at the previously established rate.	 *Regulate infusion with primary IV line roller clamp* If the medication is administered via gravity, remember to return to the patient when the minibag is infused and readjust the rate for the primary IV infusion. The primary IV solution will resume infusing at the rate of the secondary infusion, which could lead to rapid infusion of the primary solution. If medication is being given for the first time, stay with the patient for the first five minutes to monitor for any potential adverse effects. Encourage patient to notify the health care provider if IV site becomes red, painful, or swollen, or if patient notices any adverse effects from the medication.
12. Leave IV mini-bag and tubing in place for future drug administration. Check agency policy to verify if this practice is acceptable.	Repeated changes to IV tubing increase risk for infection transmission. Secondary IV tubing should be changed as per agency policy (usually every 24 hours).

13. Perform hand hygiene.	Hand hygiene reduces the transmission of microorganisms.
14. Document administration of the IV piggyback on MAR, and as per agency policy.	Document time, therapeutic effect (if appropriate), and any adverse reactions. Prompt documentation avoids the possibility of accidentally repeating the administration of the drug. If the drug was omitted or refused, record this appropriately and notify the primary health care provider.
Data source: Clayton et al., 2010; Lynn, 2011; Perry et al., 2018; WHO, 2012	

Watch the video Reconstitution of Powdered IV Medication and *Administration via an IV Mini-Bag* by Renée Anderson and Wendy McKenzie (2018). Thompson Rivers University.

Continuous Intravenous (Medication) Infusion



Continuous IV medication administration

A **continuous intravenous medication infusion** is the infusion of a parenteral drug over several hours to several days. It involves adding medication to sterile IV solution (100 to 1,000 ml bag), and hanging the IV solution as a primary infusion. A continuous infusion must be ordered by the prescriber and listed in the PDTM as a medication to be given by IV continuous infusion. Examples of continuous IV infusion medications include heparin, KCL, and pantaprazole. Continuous intravenous infusions often come pre-mixed from the pharmacy. They might be labelled with the patient name. They will be labelled with IV solution; volume, amount, and concentration of medication; initials of person who prepared it; and date and time prepared (Alberta Health Services, 2009) or they might be ward stock direct from the manufacturer. Always refer to the PDTM for guidelines on how to administer, regulate, and titrate continuous infusions.

An electronic infusion device (EID) should be used to infuse continuous IV medications and MUST be used for specific medications like IV insulin and high dose KCL. Assessments and lab values must be monitored following the PDTM guidelines. A health care provider must assess the continuous medication infusion for the dose, rate, and patency of the IV site, and assess the patient for therapeutic and adverse reactions to the medication. The Institute for Safe Medication Practices (ISMP) (2013) recommends that all high-alert medications be independently double-checked to detect potential harmful errors before they reach the patient. Independent double checks have been shown to detect up to 95% of errors (ISMP Canada, 2014a).

Critical Thinking Exercises

1. Explain your thinking about whether or not the same secondary IV tubing be used more than once and for more than one kind of medication.
2. What is the purpose of hanging the secondary (piggyback) IV medication higher than the primary IV solution?
3. Your patient has an IV antibiotic infusing via a mini-bag and requests analgesic. The analgesic is IV route and not compatible with the current antibiotic. Explain your next action(s).

Attributions

Figure 7.33 Secondary Medication by BCIT is used under a CC BY 4.0 International license.

Figure 7.34. Untitled from pxhere has been designated to the public domain (CC0).

7.8 IV Medications Adverse Events and Management of Adverse Reactions

Safe medication administration requires special attention to transition points where medication errors are more likely to occur. For example, many errors occur in the ordering and preparing phase. Many parenteral medications are considered high-alert medications because of the potential significant harm when used in error. Therefore, these medications require special safeguards to reduce the risk of error. ISMP (2014) lists IV medications classified as high alert. All parenteral routes of insulin (SC/IV) are considered high alert (ISMP, 2014). Specific safeguards may include:

- Know the safe dosage range for each medication you administer.
- Label all medications that are prepared away from the bedside and not in the original container.
- Refer to the ISMP lists for high-alert medications: do not crush, do not use any error-prone abbreviations or look-/sound-alike drugs and symbols.
- Never assume an ordered medication dose is the correct medication or correct dose. Know your medications.

In addition, complications may occur if medication is injected incorrectly, if incorrect equipment (needle or syringe) is used to prepare the medication, or if an error occurs in preparing (calculation, selection of the med), administration, or post-assessment of the patient receiving the medication. Additional complications may include nerve or tissue damage, medication being absorbed too fast or too slow, wrong location for the medication (i.e., heparin given IM instead of SC), pain, bleeding, or a sterile abscess (Perry et al., 20148.

Despite safe medication administration practices, an adverse reaction may happen to a patient for a variety of complex reasons and contributing factors (College of Nurses of Ontario, 2015). An **adverse reaction,** also known as an **adverse event**, is an undesirable effect of any health product such as prescription and non-prescription pharmaceuticals, vaccines, serums, and blood-derived products; cells, tissues, and organs; disinfectants; and radiopharmaceuticals. An adverse reaction may occur under normal use and conditions of the product. Reactions may be evident within minutes or years after exposure to the product and may range from minor reactions, like a skin rash, to serious and life-threatening events such as a heart attack or liver damage (Health Canada, 2012). For example, some IV bolus medications may cause a sudden drop in blood pressure or heart rate, or hives may result.

Complications of Intravenous Medications

Complications may result from direct, continuous, or secondary IV medications. The complications are not specific to one medication. It is important for the health care provider to know which adverse event may occur with each individual medication. For example, the administration of an IV opioid (narcotic) medication could result in respiratory depression. Table 7.9 provides a list of possible complications and related interventions.

Table 7.9 Possible Complications related to IV medications and Related Interventions

Complications	*Related Interventions*
Speed shock: A systemic reaction caused by the rapid injection of a medication into the circulation, resulting in toxic levels of medication in the plasma. Symptoms can include cardiac arrest, flushed face, headache, irregular pulse, shock, syncope, and tightness in the chest.	Use a peripheral IV site, if possible, to allow for maximum hemodilution before the medication reaches the heart/brain. Stay with the patient and observe for symptoms or changes in vital signs and level of consciousness during and after administration. Stop the injection immediately if the patient develops signs or symptoms of circulatory (drop in BP), respiratory (dyspnea), or neurological (decrease in LOC) deterioration during administration.
IV medication is incompatible with IV fluids or residual meds in the same IV line: Results in chemical or physical changes in their composition. Precipitates may form, colour may change (e.g., IV fluid becomes cloudy in the IV tubing), or the change may not be visible. Therapeutic effect of the medication may be reduced, obliterated, or potentiated. Toxic substances may be formed.	Always follow the guidelines in the PDTM. Do not mix medications in one syringe and only give one medication at a time. Never add medications to blood, blood products, or parenteral nutrition. To avoid mixing of medications, ensure IV tubing and injection ports are flushed adequately between medication administrations. If precipitates are noted in the tubing, stop the infusion. Prime a new IV line and change at the cannula site. Flush IV catheter with normal saline. Document and notify prescriber. Report incident as per agency policy.
IV site shows signs of **phlebitis or irritation**: Injection of medication into a vein may cause inflammation or roughening of the endothelial lining (phlebitis), which can result in thrombus formation. Septic thrombophlebitis can result from poor aseptic technique.	Dilute and administer IV meds according to PDTM. WArm compress may encourage vasodilation and provide patient comfort.Monitor for signs and symptoms of phlebitis: redness, swelling, pain, blanching, and streaking. If these signs are present, stop infusion immediately. Discontinue access device and restart in another site. If required, provide extravasation care as per agency policy. Sepsis may present as fever, chills, general malaise. Report symptoms to prescriber and investigate cause of symptoms.

Medication may also be inadvertently injected into surrounding tissue (**infiltration**) and cause tenderness, swelling and pain. Some agents when infused into tissue cause these symptoms plus tissue necrosis and /or nerve damage. The later is referred to as **extravasation.** Agents that can cause extravasation include chemotherapeutic agents	Ensure IVs are patent prior to administering IV medication. Monitor for signs and symptoms of infiltration. Sites that are infiltrating must be stopped. Check to determine if the medication is a vesicant and follow agency protocols if infiltration has occurred.. Document and notify prescriber. Report incident as per agency policy.
Data source: Alberta Health Services, 2009; Children's Hospitals and Clinics of Minnesota, 2018; Lynn, 2011	

Table 7.10 lists five steps to manage an adverse reaction.

Table 7.10 Managing Adverse Reactions to IV Medications

Step	*Additional Information*
1.	Immediately stop the injection (or infusion) of the medication. Keep syringe of medication for further investigation of the reaction.
2.	Assess and monitor vital signs. Alert other members of the health care team and ask for assistance as required. Provide reassurance to the patient about the event.
3.	Notify responsible health care provider.
4.	Perform interventions (CPR, O_2 support) as required. Ensure patient has a patent IV site for any required medications to manage the adverse reaction.
5.	Document and report the event through PSLS or agency-specified reporting system.
Data source: Alberta Health Services, 2009; Clayton et al., 2010; College of Nurses of Ontario, 2015; Health Canada, 2012	

Reporting Medication Errors

Medication errors are the leading cause of preventable errors in Canada (ISMP Canada, 2014a). A **medication incident** is "any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional, patient, or consumer. Medication incidents may be related to professional practice, drug products, procedures, and systems, and include prescribing, order communication, product labelling / packaging / nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use" (ISMP Canada, 2014a, p. 8).

Most of the critical incidents reported to the ISMP occurred during administration of a medication with the wrong quantity of medication. The top five medications were hydromorphone, desmopressin, epinephrine, heparin, and morphine. Opioids continue to be the top medication classes associated with harmful incidents reported. Most of the opioid-related deaths involved overdoses, overlapping drug toxicities, administration of opioids to people who should not have received them, and use of hydromorphone (ISMP Canada, 2014b).

Overall, the top three contributing factors were communication, independent check processes, and insufficient knowledge (ISMP Canada, 2014a). Table 7.11 lists areas for improvement to prevent IV medication errors.

Table 7.11 Areas for Improvement to Prevent IV Medication Errors

Area	*Additional Information*
Monitoring of patient after medication administration	Be diligent in post-assessments of all IV medications. However, be particularly aware of high-alert medications, such as insulin, opioids, and anticoagulants. Many incident reports state that timely observation by a health care provider or family member prevents a bad outcome. Many overdoses can be reversed if caught in a timely manner.

IV infusion pump errors	Errors can include:
	
	• Lack of available IV pumps
	• Transcription errors such as:
	  ◦ Decimal point omitted
	  ◦ Decimal point moved
	  ◦ Concentration input
	• Incorrect drug selection
	• Multiple line confusion
	• Pump setup
	
	To decrease patient harm, hospitals need additional funding to purchase more IV pumps.

Health care technology	Computer-prescribed order entry (CPOE), automated dispensing cabinets (ADC), and other tools seek to improve patient safety and decrease errors. Protocols and force functioning need to be developed to minimize potential errors and to identify potential gaps in the system process.
Reporting, analysis, and knowledge translation	The collection and analysis of incident reports is the backbone to further improvements. Without a robust system, there cannot be the identification of contributing factors to medication incidents. Always report near misses, adverse reactions, and medication errors to ensure investigation and improvement is initiated. In addition, shared learning and strategies are vital for safer health care.

Data source: Clayton et al., 2010; ISMP Canada, 2014a

Critical Thinking Exercises

1. List four complications of IV medications, and preventive measures for each one.
2. Name two strategies to reduce the risk of harm from high-alert medications.

7.9 Summary

Parenteral medication administration is an effective method of delivering medication to patients, and it can be safely accomplished by utilizing the appropriate guidelines and policies in place to keep patients safe from harm. IV medications have a higher risk of harm than non-parenteral medication. The ever-increasing complexity of the health care environment increases the risk of a medication error with parenteral medications. The key takeaways below provide advice for preventing errors with parenteral medications.

Key Takeaways

- Parenteral medications have a relatively quick onset of therapeutic effects. Be aware of the onset, peak, and duration of all parenteral medications.
- Know which medications are considered high-alert medications, and perform independent double checks to minimize errors.
- Always consider the therapeutic effects and adverse effects when administering parenteral medications.
- Safeguards for medication administration exist in most hospitals. Make use of all safety strategies (such as smart IV pumps, no-interruption zones, two patient identifiers, and checklists) to administer medications safely.
- Quality and safety controls for safe medication administration must be considered along the entire process, not just at the point of administration.
- It is human nature to look for quick and easy ways to perform a task, but doing so may lead to errors. Avoid workarounds: Most hospitals have operational failures that lead to front line health care providers finding ways to manage deficiency in hospital operating systems. Rather than creating workarounds, engage in the additional steps to prevent re-occurrence of issues.
- Stay current with evidence-based research regarding potential system errors in health care. Commit to improving patient safety with medication administration.
- Report all errors, near misses, and adverse reactions to ensure knowledge is shared, and to prevent further errors from occurring.

Suggested Online Resources

1. Agency for Healthcare Research and Quality (AHRQ). This website provides evidence-based research, guidelines, recommendations, and resources on improving patient safety.
2. Canadian Patient Safety Institute (CPSI). This organization's website provides guidelines, research, and recommendations for improving patient safety in Canada.

3. Drug calculations. This medication calculation website reviews how to calculate the dosages for parenteral and non-parenteral medications, and IV fluids. It also includes metric conversions and IV drop rate calculations.
4. Institute for Healthcare Improvement (IHI). This group's website provides educational resources, webinars, publications, and improvement stories and tools to enhance patient safety.
5. Institute for Safe Medication Practices (ISMP). This organization focuses on improving medication administration. The website lists high-alert medications, offers newsletters and webinars, and provides a system for reporting medication errors, guidelines, and policies on safe practices.

References

Ağac, E., & Günes, U. Y. (2011). Effect on pain of changing the needle prior to administering medication intramuscularly: A randomized controlled trial. *Journal of Advanced Nursing*, 67(3), 563-568. doi: 10.1111/j.1365-2648.2010.05513.x.

Agency for Healthcare Research and Quality. (2014). *Checklists*. Retrieved from http://psnet.ahrq.gov/primer.aspx?primerID=14.

Alberta Health Services. (2009). Direct IV medications. *Specialized clinical competency program*. Retrieved from http://extcontent.covenanthealth.ca/Policies/iii-45_Learning_Module.pdf.

American Nurses Association. (2002). *Needlestick prevention guide*. Retrieved from http://www.who.int/occupational_health/activities/2needguid.pdf.

Astle, B., & Duggleby, W. (2019). *Canadian fundamentals of nursing* (6th ed.). Milton, ON: Elsevier.

Becton, Dickinson UK. (2013). *Hidden talents of BD Saf-T-Intima.* Retrieved from https://www.bd.com/europe/safety/en/pdfs/Saf-T-Intima%20use%20Guide.pdf.

Berman, A., & Snyder S. J. (2016). *Skills in clinical nursing* (8th ed.). Hoboken, NJ: Pearson.

Black, L. (2013). Ditch the pinch: Bilateral exposure injuries during subcutaneous injections. *American Journal of Infection Control*, 41(9), 815-819. doi: 10.1016/j.ajic.2012.10.017.

British Columbia Institute of Technology (BCIT). (2015). Week 11 PowerPoint notes. In, *NURS 3020: Clinical Techniques*. Vancouver, BC: BCIT.

Brookside Associates. (2015a). *Procedure for administering an intradermal injection*. Retrieved

from http://brooksidepress.org/intramuscular/lessons/lesson-2-administer-an-intramuscular-injection/2-07-procedure-for-administering-an-intradermal-injection/.

Brookside Associates. (2015b). *Procedure for administering a subcutaneous injection*. Retrieved from http://brooksidepress.org/intramuscular/lessons/lesson-2-administer-an-intramuscular-injection/2-05-procedure-for-administering-a-subcutaneous-injection/.

Butt, A. R. (2010). Medical error in Canada. Issues related to reporting medical error and methods to increase reporting. *McMaster University Medical Journal*, *Clinical Review*, 7(1), 15-18.

Canadian Agency for Drugs and Technologies in Health. (2014). *Aspirating versus not aspirating prior to injection of medication: Comparative clinical evidence and guidelines*. Retrieved from https://www.cadth.ca/sites/default/files/pdf/htis/nov-2014/RB0669%20Aspiration%20Prior%20to%20Injection%20Final.pdf.

Canadian Diabetes Association. (2013). Canadian Diabetes Association Clinical Practice Guidelines Expert Committee. Clinical practice guidelines for the prevention and management of diabetes in Canada. *Canadian Journal of Diabetes*, 37(1), s1-s212.

Canadian Institute for Health Information. (2009). *National system for incident reporting: An innovative approach to information management* [CPSI Forum, April 29, 2009]. Retrieved from http://www.patientsafetyinstitute.ca/English/toolsResources/Presentations/Documents/2009/Canada%27s%20Forum%20-%20Presentation%20A4-b.pdf

Canadian Patient Safety Institute. (2012). *Canadian analysis incident framework*. Retrieved from http://www.patientsafetyinstitute.ca/english/toolsresources/incidentanalysis/documents/canadian%20incident%20analysis%20framework.pdf.

Centers for Disease Control (CDC). (2012). *NOISH fast facts (home healthcare workers). How to prevent needlestick and sharps injuries*. Retrieved from http://www.cdc.gov/niosh/docs/2012-123/pdfs/2012-123.pdf.

Centers for Disease Control (CDC). (2013). *Infection control*. Retrieved from http://www.cdc.gov/oralhealth/infectioncontrol/faq/protective_equipment.htm.

Centers for Disease Control (CDC). (2015). *Injection safety*. Retrieved from http://www.cdc.gov/injectionsafety/.

Children's Hospitals and Clinics of Minnesota. (2018). *Infiltration and extravasation care*. Retrieved from https://www.childrensmn.org/educationmaterials/childrensmn/article/16565/infiltration-and-extravasation-care/.

College of Nurses of Ontario. (2015). *Medication practice standard*. Retrieved from http://www.cno.org/Global/docs/prac/41007_Medication.pdf.

Clayton, B. D., Stock, Y. N., & Cooper, S. E. (2010). *Basic pharmacology for nurses*. St. Louis, MO: Mosby Elsevier.

Cocoman, A., & Murray, J. (2008). Intramuscular injections: A review of best practice for mental health nurses. *Journal of Psychiatry Mental Health Nursing*, 15(5), 424-434. doi: 10.1111/j.1365-2850.2007.01236.

Davidson, K. M., & Rourke, L. (2014). *Teaching best evidence: Deltoid intramuscular injection techniques*. Retrieved from http://www.sciedu.ca/journal/index.php/jnep/article/view/1888/1291.

Debono, D. S., Greenfield, D., Travaglia, J. F., Long, J. C., Black, D., Johnson, J., & Braithwaite, J. (2013). Nurses' workarounds in acute healthcare settings: A scoping review. *BMC Health Services Research*, 13(175). doi: 10.1186/1472-6963-13-175.

Ellis, J., & Parush, A. (2012). *Preventing errors with high alert drugs: Testing a computerized double check*. Retrieved from http://www.patientsafetyinstitute.ca/English/research/cpsiResearchCompetitions/2009/Documents/Ellis/Ellis%20Techinical%20Report%20English.pdf.

Greenway, K. (2014). Rituals in nursing: Intramuscular injection. *Journal of Clinical Nursing*, 23(23-24), 3583-3588. doi: 10.1111/jocn.12627.

Goossens, G. (2015). Flushing and locking of venous catheters: Available evidence and evidence deficit. *Nursing Research and Practice*, 2015(985686). https://dx.doi.org/10.1155%2F2015%2F985686.

Health Canada. (2012). *Adverse reaction information*. Retrieved from http://www.hc-sc.gc.ca/dhp-mps/medeff/advers-react-neg/index-eng.php.

Hunter, J. (2008). Intramuscular injection techniques. *Nursing Standard*, 22(24), 35-40.

Hutin, Y., Hauri, A., Chiarello, L., Caitlin, M., Stillwell, B., Ghebrehiwet, T., Garner, J., & Members of the Safe Injection Practices Development Group (2003). *Best infection control practices for intradermal, subcutaneous, and intramuscular injections*. Retrieved from http://www.who.int/bulletin/volumes/81/7/Hutin0703.pdf.

Institute for Healthcare Improvement. (2015). *High-alert medication safety*. Retrieved from http://www.ihi.org/topics/highalertmedicationsafety/pages/default.aspx.

Institute for Safe Medication Practices (ISMP). (2003). How fast is too fast for IV push medications? *Journal of Radiology Nursing*, 28(2), 66. https://doi.org/10.1016/j.jradnu.2007.05.002.

Institute for Safe Medication Practices (ISMP). (2013). *Independent double checks: Undervalued and misused: Selective use of this strategy can play an important role in medication safety*. Retrieved from https://www.ismp.org/resources/independent-double-checks-undervalued-and-misused-selective-use-strategy-can-play.

Institute for Safe Medication Practices (ISMP). (2014). *ISMP list of high alert medications in acute care settings*. Retrieved from https://www.ismp.org/tools/highalertmedications.pdf.

Institute for Safe Medication Practices Canada (ISMP Canada). (2014a). *Ontario hospital critical incident related to medications or IV fluids analysis report: January to December 2013*. Retrieved from http://www.ismp-canada.org/download/ocil/ON_Critical_Incidents_Analysis_Report_3JUL2014.pdf.

Institute for Safe Medication Practices Canada (ISMP Canada). (2014b). *Opioid-related deaths associated with medication incidents. Findings of multi-incident analysis*. Retrieved from http://www.ismp-canada.org/download/OpioidStewardship/Opioid-Related_Deaths_Associated_with_Medication_Incidents_Nov2014.pdf.

Ipp, M., Sam, J., & Parkin, P. C. (2006). Needle aspiration and intramuscular vaccination. *Archives of Pediatrics and Adolescent Medicine*, 160(4), 451-453. doi: 10.1001/archpedi.160.4.451-a.

Lynn, P. (2011). *Photo atlas of medication administration* (4th ed.). Philadelphia, PA: Lippincott Williams & Wilkins.

Malkin, B. (2008). Are techniques used for intramuscular injection based on research evidence? *Nursing Times*, 104(50-51), 48–51.

Mitchell, J. R., & Whitney, F. W. (2001). The effect of injection speed on the perception of intramuscular injection pain. A clinical update. *American Association of Occupational Health Nurses (AAOHN) Journal*, 49(6), 286-292. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/11760527.

National Institute for Occupational Safety and Health. (1999). *ALERT: Preventing needlestick injuries in health care settings*. Retrieved from http://www.cdc.gov/niosh/docs/2000-108/pdfs/2000-108.pdf.

National Institute of Health Clinical Center. (2015). *NIH Clinical Center patient education material. Giving a subcutaneous injection*. Retrieved from http://www.cc.nih.gov/ccc/patient_education/pepubs/subq.pdf.

National Patient Safety Agency. (2009). *Safety in doses. Improving the use of medication in NHS*. Retrieved from http://www.nrls.npsa.nhs.uk/resources/?entryid45=61625.

National Priority Partnership. (2010). *Preventing medical errors: A $21 billion opportunity*. Retrieved from http://psnet.ahrq.gov/resource.aspx?resourceID=20529.

Nisbet, A. C. (2006). Intramuscular gluteal injections in the increasingly obese population: Retrospective study. *British Medical Journal*, 332(7542), 637-638. http://dx.doi.org/10.1136/bmj.38706.742731.47.

Ogston-Tuck, S. (2014a). Intramuscular injection technique: An evidence-based approach. *Nursing Standard*, 29(4), 52-59. Retrieved from http://journals.rcni.com/doi/pdfplus/10.7748/ns.29.4.52.e9183.

Ogston-Tuck, S. (2014b). Subcutaneous injection technique: An evidence-based approach. *Nursing Standard*, 29(3), 53-58.

Öztürk, D., Baykara, Z., Karadag, A., & Eyikara, E. (2017). The effect of the application of manual pressure before the administration of intramuscular injections on students' perceptions of postinjection pain: a semi-experimental study [PMID: 27535654]. *Journal of Clinical Nursing*, 26, 1632-1638. https://doi.org/10.1111/jocn.13530.

Parenteral. (2015). In Merriam-Webster on line dictionary. Retrieved from http://www.merriam-webster.com/medical/parenteral.

Perry, A., Potter, P., & Ostendorf, W. (2018). *Clinical skills and nursing techniques* (9th ed.). St. Louis, MO: Elsevier-Mosby.

Prakash, V., Koczmara, C., Savage, P., Trip, K., Stewart, J., McCurdie, T., … Trbovich, P. (2014). Mitigating errors caused by interruptions during medication verification and administration: Interventions in a simulated ambulatory chemotherapy setting. *BMJ Quality and Safety*, 23, 884-892. doi:10.1136/bmjqs-2013-002484

Pratt, J. R., Pellowe, C. M., Wilson, J. A., Loveday, H. P., Harper, P. J., Jones, S. R., … Wilcox, M. J. (2007). Epic2: National evidence based guidelines for preventing health care associated infections in NHS hospitals in England. *Journal of Hospital Infection*, 65(1), S1-64. https://doi.org/10.1016/S0195-6701(07)60002-4.

Provincial Infectious Disease Advisory Committee. (2014). *Best practices for hand hygiene in all health care settings* (4th ed.). Retrieved from http://www.publichealthontario.ca/en/eRepository/2010-12%20BP%20Hand%20Hygiene.pdf.

Rodgers, M. A., & King, L. (2000). Drawing up and administering intramuscular injections: A review of the literature. *Journal of Advanced Nursing*, *31*(3), 574–582. doi: 10.1046/j.1365-2648.2000.01312.x.

Royal Children's Hospital Melbourne (RCH). (2014). Subcutaneous catheter devices management of insuflon and BD safTIntima devices. *Clinical Guidelines (Nursing)*. Retrieved from https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Subcutaneous_catheter_devices_management_of_insuflon_and_BD_safTIntima_devices/.

Saskatchewan Health Authority. (2018). Subcutaneous therapy – intermittent and continuous – adult & pediatric [catalogue no. 1074]. *Policies & Procedures: Subcutaneous Therapy – Intermittent and Continuous*. Retrieved from https://www.saskatoonhealthregion.ca/about/NursingManual/1074.pdf.

Sepah, Y., Samad, L., Altaf, A., Rajagopalan, N., & Khan, A. J. (2014). Aspiration in injections: Should we continue or abandon the practice? *F1000Research*, *3*(157). 10.12688/f1000research.1113.1.

Siegel, J. D., Rhinehart, E., Jackson, M., Chiarello, L., & Healthcare Infection Control Practices Advisory Committee. (2007). *Guideline for isolation precautions: Preventing transmission of infectious agents in healthcare settings*. Retrieved from http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf.

Shah, K., Lo, C., Babich, M., Tsao, N., & Bansback, N. (2016). Bar code medication administration technology: A systematic review of impact on patient safety when used with computerized prescriber order entry and automated dispensing devices [PMID: 27826157]. *Canadian Journal of Hospital Pharmacy*, *69*(5), 394-402. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5085324/.

Sisson, H. (2015). Aspirating during the intramuscular injection procedure: A systematic literature review. *Journal of Clinical Nursing*, *24*(17-18), 2368-2375. https://doi.org/10.1111/jocn.12824.

Wilburn, S. Q. (2004). Needlestick and sharps injury prevention. *The Online Journal of Issues in Nursing*, *9*(3). Retrieved from http://www.nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TableofContents/Volume92004/No3Sept04/InjuryPrevention.html.

Wilburn, S. Q., & Eijkemans, G. (2004). Preventing needlestick injuries among healthcare workers: A WHO-ICN collaboration. *International Journal of Occupational and Environmental Health*, *10*(4), 451-456. https://doi.org/10.1179/oeh.2004.10.4.451.

Workers Compensation Act: Occupational health and safety regulation. (2015). BC Reg. 296/297. Retrieved from the BC Laws website: . http://www.bclaws.ca/Recon/document/ID/freeside/296_97_04.

Workman, B. (1999). Safe injection techniques. *Nursing Standard*, 13(39), 47-53. https://doi.org/10.7748/ns1999.06.13.39.47.c2623.

World Health Organization (WHO). (2012). *Course: Knowledge is the enemy of unsafe care*. Retrieved from http://who.int/patientsafety/education/curriculum/course7_handout.pdf.

CHAPTER 8. INTRAVENOUS THERAPY

8.1 Introduction

The use of intravenous (IV) therapy is common in the healthcare setting. IV therapy is a treatment that infuses fluids, nutrients, blood, blood products, or medication directly into a vein. It is a fast, efficient way to infuse fluids and medications into the body.

This chapter will review how to care for a patient with peripheral intravenous therapy and central venous catheters. It will cover how to prepare IV infusions, and how to assess, maintain, and prevent complications related to intravenous therapy.

Learning Outcomes

- Define three patient conditions that may require IV therapy.
- Identify five systemic complications associated with IV therapy , signs and symptoms, and preventative measures.
- Identify five local complications associated with IV therapy, signs and symptoms, and preventative measures.
- Identify five potential complications associated with central venous catheters (CVCs) specifically, signs and symptoms and appropriate interventions.
- Differentiate common types of venous access devices: peripheral venous access device–short cannula; PVAD midline; CVADs–including peripherally inserted central catheter (PICC); percutaneuous non hemodialysis line; tunneled catheters; and implanted venous access device (IVAD).
- Identify rationale for selection of specific venous access devices and the benefits and complications associated with them.
- Differentiate isotonic, hypotonic, and hypertonic IV solutions.
- Describe the components of an IV administration set.
- Demonstrate flushing and locking protocols for PVAD-short, PICC, percutaneous non hemodialysis central line, and midline catheter.
- Demonstrate:
    - Initiating a continuous IV infusion from a locked IV, and discontinuing a continuous infusion
    - Removing a PVAD-short cannula
    - Priming of IV tubing
    - Changing IV bags
    - Changing IV tubing
    - Calculating IV rates
- Describe the primary difference when removing a PVAD-short versus removing a percutaneous non hemodialysis CVC.
- Describe principles of IV site dressings.
- Identify three indications for blood and blood product transfusions.

- Identify five key steps in the pre-transfusion preparation intended to increase safety associated with transfusions.
- Identify signs and symptoms of transfusion reaction and initial nursing management.
- Identify four indications for parenteral nutrition (PN) therapy.
- Describe three PN specific complications and one preventative measure for each.
- Describe four key elements in the plan of care (including rationale) for someone with PN therapy.

8.2 Intravenous Therapy: Guidelines and Potential Complications

Intravenous therapy is treatment that infuses intravenous solutions, medications, blood, or blood products directly into a vein (Perry et al., 2018). Intravenous therapy is an effective and quick way to administer fluid or medication treatment in an emergency situation, and for patients who are unable to take medications orally. Approximately 80% of all patients in the hospital setting will receive intravenous therapy.

The most common reasons for IV therapy (Waitt, Waitt, & Pirmohamed, 2004) include:

1. To replace fluids and electrolytes and maintain fluid and electrolyte balance: The body's fluid balance is regulated through hormones and is affected by fluid volumes, distribution of fluids in the body, and the concentration of solutes in the fluid. If a patient is ill and has fluid loss related to decreased intake, surgery, vomiting, diarrhea, or diaphoresis, the patient may require IV therapy.
2. To administer medications, including chemotherapy, anesthetics, and diagnostic reagants: About 40% of all antibiotics are given intravenously.
3. To administer blood or blood products: The donated blood from another individual can be used in surgery, to treat medical conditions such as shock or trauma, and/or to treat a failure in the production of red blood cells. The infusion restores circulating volumes, improving the ability to carry oxygen and replace blood components that are deficient in the body.
4. To deliver nutrients and nutritional supplements: IV therapy can deliver many of the nutritional requirements for patients unable to obtain adequate amounts orally or by other routes.

Guidelines Related to Intravenous Therapy

The following are general guidelines for peripheral IV therapy:

- IV fluid therapy is ordered by a physician or nurse practitioner. The order must include the type of solution or medication, rate of infusion, duration, date, and time. IV therapy may be for short or long duration, depending on the needs of the patient (Perry et al, 2018).
- IV therapy is an invasive procedure; therefore, significant complications can occur if the

wrong amount of IV fluids or the incorrect medication is given.

- Principles of asepsis must be maintained throughout all IV therapy procedures, including initiation of IV therapy, preparing and maintaining equipment, and discontinuing an IV system. Always perform hand hygiene before handling IV equipment. If the connectors in the administration set and/or the solution become contaminated, they should be replaced with new ones to prevent introducing bacteria or other contaminants into the system and, thus, the patient (Centers for Disease Control [CDC], 2017).
- Understand the indications and duration for IV therapy for each patient. Practice guidelines recommend that patients receiving IV therapy for more than six days should be assessed for an intermediate or long-term venous access device (CDC, 2017).
- If a patient has an order to keep a vein open, or "TKVO," the usual rate of infusion is 20 to 50 ml per hour (Fraser Health Authority, 2014).
- Complications may occur with IV therapy, including but not limited to localized infection, catheter-related bloodstream infection (CR-BSI), fluid overload, and complications related to the type and amount of solution or medication given (Perry et al., 2018).
- IV access devices are chosen based on need. A few of the reasons include if the solution or drugs have high or low pH or high osmolality. If so, a device where the tip of the catheter is in a large vessel that allows for high hemodilution is necessary. The anticipated length of treatment is another deciding factor because some devices have a longer dwell time than others—PVAD-short catheters have a shorter dwell time than CVADs (Perry et al., 2018). There are a variety of CVAD choices that allow treatment to better meet the needs of the situation.
- IV sites must be assessed regularly. Check your agency for specific guidelines. Some guidelines may suggest every 5 minutes, others hourly, others every 12 hours (Gorski et al., 2012; RCH, n.d.; RNAO, 2005). In the absence of guidelines, exercise some clinical judgement and consider that sites requiring more frequent assessment include those that have an infusion versus those that are locked; in an acute care environment versus a home environment; patient conditions where cognitive and sensory changes inhibit their ability to voice concerns; types of solutions—vesicants require more frequent site assessment than solutions with less potential for harm if infiltrated; location and type of catheter—areas of flexion have higher risk of infiltration; central venous access have higher risk of air emboli if equipment fails (Gorski et al., 2012).

Potential Complications of IV Therapy

Several potential complications may arise from intravenous therapy. It is the responsibility of the healthcare provider to monitor for signs and symptoms of complications and intervene

appropriately. Complications can be categorized as local or systemic. Most complications are avoidable if simple hand hygiene and safe principles are adhered to for each patient at every point of contact (Fraser Health Authority, 2014; McCallum & Higgins, 2012). Table 8.1 lists the potential local and complications and treatment. It should be noted that local complications are more apparent with PVAD-short catheters but still apply to CVADs.

Table 8.1 Potential Local Complications of IV Therapy

Complication	*Signs and Symptoms*	*Prevention and Treatment*
Phlebitis, causes include: • Mechanical: caused by the cannula rubbing and irritating the vein • Chemical: usually caused by meds or solutions that have high or low pH or with high osmolality • See Table 8.2 Phlebitis Scale.	Localized redness, pain, heat, and swelling which can track up the vein leading to a palpable venous cord (feels like a small rope) **Note**: Phlebitis may be more difficult to assess with a CVAD because the tip of the catheter (thus delivery of the meds or solutions) occurs in a larger vessel.	Prevention: Assess sites frequently. • Peripheral: Choose PVADs with smallest gauge necessary for purpose. Follow agency protocols for use of IV securement of devices or dressings. • Chemical: Follow Parental Drug Therapy Manual guidelines in your agency for medication dilution and administration guidelines. • Treatment: Remove PVAD-short or midline catheters. Apply warm compress. Slow infusion rates. Initiate new PVAD-short if necessary. • Document. Report to agency Patient Safety & Learning System.
Infection: at insertion site or systemically	Insertion site may become red, tender, swollen, or have purulent drainage. Systemic signs and symptoms may include malaise, fever, hypotension, or tachycardia.	Strict hand-washing, aseptic technique for all procedures, close monitoring of vital signs, strict protocols for dressing, tubing and cap changes. Report concerns to prescriber and agency Patient Safety & Learning System. Monitor blood work and vital signs. C&S of the site as per agency policy. PVAD-short and midline catheters showing S&S of local infection should be removed immediately. Monitor for signs and symptoms of systemic infection.

Occlusions: • Most likely caused by a clot due to inadequate flushing protocol on locked sites or infusion rates too slow to keep vein open. • **Note:** Specific information regarding CVAD occlusion will follow.	Sluggish flow rate. Inability to flush or infuse IV solution or meds. Frequent downstream occlusion alarms on the IV controller / pump.	Prevention: Follow agency flushing protocols. Know what kind of needleless cap is in use and follow correct flushing procedure. Assess and resolve any mechanical occlusions. Remove occluded PVAD-short catheters. **Note**: Specific information regarding CVAD occlusion will follow.
Infiltration: • Occurs when a non-vesicant IV solution is inadvertently administered into surrounding tissue. • **Note**: This will be more difficult to see on CVADs because the vessel is deep and not near the skin surface.	Pain, swelling, redness, skin surrounding insertion site is cool to touch, change in quality or flow of IV, tight skin around IV site, IV fluid leaking from IV site, frequent occlusion alarms on IV pump.	Prevention: Confirm IV patency during IV therapy. Recheck IV patency before medication administration. Use IV securement devices to stabilize IV insertion sites. Avoid areas of flexion and always assess IV sites before, during, and after infusing IV fluids or medications. Treatment: Stop infusion and remove cannula. Follow agency policy and guidelines related to infiltration.
Extravasation: • Occurs when vesicant (irritating, toxic) solution is administered and inadvertently leaks into surrounding tissue causing damage to surrounding tissue. • Like infiltration, this will be more difficult to see on CVADs because the vessel is deep and not near the skin surface.	Same as infiltration but also includes burning, stinging redness, blistering, or necrosis of tissue.	Stop infusion. Remove PVAD-short or midline catheter. Follow agency policy for extravasation for specific medications. For example, toxic medications have a specific treatment plan.
Bleeding / hemorrhage	Bleeding at the insertion site. If this is an arterial bleed, significant edema and pain may present itself.	Bleeding (venous) at site sometimes controlled with manufactured hemostatic product (StatSeal). Suspected arterial bleeds must be reported to an appropriate healthcare provider immediately

Data sources: Fraser Health Authority, 2014; Fulcher & Frazier, 2007; Interior Health Authority, 2012; McCallum & Higgins, 2012; Perry et al., 2018.

Some agencies recommend using a phlebitis scale to objectively describe signs and symptoms of

this IV site complication. IV sites should be assessed during IV therapy and for days following removal in the event site complications present themselves.

Table 8.2 Phlebitis Scale

Grade	*Clinical Indications*
0	No symptoms.
1	Erythema at the access site. Pain may or may not be present.
2	Pain at access site with erythema or edema.
3	Pain at access site with erythema or edema. Streak formation. Palpable venous cord.
4	Pain at access site with erythema or edema. Streak formation. Palpable venous cord greater than 1.5 cm in length. Purulent drainage at insertion site

Data sources: Infusion Nurses Society, 2011; Interior Health, 2018

Systemic complications can occur apart from chemical or mechanical complications. To review the systemic complications of IV therapy, see Table 8.3.

Table 8.3 Potential Systemic Complications of IV Therapy

Safety considerations:

- People with cardiac and renal health challenges have increased risk of systemic complications.
- Pediatric patients, neonates, and elderly people have increased risk of systemic complications.

Complication	*Signs and Symptoms*	*Prevention and Treatment*
Pulmonary edema: Also known as fluid or circulatory overload. A condition caused by excess fluid accumulation in the lungs due to excess fluid in the circulatory system and inability of the body to adapt.	↓ SpO_2, ↑ respiratory rate, dyspnea, coughing up pink frothy sputum, auscultation of dependent fine crackles	Prevention: Use IV controller / pump to prevent accidental bolus. Treatment: Must be immediate. ↑ HOB, vitals, administer oxygen, notify prescriber. Anticipate diuretics and slowed IV rates.
Catheter-related bloodstream infection (CRBSI): Caused by microorganisms that are introduced into the body during insertion if the device is contaminated, through skin organisms at the time of insertion, and afterward from the IV hub / connector and/or the solutions.	Confirmed by blood cultures. Elevated temperature, flushed, headache, malaise, tachycardia, ↓ BP, and additional signs and symptoms of sepsis	Prevention: Strict hand-washing, aseptic technique for all procedures, close monitoring of vital signs, strict protocols for dressing, tubing, and cap changes, prevent contamination of hub. Treatment: Report concerns to prescriber; monitor bloodwork and vital signs; anticipate blood cultures; IV antibiotic therapy; consider catheter removal, if suspect.
Air embolism: The presence of air in the vascular system. 10 ml of air have been proven to have serious effects and is sometimes fatal. Tiny air bubbles are tolerated by most patients.	Sudden shortness of breath, continued coughing, breathlessness, shoulder or neck pain, agitation, feeling of impending doom, light-headedness, hypotension, wheezing, tachycardia, altered mental status, jugular venous distension, ↓ SpO_2, cardiac arrest. The effect of the air emboli depends on the rate and volume of air introduced.	Prevention: Clamp extensions when not in use. IV equipment with Luer locks; fill drip chambers 1/2 to 1/3 full; use IV controller / pump; remove all air from tubing when priming; prime IV tubing prior to attaching to patient. Treatment: Occlude source of air entry. Place patient in Trendelenburg position on left side (if not contraindicated), administer oxygen, vital signs, notify prescriber / RT.

Pulmonary embolism: A blood clot becomes free floating, enters venous circulation, and completely or partially blocks a pulmonary artery. The resulting hypoxic injury to lobe(s) of the lung result in circulatory issues.	Anxiety, chest pain, tachycardia, dyspnea, blood in sputum, $\downarrow SpO_2$	Prevention: Never irrigate clotted lines. Follow flushing protocols to prevent fibrin build up in lines. Prevent thrombophlebitis. Use filters when administering specific products (see agency policy).
Device embolism: Occurs when a small part of the cannula breaks off and flows into the vascular system. Most likely to happen with repeated failed attempts of insertion of the same cannula, inferior quality of the IV cannula, or prolonged peripheral IV cannulation (Singh et al., 2015).	Dependent on where the piece of IV cannula ends up, symptoms would depend on where the piece lodges itself. If lodged in extremity: redness, pain, edema in the distal part of the extremity.	Prevention: Do not reintroduce loosened stylets (needle) during insertion. When removing any IV catheters, inspect tip to ensure end is intact. Report any concerns.

Data sources: Fraser Health Authority, 2014; Fulcher & Frazier, 2007; Interior Health, 2012; McCallum & Higgins, 2012; Perry et al., 2018; Singh, Kaur, Singh, & Kaur, 2015

Healthcare providers should assess a patient with a central line at the beginning and the end of every shift, and as needed. For example, if the central line has been compromised (pulled or kinked), ensure it is functioning correctly. Each assessment should include: CVCs have specific protocols for accessing, flushing, disconnecting, and assessment. All healthcare providers require specialized training to care for, manage complications related to, and maintain CVCs as per agency policy. Never access or use a central line for IV therapy unless trained as per agency policy. For more information on CVC care and maintenance, see the suggested online reference list at the end of this chapter.

- Type of CVC and insertion date: Reason for CVC?
- Dressing: Is it dry and intact?
- Lines: Secure with stat-lock, sutures, or Steri-Strips?
- Review: Patient still requires a CVC?
- Insertion site: Free from redness, pain, swelling?
- Positive pressure cap: Attached securely?
- IV fluids: Running through an IV pump?
- Lumens: Number of lumens and type of fluids running through each?
- Vital signs: Fever?
- Respiratory/cardiovascular assessment: Any signs and symptoms of fluid overload?

There are potential complications specific to central lines that the nurse should be aware of. Table 8.4 describes complications associated with CVADs specifically, along with signs and symptoms, interventions, and prevention. Assessment for persons with a CVAD also involves observing for the local and systemic complications discussed in Tables 7.9, 8.1 and 8.3.

Table 8.4 Potential Complications Associated Specifically with CVADs

Complication	*Signs and Symptoms*	*Interventions*
Mechanical related complications: Some of these may present at the time of insertion. • Pneumothorax can occur during insertion of subclavian placed lines.	Pneumothorax is characterized by ↓ / absent breath sounds in one lung, dyspnea, ↓ SpO_2, sharp pain in chest or shoulder. Subcutaneous emphysema may be present (palpate skin around insertion site…feels like bubbles popping under one's fingers).	Elevate head of bed, respiratory assessment, administer oxygen, vitals, consult prescriber. Anticipate chest x-ray, possible chest tube insertion.
• Cardiac dysrhythmias due to catheter malposition or migration.	Irregular heart rate.	Prevention post insertion: Use securement devices. Measure and record external length. Report discrepancies. Treatment: Monitor vitals; notify prescriber; anticipate x-ray to confirm position. When confirmed, pull out catheter a prescribed distance.
• Catheter migration may occur due to increased intrathoracic pressure due to coughing, change in body position, or physical movement (of the arms), sneezing, or weightlifting.	Change in external length.	Prevention post insertion: Use securement devices. Measure and record external length. Report discrepancies. See Table 8.13 Principles of IV site dressing changes Treatment: Assess vitals; consult prescriber; malposition may be confirmed by x-ray; may require central line to be pulled out some distance. The prescriber will advise.
• Hemothorax: blood in the pleural space	Characterized by ↓ SpO_2, ↑ respiratory rate, dyspnea, hypotension, ↓ / absent air entry to one lung	Elevate head of bed, respiratory assessment, administer oxygen, vitals, consult prescriber. Anticipate chest x-ray, possible chest tube insertion.

• Bleeding: potential arterial / venous bleed during insertion	Arterial bleed may be pulsating, ++ bruising and edema, blood bright red. Venous bleed slower, blood darker red.	Arterial bleed requires pressure. Monitoring vitals including pulse distal to the site. Bleeding (venous) at site sometimes controlled with manufactured hemostatic product (StatSeal ®).
Catheter-related thrombosis (CRT) can be: • Intraluminal clots • Blood clot occurring between the catheter and the vein. Usually related to long-term CVC use. Occurs mostly in the upper extremities. • Both can lead to further complications.	Pain, tenderness, swelling, limb edema, warmth, erythema, and appearance of distended collateral vessels in surrounding area. Extreme complications include pulmonary embolus, post-thrombotic syndrome, and vascular compromise Most catheter related thrombi are asymptomatic.	Prevention through routine flushing following appropriate protocols. Prior catheter infections increase risk for developing a CRT. Treatment: Vital signs; repositioning for comfort; notify prescriber; anticipate ultrasound, venogram, x-rays; may require anticoagulant therapy and possible removal of the CVC.
Air embolism: the presence of air in the vascular system. Can occur during CVAD insertion or removal, during line changes, from cracked or disconnected equipment. 10 ml of air has been proven to have serious effects and is sometimes fatal. Tiny air bubbles are tolerated by most patients.	Sudden shortness of breath, continued coughing, breathlessness, shoulder or neck pain, agitation, feeling of impending doom, light-headedness, hypotension, wheezing, tachycardia, altered mental status, jugular venous distension, ↓ SpO_2, cardiac arrest.	Prevention: Clamp extensions when not in use. IV equipment with Luer locks; fill drip chambers 1/2 to 1/3 full; use IV controller / pump; remove all air from tubing when priming; prime IV tubing prior to attaching to patient; Valsalva maneuver prior to insertion and removal of CVAD. Treatment: Occlude source of air entry. Place patient in Trendelenburg position on left side (if not contraindicated), administer oxygen, vital signs, notify prescriber / RT.
Occlusions can be: • Mechanical (pinch off syndrome) caused by internal pinching of the central line between the first rib and clavicle • Caused by precipitate in the line (IV meds, PN) • Caused by thrombus / fibrin sheath within and around tip and moving into the catheter	Sluggish flow rate. Inability to flush or infuse IV solution or meds. Frequent downstream occlusion alarms on the IV controller / pump. ++ resistance when flushing	Prevention: • Follow agency flushing protocols before and after medication administration, and before and after blood draws. • Know what kind of needleless cap is being used, and follow correct flushing protocol procedure. • Follow agency specific guidelines for managing various types of occlusions. • Thrombolytic therapy may be initiated. The important part is to report them for possible early treatment.

Damage to CVC line: Catheters can become broken or cracked.	Evidence of leaking	Prevention: Avoid sharp objects around CVADs, and only use needleless systems when accessing IV system. Do not use extreme force when flushing. Assess for pinholes, cracks, tears, or leaks during routine care. Assess for leaks during routine care. Clamp immediately, and seal with sterile occlusive dressing to prevent air embolism, bleeding, or a catheter related blood stream infection (CRBSI). Notify prescriber / PICC team. Decisions to repair or replace the device to be made by someone who is specially trained.
Catheter-related bloodstream infection (CRBSI): • A common complication of indwelling CVCs in patients with a vascular device and no apparent source for the bloodstream infection other than the device. Confirmed with one positive blood culture in patients who have had a vascular device implanted within the last 48 hours. • Caused by microorganisms that are introduced into the blood through the puncture site, the hub, or contaminated IV tubing or IV solution, leading to bacteremia or sepsis. • Is a preventable nosocomial infection and an adverse event.	Systemic: elevated temperature, flushed, headache, malaise, tachycardia, decreased BP, and additional signs and symptoms of sepsis	CRBSI is confirmed with blood cultures. Prevention through strict hand-washing, aseptic technique for all procedures, close monitoring of vital signs, strict protocols for dressing, tubing and cap changes, blood cultures as required, IV antibiotic therapy, remove/replace catheter, prevent contamination of hub.
Data sources: Baskin et al., 2009; BCIT, 2015a; Brunce, 2003; Fraser Health Authority, 2014; Interior Health Authority, 2012; Perry et al., 2018; Prabaharan & Thomas, 2014		

Critical Thinking Exercises

1. A patient is two days post op with nausea and vomiting. The prescriber orders to "saline lock the IV." As the nurse describe your subsequent actions.
2. During night shift rounds, the patient who was restless all night has pulled apart their IV tubing (the CVC remains in situ). As the nurse describe your subsequent actions.
3. A first year student is shadowing you the nurse for the day and asks how you would know if someone is experiencing fluid overload from their IV therapy. How might you respond?

8.3 Types of Venous Access

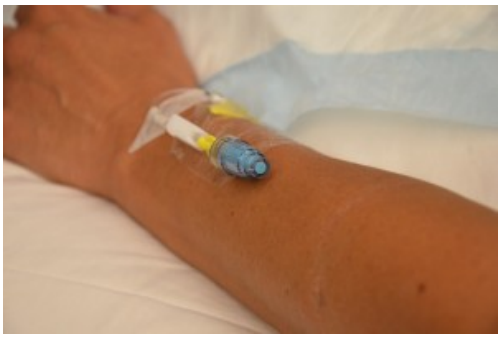
Safe and reliable venous access for infusions is a critical component of patient care in acute and community health settings. There are a variety of options available, and a venous access device must be selected based on the duration of IV therapy, type of medication or solution to be infused, and the needs of the patient. In practice it is important to understand the options of appropriate devices available.

This section will describe two types of venous access: peripheral IV access and central venous catheters. Besides observing the site for complications, accessing, flushing, and removal of IVADs, tunneled catheters, and catheters used for hemodialysis require specialized skill and they are not within the scope of this textbook.

Peripheral Venous Access Device—Short Cannula (PVAD-Short) a.k.a. Short Peripheral Catheter (SPC)

A PVAD-short cannula is a common, preferred method for short-term IV therapy in the hospital setting (see Figure 8.1). Principles of asepsis are followed during insertion. Sites are covered with dressings, which can be a sterile transparent semi-permeable dressing or a gauze dressing if the site is bleeding (RNAO, 2005/2008). Dressings serve to keep the site sterile and prevent accidental dislodgement (CDC, 2017). Upper extremities (hands and arms) are the preferred sites for insertion by a specially trained healthcare provider. If a lower extremity is used, remove the peripheral IV and re-site in the upper extremities as soon as possible (CDC, 2017; McCallum & Higgins, 2012). The hub of a short intravenous catheter should be attached to IV extension tubing with a needleless cap (Fraser Health Authority, 2014).

PVAD-shorts are used for infusions under six days and for solutions that are iso-osmotic or near iso-osmotic (CDC, 2017). They are easy to monitor and can be inserted at the bedside. CDC (2017) recommends that PVAD-shorts be replaced every 72 to 96 hours to prevent infection and phlebitis in adults. Other literature suggests that PVAD-short catheters be changed based on individual assessment of the site and not specific time frames (Gorski et al., 2012). Many agencies require additional training to initiate IV therapy, but the care and preparation of equipment, and the maintenance of an IV system, is the responsibility of the trained healthcare provider.



PVAD-short device – locked

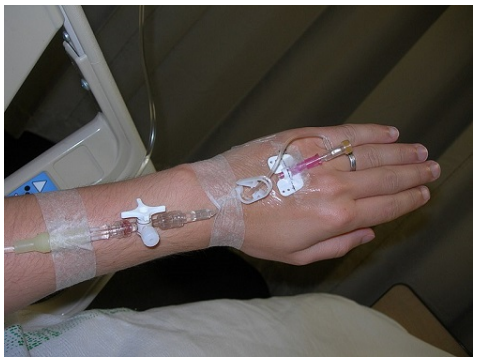


Figure 8.1 PVAD-short – with infusion

PVAD-short sites are prone to phlebitis and infection, and should be removed (CDC, 2017) as follows:

- Every 72 to 96 hours and p.r.n. Some literature challenges this firm timeline and suggests that sites should be assessed individually for decisions about removal (Gorski et al., 2012).
- As soon as the patient is stable and no longer requires IV fluid therapy
- As soon as the patient is stable following insertion of a cannula in an area of flexion
- Immediately if tenderness, swelling, redness, or purulent drainage occurs at the insertion site
- When the administration set is changed (IV tubing)

Midline Catheters

A midline catheter differs from a PVAD-short catheter in terms of length. Midline catheters are 7.5 to 20 cm long; usually inserted into an antecubital fossa; the catheter tip sits in the vein below the level of the axilla. They are considered for IV therapy longer than a PVAD-short although the literature is inconsistent in terms of how long. The range is from 6 days to 8 weeks (RNAO, 2005/2008). While the tip of the catheter sits in a vessel larger than a peripheral vein, it is significantly smaller than the superior vena cava (SVC). As such the types of drugs and solutions that can be safely administered through a midline catheter are the same as a PVAD-short (Rosenthal, 2007).

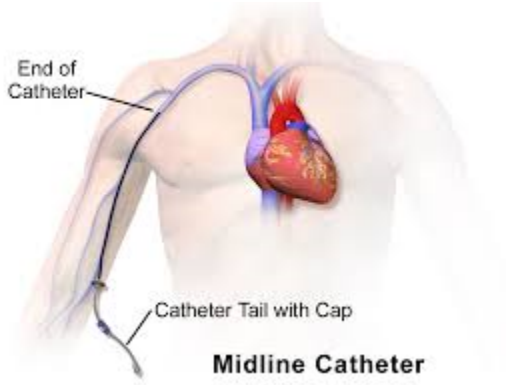


Figure 8.2 Midline catheter

Peripherally inserted central catheters (PICCs) are also inserted peripherally, but because the tip of the catheter sits in the superior vena cava, PICCs will be discussed with CVADs.

Central Venous Access Device (CVAD)

A CVAD is a type of catheter or device inserted into the central circulation. They are also referred to as a central venous catheter (CVC) or central line (see Table 8.5). Usually the tip of the catheter terminates in the superior vena cava just above the right atrium. For CVADs that are inserted femorally, the tip of the catheter should sit in the inferior vena cava. Because of the large size of vein and the high volume blood flow associated with it, a CVAD has many advantages over a PVAD-short. This includes the ability to deliver fluids and/or medications that can be overly irritating (high or low pH, high osmolality) to small peripheral veins; the ability to access multiple lumens and deliver multiple medications or solutions simultaneously even if they are incompatible with each other (Fraser Health Authority, 2014); the ability to deliver large volumes quickly; and the ability to maintain IV access over a prolonged period of time (Perry et al., 2018). Some CVADs have technology associated with them that allows for monitoring of central venous pressure, which is beyond the scope of this textbook.

While PVAD-short catheters are generally removed within a few days, CVADs can remain in situ much longer (Perry et al., 2018):

- Non-tunneled percutaneous CVADs for several days to weeks.
- IVADs can remain in place and function for many years.
- PICCs can remain in place as long as there is no evidence of complications.

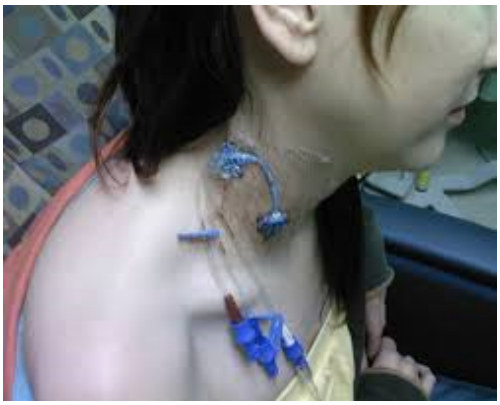
CVADs can be inserted on the unit or in the operating room through the jugular, subclavian, or

femoral veins, or via the chest or upper arm peripheral veins (Perry et al., 2014). Femoral veins are not recommended, as the rate of infection is increased in adults (CDC, 2017; Safer Healthcare Now, 2012). Initial access of a CVAD should only be done after placement is verified. Sometimes this includes a chest x-ray. Equipment used during PICC insertion has the capability to confirm placement through ultrasound technology (Safer Healthcare Now, 2012; Interior Health, 2012). Using an IV pump will reduce risk of some complications associated with CVADs and may be part of your agency policy. Some CVADs can be removed by a nurse with specific training (PICC, percutaneous non hemodialysis line), others must be removed surgically (tunneled catheter, IVAD).

Table 8.5 Types of Central Venous Catheters (CVCs)

Safety considerations:

- CVAD care and maintenance requires specialized training to prevent complications.
- Central lines heighten the risk for patients to develop a nosocomial infection. Strict adherence to aseptic technique is required for all CVC care.
- External length (the measurement of IV line from the insertion site to the IV hub) is an important part of CVAD assessment (except IVAD) to ensure catheter migration hasn't occurred.

Percutaneuos central venous catheter (CVC)—non hemodialysis	Tip location: The tip of the catheter is located in the superior vena cava (SVC). Can be inserted at the bedside by specially trained physician or nurse. The **percutaneous CVAD** is inserted directly through the skin. The internal or external jugular, subclavian, or femoral vein is used. Most commonly used in critically ill patients. Can be used for days to weeks. Usually held in place with sutures or a manufactured securement device.  *Figure 8.3 Percutaneous CVAD (subclavian)*  *Figure 8.4 Percutaneous CVAD (jugular)*

Peripherally inserted central catheter (PICC)

Tip location: The tip of a PICC is located in the SVC.

A **PICC** (see Figure 8.4) may be inserted at the bedside, in a home, or in the radiology setting. The line is inserted through the antecubital fossa or upper arm (basilic or cephalic vein) and is threaded the full length until the tip reaches the SVC. Can provide venous access for up to one year. The patient may go home with a PICC. PICCs can easily occlude and may not be used with dilantin IV. It is held in place with sutures or a manufactured securement device for as long as there is no evidence of complications.

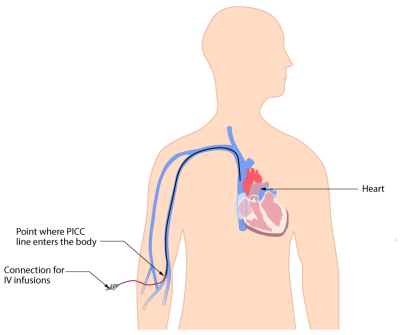


Figure 8.5 PICC line inserted in the upper arm (through the basilic vein)

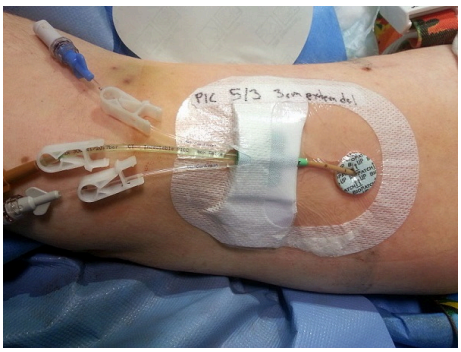


Figure 8.6 PICC

Tunnelled central venous catheter

A **tunnelled CVC**, also known as a Hickman, Broviac, or Groshong, is a long-term CVC . The catheter tip is in the superior vena cava. Insertion is a surgical procedure, in which the catheter is tunnelled subcutaneously under the skin in the chest area before it enters the SVC. A tunnelled catheter may remain inserted for months to years. These CVCs have a low infection rate due to a **Dacron cuff**, an antimicrobial cuff surrounding the catheter near the entry site, which is coated in antimicrobial solution and holds the catheter in place after two to three weeks of insertion.

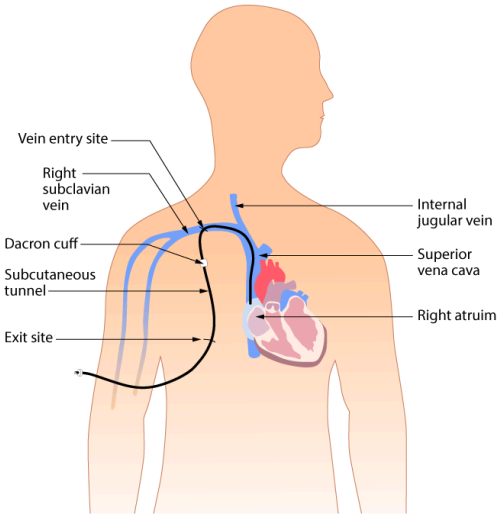


Figure 8.7 Tunnelled CVAD

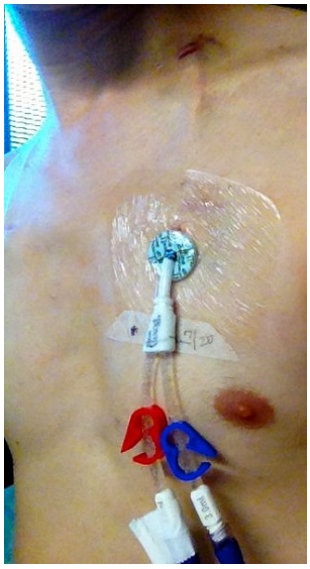


Figure 8.8 Tunneled CVAD (Hickman)

Implanted venous access device (IVAD)

- a.k.a. implanted central venous catheter (ICVC)
- a.k.a. port a cath

The **implanted central venous access device (IVAD)** (a.k.a. implanted central venous access catheter, ICVC) is inserted into a vessel, body cavity, or organ, and is attached to a reservoir or "port" located under the skin. The ICVC is also referred to as a **port a catheter** or **port a cath**. A surgical procedure is required to insert the device, which is considered permanent. The device may be placed in the chest, abdomen, or inner aspect of the forearms. For some this is preferred because of body image. For others this is preferred because the unit is concealed under the skin, so it is ideal for those who like to swim or use a hot tub. IVADs are accessed by specially trained personnel using a non-coring needle.

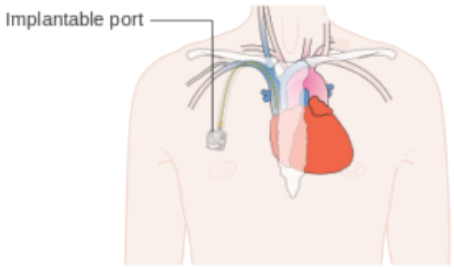


Figure 8.9 IVAD

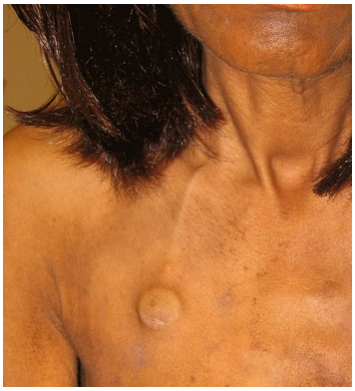


Figure 8.10 Implanted venous access device

Data sources: Fulcher & Frazier, 2011; Perry et al., 2018

CVCs have specific protocols for accessing, flushing, disconnecting, and assessment. All healthcare providers require specialized training to care for, manage complications related to, and maintain CVCs as per agency policy. Never access or use a central line for IV therapy unless trained as per agency policy. For more information on CVC care and maintenance, see the suggested online reference list at the end of this chapter.

Healthcare providers should assess a patient with a central line at the beginning and the end of every shift, and as needed. For example, if the central line has been compromised (pulled or kinked), ensure it is functioning correctly. Each assessment should include:

- Type of CVC and insertion date: Reason for CVC?
- Dressing: Is it dry and intact?
- Lines: Secure with stat-lock, sutures, or Steri-Strips?
- Review: Patient still requires a CVC?
- Insertion site: Free from redness, pain, swelling?
- Positive pressure cap: Attached securely?
- IV fluids: Running through an IV pump?
- Lumens: Number of lumens and type of fluids running through each?
- Vital signs: Fever?
- Respiratory/cardiovascular check: Any signs and symptoms of fluid overload?

Central Venous Catheter Structure and Technology

Understanding central venous catheter structure and technology is necessary for understanding the care and maintenance associated with them. CVADs have specific protocols for accessing, flushing, disconnecting, and assessment. Some agencies require specialized training to care for, manage complications related to, and maintain CVADs. As such, know your agency policy.

Mulitlumen CVCs

Multilumen catheters allow the infusion of multiple medications and multiple solutions simultaneously because the exit ports are located in different locations along the catheter lumen(s). Medications do not come in contact with each other until they enter the blood stream where turbulent flow and blood volume allow for dilution. When a CVC has more than one lumen, each lumen must be treated as a separate catheter. Thus each lumen receives individual attention in relation to care and maintenance.

Figure 8.11 Multiple lumens

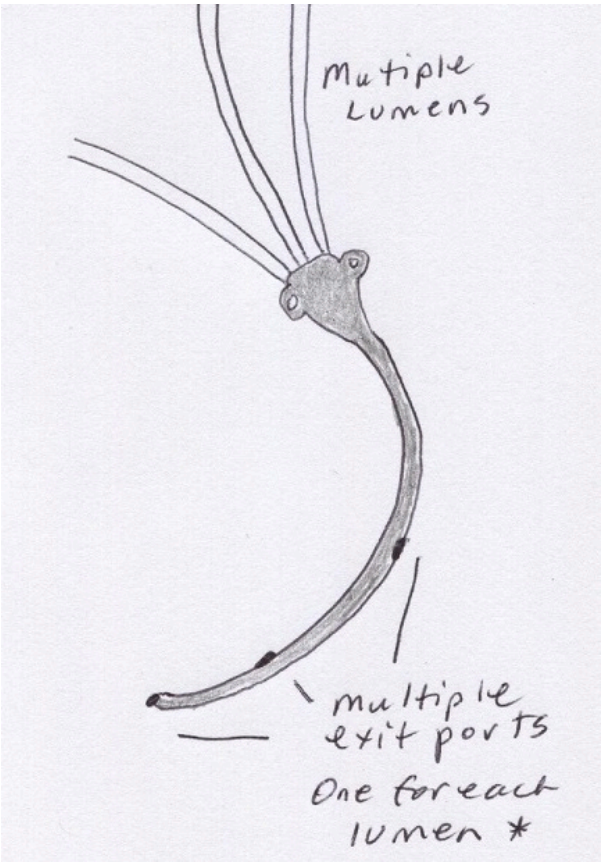


Figure 8.12 Triple lumen central line – multiple ports of exit

Valve Technology: Open-Ended Versus Closed-Ended Lumens

CVCs are available with open and closed ends. Figure 8.11 explains the theory behind valve technology. Table 8.6 outlines some key differences between open versus closed-ended lumens. It is important for the nurse to differentiate them because care and maintenance differs slightly. Recent literature has found limited evidence comparing valved and non-valved PICCs in the incidence of occlusion of the catheters or PICC-related blood stream infection and complications (obstruction, rupture) (Ho & Spry, 2017). Ongoing research will continue to influence nursing practices and as such life long learning is a part of nursing practice.

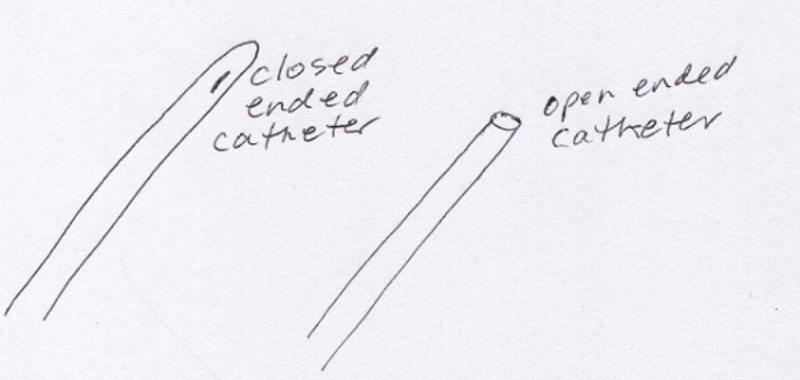


Figure 8.13 Open-ended versus closed-ended catheters

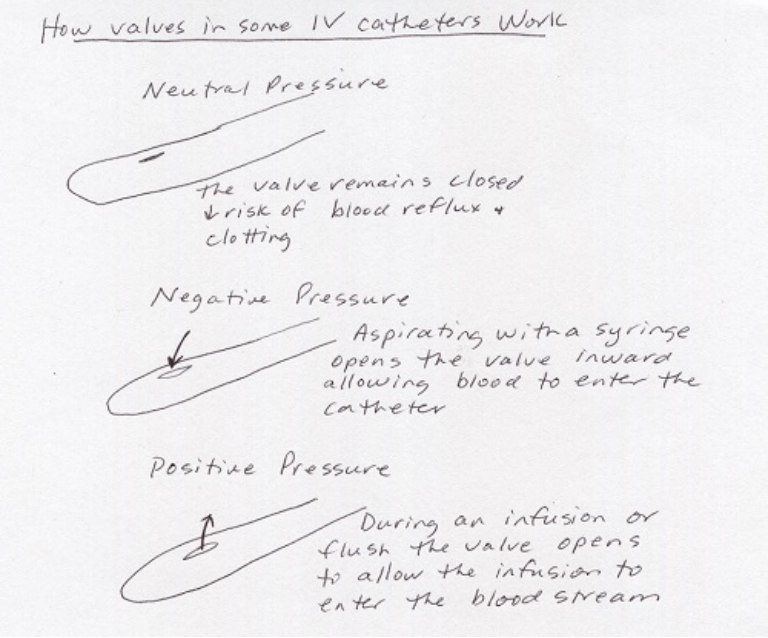


Figure 8.14 Valve technology – some CVCs

Table 8.6 Characteristics of Open- Versus Closed-Ended CVC Lumens

Open–Ended	*Closed–Ended*
• The catheter is open at the distal tip. • The catheter requires clamping before entry into the system. • Clamps should remain on when catheter not in use. • Clamps are usually found as a part of but on the outside of catheter. • Locking procedure involves low dose heparin. • Open-ended catheters have a higher risk for complications, such as hemorrhage, air embolism, and occlusion from fibrin or clots.	• Valved devices are those in which the tip is configured with a three-way pressure-activated valve to prevent reflux of blood into the catheter. • The valve is closed except during infusion or aspiration. • Clamps are not required.

Data sources: Perry et al., 2018; RNAO, 2005/2008

Critical Thinking Exercises

1. Differentiate different venous access devices: PVAD-short, midline catheter, peripherally inserted central catheter (PICC), percutaneous non hemodialysis central catheter, implanted venous access device (IVAD), and tunneled catheter. Provide one indication for each.
2. Identify a situation where having a multilumen CVC is desired.

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Figure 8.14. Valve technology – some CVCs is adapted from Registered Nurses' Association of Ontario. (2005). *Care and Maintenance to Reduce Vascular Access Complications*. Toronto, Canada: Registered Nurses' Association of Ontario. Appendix E: Groshong® Valve Function [Image]. p. 69.

8.4 IV Fluids

Patients are prescribed an IV solution (fluids) based on their electrolyte and fluid volume status. IV fluids are commonly categorized as colloids and crystalloids. **Colloid solutions** contain large molecules that cannot pass through semi-permeable membranes and are used to expand intravascular volume by drawing fluid from extravascular space via high osmotic pressure. Examples of colloid solutions are albumin, dextrans, and hydroxyethyl starches (Crawford & Harris, 2011). **Crystalloid solutions** contain solutes such as electrolytes or dextrose, which are easily mixed and dissolvable in solution. Crystalloids contain small molecules that flow easily across semi-permeable membranes, which allows for transfer from the bloodstream into the cells and tissues (Crawford & Harris, 2011). They may increase fluid volume in interstitial and intravascular space. Examples of crystalloid solutions are isotonic, hypotonic, and hypertonic solutions.

Isotonic solutions have an osomolality of 250 to 375 mOsm/L. Isotonic solutions have the same osmotic pressure as plasma, creating constant pressure inside and outside the cells, which causes the cells to remain the same (they will not shrink or swell) and does not cause any fluid shifts within compartments. Isotonic solutions are useful to increase intravascular volume, and are utilized to treat vomiting, diarrhea, shock, and metabolic acidosis, and for resuscitation purposes and the administration of blood and blood products. Examples of isotonic solutions include normal saline (0.9% sodium chloride), lactated Ringer's solution, 5% dextrose in water (D5W), and Ringer's solution. It is important to monitor patients receiving isotonic solutions for fluid volume overload (hypervolemia) (Crawford & Harris, 2011).

Hypotonic solutions have a lower concentration, or tonicity, of solutes and have an osomolality equal to or less than 250 mOsm/L. The infusion of hypotonic solutions lowers the osmolality within the vascular space and causes fluid to shift to the intracellular and interstitial space. Cells will swell but may also delete fluid within the vascular space. Examples of hypotonic solutions include 0.45% sodium chloride, 0.33% sodium chloride, 2.5% dextrose in water, and 0.2% sodium chloride. Monitor for hypovolemia and hypotension related to fluid shifting out of the vascular space, and do not administer to patients with increased intracranial pressure (ICP), as it may exacerbate cerebral edema. Use cautiously in patients with burns, liver failure, and traumas (Crawford & Harris, 2011).

Hypertonic solutions have a higher concentration, or tonicity, of solutes and have an osomolality equal to or greater than 375 mOsm/L. The osmotic pressure gradient draws water out of the intracellular space into the extracellular space. Examples of hypertonic solutions include D5W with 0.45% sodium chloride, D10W, and 3% sodium chloride. Hypertonic solutions may cause intravascular fluid volume overload and pulmonary edema, and they should not be used for an

extended period of time. Hypertonic solutions should not be used in patients with heart or renal disease who are dehydrated (Crawford & Harris, 2011).

Read the article *IV Fluids: What Nurses Need to Know* by Crawford and Harris (2011) for more in-depth information regarding colloid and crystalloid solutions.

Although all IV fluids must be administered carefully, hypertonic solutions are additionally risky.

An order for IV fluids may be continuous or as a bolus, depending on the needs of the patient. IV solutions are available in 25 ml to 1000 ml bags. The frequency, duration, amount, and additives to solution must be ordered by a physician or nurse practitioner; for example, an order may be "give NS at 125 ml/hr" or "D50.45%NS with 20 MEq KCl @ 75cc/hr'.

Patients may also have medications such as potassium chloride, thiamine, and multivitamins added to IV solutions. Check your regulator's scope of practice guidelines and your institution's policies and guidelines to determine if you need an order to discontinue an IV infusion / saline lock or if you as an RN can do this within your autonomous scope of practice (BCCNP, 2018; Perry et al., 2014).

Critical Thinking Exercises

1. Describe what is meant by and indications for isotonic, hypotonic, and hypertonic IV solutions.

8.5 IV Administration Equipment

Intravenous fluids are administered through thin, flexible plastic tubing called an *infusion set* or **primary infusion tubing/administration set** (Perry et al., 2018). The infusion tubing/ administration set connects to the bag of IV solution. IVs are then run either by gravity or by an intravenous infusion pump, sometimes referred to as electronic infusion device (EID).

Primary IV tubing is used to infuse continuous or intermittent fluids or medication. It consists of the following parts (see Figure 8.15):

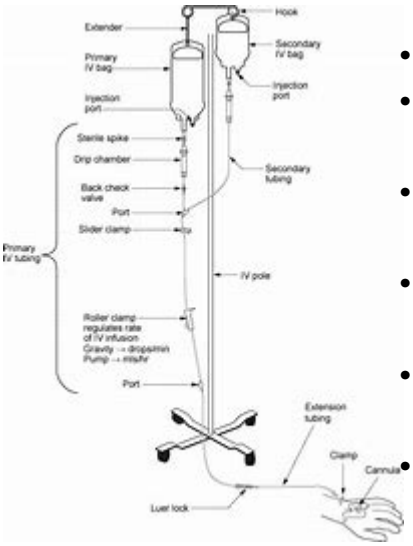


Figure 8.15 IV tubing (primary & secondary)

- Sterile spike: Connects the tubing into the IV bag.
- Drip chamber: Used to observe flow of IV fluids and / or to calculate drops per minute.
- Backcheck valve: Prevents fluid or medication from travelling up the IV.
- Access ports: Used to infuse secondary medications and give IV push medications.
- Roller clamp: Used to regulate the speed of, or to stop or start, a gravity infusion.
- Extension set: 10 to 20 cm IV tubing attached to IV cannula. Helps to reduce micro-movements at IV insertion sites and protects from BBF exposure during IV tubing changes.
- Slide clamps: Used to stop the infusion. Are needed to open and close IV infusion pump (a.k.a. EID).

The following table is intended to familiarize you with common IV equipment.

Table 8.7 Common IV Equipment

Primary IV tubing	IV tubing/administration set that connects to the bag of IV solution. May or may not contain injection ports. See Table 8.9 Frequency of IV Tubing Changes. Primary IV tubing is either a macro-drip solution administration set that delivers 10, 15, or 20 gtts/ml, or a micro-drip set that delivers 60 drops/ml. Macro-drip sets are used for routine primary infusions. Micro-drip IV tubing is used mostly in pediatric or neonatal care, when small amounts of fluids are to be administered over a long period of time (Perry et al., 2014). The drop factor can be located on the packaging of the IV tubing.  *Figure 8.16 Drop factor located on IV tubing package*
Secondary tubing	**Note**: Suppliers provide different kinds of tubing for different purposes. Read the packaging and choose tubing that is appropriate. It is shorter in length than primary tubing, with no access ports or backcheck valve. It is connected to a primary line via an access port near the top of the set. It is used to infuse intermittent medications or fluids. Secondary tubing should be changed every 24 hours.

IV solutions come in a variety of solutions, concentrations, and volumes. They are considered medication, and as such the 7 Rights apply. The prescriber will order the IV solution and rate. The nurse monitors for signs of complications related to the solution and IV equipment. IV bags and tubing should have a sticker or label with the date, time, and initials of the healthcare provider marked on them to be valid. IV bags and/or IV tubing should be changed if:

- IV tubing is disconnected or becomes contaminated by touching a non-sterile surface
- Less than 100 ml is left in the IV solution bag
- Cloudiness or precipitate is found in the IV solution
- Equipment (date and time) is outdated
- IV solution is outdated (24 hours since opened)

IV bags

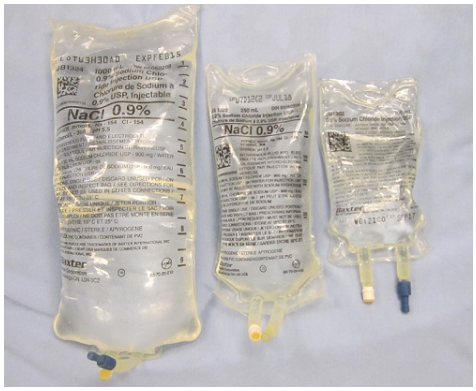


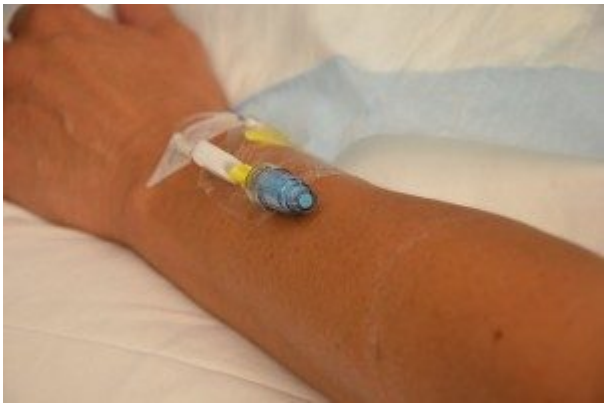
Figure 8.17 Different volumes of IV bags

Extension sets

A.k.a. “add on device,” 10 to 20 cm of IV tubing attached to IV cannula. Helps to reduce micro-movements at IV insertion sites, and protects from BBF exposure during IV tubing changes. Should be added to all PVAD-short and CVADs that do not have permanent extension tubing as part of their structure if tubing changes are expected.

If added at the time of insertion—does not require routine changing—it is considered part of the IV cannula.

If added after the insertion, change when integrity is compromised and at each tubing change.



PVAD-short – Saline lock with extension and needleless cap

	Added to the distal end of all extension sets of all lumens of VADs to prevent backflow of blood and BBF exposure to healthcare provider. Also added to indwelling subcutaneous devices (butterflies) to allow needleless access when administering medications. Can be bonded to the extension set or can be separate (add on) to the extension set. Must be sanitized according to agency policy prior to accessing. Can be neutral, negative displacement, and positive pressure. Negative caps are not recommended.
Needleless cap	Changed q 7 days; each time a site is changed; following blood draws; following blood product administration; when all residual blood cannot be cleared for the device; when contamination is suspected or confirmed. Check agency protocols for correct flushing technique.

Figure 8.18 Different types of needleless caps

IV tubing with filter	Used to filter bacterial particulate and candida. Available with different filter capabilities. Used when administering packed red blood cells, PN, and some medications. Refer to your agency's parenteral practices guidelines. When administering packed red blood cells, always use a special blood administration set with a filter.
Vented set	IV administration set used for solutions that are supplied in glass containers.

Volume control set	A type of reservoir that holds a controlled volume of fluid from the IV bag. Limits volume of IV fluids or medications able to infuse into the patient. Often used in pediatrics. IV fluids are attached above the buretrol and refilled manually as the volume decreases.

Figure 8.19 volume control set

Data sources: Interior Health, 2012; Perry et al., 2018; Vancouver Coastal Health, 2008

Frequency of IV Tubing Changes

Primary and secondary administration sets should be changed regularly to minimize risk and prevent infection (CDC, 2017; Fraser Health Authority, 2014). Change IV tubing according to agency policy. Table 8.8 lists the frequency of IV tubing change.

Table 8.8 Frequency of IV Tubing Changes

Safety considerations:

- All IV tubing must be changed using principles of asepsis.
- IV tubing is changed based on the type of tubing, time used, and the type of solution.
- If possible, coordinate IV tubing changes with IV solution changes.
- Tubing that contains a large amount of blood and is suspected of being clotted requires immediate changing to prevent risk of introducing a thrombus into circulation.

Frequency of IV Tubing Change	*Type of IV Tubing and Solution*
Every 72 to 96 hours	For continuous primary infusion sets with hypotonic, isotonic, or hypertonic solution, when insertion site is changed, or when indicated by the type of solution or medication being administered.
Every 24 hours	As of 2017, the CDC is saying no recommendation can be made regarding the frequency for replacing intermittently used administration sets. Historical thinking was that when an intermittent infusion is repeatedly disconnected and reconnected for infusion, there is increased risk of contamination at the catheter hub, needleless connector, and the male Luer end of the administration set, potentially increasing risk for CR-BSI. Follow agency protocol. **Note**: Agency policy sometimes recommends secondary tubing be changed every 24 hours.
Every 24 hours	Infusions containing fat emulsions (IV solutions combined with glucose and amino acids infused separately or in a 3-in-1 admixture). **Example**: Parenteral nutrition (PN).
4 hours or 4 units, whichever comes first, or between products	Blood and blood products

Data sources: CDC, 2017; Interior Health, 2012

Assessing an IV System

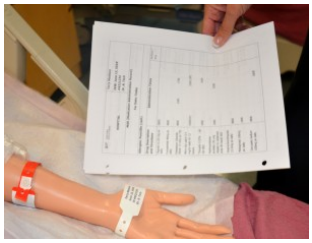
All patients with IV therapy (PVAD-short, midline catheters, and CVADs) are at risk for developing IV-related complications. The assessment of an IV system (including the IV site, tubing, rate, and solution) should take into account the IV administration system AND the patient. Checklist 65 provides general guidelines for assessing an IV system.

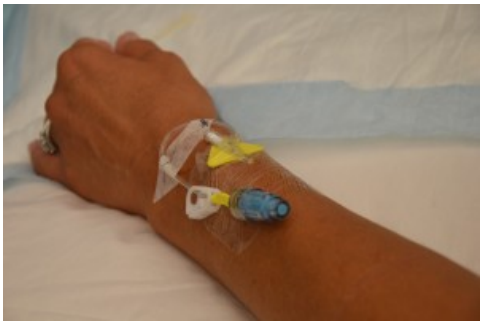
Checklist 65: Assessing an IV System

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- IV systems must be assessed according to agency protocols. This might mean every 5 minutes when administering specific medications, to hourly, to every 1 to 2 hours, or to once per shift.
- An IV system should be assessed whenever the electronic infusion device alarms or sounds, or if a patient complains of pain, tenderness, or discomfort at the IV insertion site.
- Review the patient's chart to determine insertion date and type of solution ordered.
- A PVAD-short catheter is usually replaced every 72 to 96 hours, depending on agency policy.
- If a venous access device is not in use (i.e., it is locked) care and maintenance are still required to keep the site patent. Refer to agency policy for flushing guidelines.
- IV therapy is considered medication. Document according to agency guidelines.
- Patients with cardiac or renal disease, as well as the elderly and young, are at a higher risk for IV-related complications.
- Elderly patients often have fragile veins and may require closer monitoring.

Steps	*Additional Information*
1. Perform hand hygiene.	This step reduces the transmission of microorganisms.
2. Introduce yourself and explain the purpose of the assessment.	This builds trust with patient and allows time for the patient to ask questions.
3. Confirm patient ID using two patient identifiers (e.g., name and date of birth), and compare the MAR printout with the patient's wristband.	This step ensures you have the correct patient and complies with agency standard for patient identification.  *Compare MAR with patient wristband*

4. Assess the IV insertion site and transparent dressing on IV site.	Check IV insertion site for signs and symptoms of phlebitis or infection. Check for fluid leaking, redness, pain, tenderness, and swelling. IV site should be free from pain, tenderness, redness, or swelling.  Ensure patient is informed to alert the healthcare provider if they experience pain or notice swelling or redness at the IV site. If patient is unable to report pain at IV site, more frequent checks are required.
5. Inspect the patient's arm for streaking or venous cords; assess skin temperature.	Assess complications on hand and arm for signs and symptoms of phlebitis and infiltration / extravasation.
6. Assess IV tubing for kinks or bends.	Kinks or bends in tubing may decrease or stop the flow of IV fluids. Ensure tubing is not caught on equipment or side rails on bed. Tubing should be properly labelled with date and time the tubing was initiated.
7. Check the rate of infusion for the primary and secondary IV solutions. Verify infusion rate in physician orders or medication administration record (MAR).	If IV solution is on gravity, calculate and count the drip rate for one minute. If solution is on an IV pump, ensure the rate is correct and all clamps are open as per agency protocol. If secondary IV medication is infusing, ensure clamp on secondary IV tubing is open. The EID is unable to distinguish if the primary bag or secondary bag is infusing.
8. Assess the type of solution and label on bag indicating when it was hung. Check volume of solution in bag. Assess labels on IV tubing for information about when tubing needs to be changed.	IV solutions become outdated every 24 hours. Ensure the correct solution is given. If 100 ml of solution or less is left in the bag, change the IV solution and document according to agency guidelines. If an IV pump is used, ensure it is plugged into an outlet. This ensures good battery charge. If IV tubing is due to be changed, consider priming a new bag and hanging it on the IV pole until the current bag is infused.
9. Assist patient into comfortable position, place call bell in reach, and ensure necessary side rails are used.	These precautions prevent injury to the patient.

10. Perform hand hygiene.	This step prevents the spread of microorganisms.
11. Document procedure and findings as per agency policy.	Timely and accurate documentation promotes patient safety.
Data sources: Fulcher & Frazier, 2007; Perry et al., 2018	

Critical Thinking Exercises

1. What is the purpose of the back-check valve on primary IV tubing?
2. When is it important for the nurse to know the drop factor of IV tubing?
3. What is the purpose of extension tubing?
4. The nurse has found the patient to have an IV administration set hung 96 hours prior. Explain the necessary next steps.

Attribution

Figure 8.15 IV Primary and Secondary Tubing Setup by BCIT is used under a CC BY-SA 4.0 international license.

Figure 8.16. drop factor by author is used under a CC BY-SA 4.0 international license.

Figure 8.17 Different volumes of IV bags by author is used under a CC BY-SA 4.0 international license.

Figure 8.18 Needleless caps by author is used under a CC BY-SA 4.0 international license.

Figure 8.19 Volume Control Set by author is used under a CC BY-SA 4.0 international license.

8.6 Infusing IV Fluids by Gravity or an Electronic Infusion Device (Pump)

To ensure therapeutic effectiveness of IV fluids, a constant, even flow is necessary to prevent complications from too much or too little fluid. A prescriber must order a rate of infusion for IV fluids. The rate of infusion for medications (given via a secondary or primary infusion) can be found in the *Parenteral Drug Therapy Manual* (PDTM). If an order for IV fluids is "to keep vein open" (TKVO), the minimum flow rate is 20 to 50 ml per hour, or according to physician's orders (Fraser Health Authority, 2014).

A healthcare provider is responsible for regulating and monitoring the amount of IV fluids being infused. IV fluid rates are regulated in one of two ways:

1. Gravity: The healthcare provider regulates the infusion rate by using a clamp on the IV tubing, which can either speed up or slow down the flow of IV fluids. An IV flow rate for gravity is calculated in gtts/min.
2. Electronic infusion device (EID) (see Figure 8.20): The infusion rate is regulated by an electronic pump to deliver the fluids at the correct rate and volume. All IV pumps regulate the rate of fluids in ml/hr. An IV pump (EID) is used for many types of patients, solutions, and medications (Vancouver Coastal Health, 2008). These devices include a variety of safety features including alerts for air and occlusions, a medication administration library, the ability to calculate infused volumes, and back up battery power.

An EID / IV pump must be used:

- Whenever possible to avoid some complications associated with IV therapy
- With all opioid infusions (use a patient-controlled analgesia)
- For all pediatric patients
- As directed in the PDTM

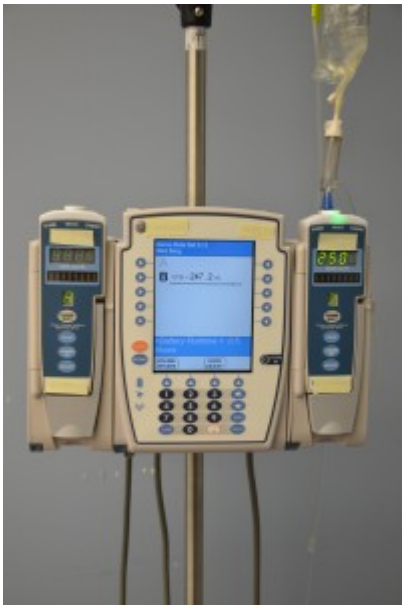


Figure 8.20 Electronic infusion device (EID)

To calculate the drops per minute for an infusion by gravity, follow the steps in Table 8.9. Remember that you only have to do this when you are running the IV by gravity.

Table 8.9 Calculating the Drops per Minute (gtts/min) for an Infusion by Gravity

Steps	*Additional Information*
1. Verify the physician's order.	An order may read: • Example 1. *Give* 0.9% NS IV 125 *ml/hr* • Example 2. *Give* 1000 *ml of* 0.9% NS IV *over 8 hours.*
2. Determine the drop factor on the IV administration set.	The drop factor is the amount of drops (gtts) per minute. IV tubing is either macro tubing (10, 15, or 20 gtts/min) or micro tubing (60 gtts/min). The drop factor (or calibration of the tubing) is always on the packaging of the IV tubing.
3. Complete the calculation using the formula.	Use the formula: $\frac{\text{infusion rate (ml/hr)} \times \text{IV drop factor (gtts/min)}}{\text{60 (administration time is always in minutes)}}$ = drops per minute To calculate ml/hr, divide 1000 ÷ 8 = 125 ml/hr. Example: *Infuse* IV NS *at 125 ml/hr. IV tubing drop factor is 20 gtts/min* $\frac{125 \times 20}{60}$ = 41.6 gtts/min, round up to 42 gtts/min (round down or up to the nearest whole number)

4. Regulate IV infusion using the roller clamp.	With tubing already primed, open the blue roller clamp and count the drips in the drip chamber and regulate for 42 gtts/min (one full minute). Alternatively, divide 42 by 4 (rounded down from 10.4 to 10 gtts/min) to count for 15 seconds. The gtts/min should be assessed regularly to ensure the IV is infusing at the correct rate (e.g., every 1 to 2 hours, if the patient accidentally bumps the IV tubing, or if a patient returns from another department).  *Regulate IV tubing by using a roller clamp*
Data sources: Fulcher & Frazier, 2007; Perry et al., 2018	

Take the *IV Drop Rate Calculations* quiz for more practice with IV fluid dose calculation.

When an infusion is by gravity, there are several factors that may alter the flow/infusion rate (Fulcher & Frazier, 2007). In addition to regulating the flow rate, assess the IV system to ensure these factors are not increasing or decreasing the flow of the IV solution. These factors are listed in Table 8.10.

Table 8.10 Factors Influencing the Flow Rate of Infusions	
Factors	*Additional Information*
Tube occlusion	May occur if the tubing is kinked or bent. Tubing may become kinked if caught under the patient or on equipment, such as beds and bed rails. Sometimes the cannula itself is kinked at the insertion site.
Vein spasms	Irritating or chilled fluids (fluids stored in the fridge) may cause a reflex action that causes the vein to go into spasm at or near the intravenous infusion site. If fluids or medications are chilled, bring to room temperature prior to infusion.
Height of the fluid container	The IV tubing drip chamber should be approximately 3 feet above IV insertion site.
Location/position of IV cannula	If the cannula is located in an area of flexion (bend of an arm), the IV flow may be interrupted when the patient moves around. To avoid this issue, replace IV cannula.
Infiltration or extravasation	If the cannula punctures the vein, the fluid will leak into the surrounding tissue and slow or stop the flow, and swelling will develop.
Accidental touching/ bumping of the control clamp or raising arm above heart level	Instruct the patient not to touch the roller clamp and to take care not to bump the clamp, as this may accidentally change the flow rate. Instruct patient to keep hand/arm below heart level; an elevated hand/arm will slow or stop an infusion running by gravity.
Needle or cannula gauge/diameter	The smaller the needle or cannula, the slower the fluid will flow.
Data sources: Fulcher & Frazier, 2007; Perry et al., 2018	

Critical Thinking Exercises

1. A patient with an IV running via gravity leaves the unit frequently. Midway through your shift you notice the IV is approximately 6 hours behind. Explain possible reasons. Explain your next steps.

Attribution

Figure 8.20. Electronic Infusion Device from BCIT is used under a CC BY-SA 4.0 international license.

8.7 Priming IV Tubing / Changing IV Bags / Changing IV Tubing

Primary and secondary IV tubing and add-on devices (extension tubing) must be primed with IV solution to remove air from the tubing. Priming refers to placing IV fluid in IV tubing to remove all air prior to attaching the IV tube to the patient. IV tubing is primed to prevent air from entering the circulatory system. An air embolism is a potential complication of IV therapy and can enter a patient's blood system through cut tubing, unprimed IV tubing, access ports, and drip chambers with too little fluid (Perry et al., 2018). It is unknown how much air will cause death, but deaths have been reported with as little as 10 ml of air. The best way to avoid air bubbles in IV tubing is to prevent them in the first place (Perry et al., 2018). New IV tubing may also be required if leaking occurs around the tube connecting to the IV solution, if the tubing becomes damaged, or if it becomes contaminated. Checklist 66 outlines the process of priming IV tubing.

Checklist 66: Priming IV Tubing

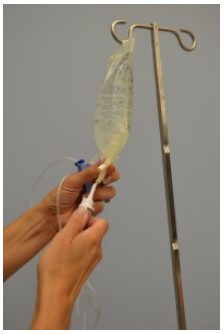
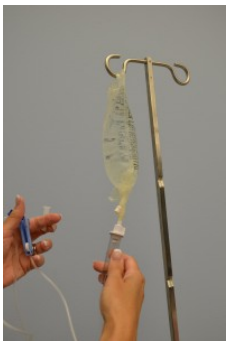
Disclaimer: Always review and follow your agency policy regarding this specific skill.

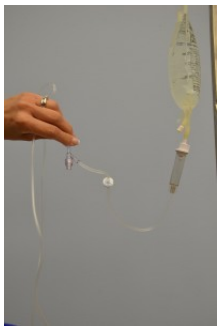
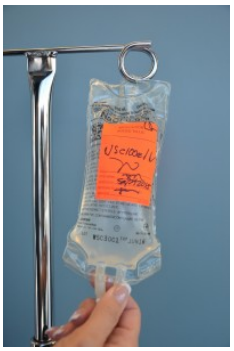
Safety considerations:

- Primary IV tubing can be macro-drip or micro-drip tubing. The drop factor of the IV tubing is required to complete the IV drip rate calculation for a gravity infusion.
- Remember to invert all access ports and backcheck valve whilst fluid is running past that location.

Steps	*Additional Information*
1. Perform hand hygiene.	This step prevents the transmission of microorganisms.
2. Check order to verify solution, rate, and frequency.	This ensures IV solution is correct and helps prevent medication error.

3. Gather supplies.	You will need IV solution, primary IV tubing, the labels for tubing and the bag, alcohol swab, and basin or sink.
4. Remove IV solution from outer packaging and gently squeeze. Check expiry date. Assess for precipitates or cloudiness. Hang IV bag on hook or IV pole in a way that will allow gravity to help you to prime the line.	You need to verify integrity of the solution. Note the expiry date on IV bags are reported by month and year. The product is valid for the entire month. 
5. Remove primary IV tubing from outer packaging. Remover paper.	
6. Move the roller clamp to about 3 cm below the drip chamber and close the clamp.	

7. Remove the protective cover on the IV solution port and keep sterile. Remove the protective cover on the IV tubing spike. Follow principles of asepsis.	 Do not contaminate the spike.
8. Remove the protective cover from the IV solution port. Without contaminating the solution port or spike, carefully insert the IV tubing spike into the port, gently pushing and twisting.	
9. Fill the drip chamber one-third to one-half full by gently squeezing the chamber. Only if absolutely necessary, remove protective cover on the distal end of the tubing and keep sterile.	Filling the drip chamber prevents air from entering the IV tubing.  *Fill drip chamber* Not removing the protective cover on the distal end of the tubing helps to maintain asepsis.

10. With distal end of tubing over a basin / sink / garbage, slowly open roller clamp to prime the IV tubing. Invert back check valve and ports as the fluid passes through the tubing. Tap gently to remove air and to fill with fluid.	Inverting and tapping the back check valve and access ports helps displace and remove air when priming the IV tubing. 
11. Once IV tubing is primed, check the entire length of tubing to ensure no air bubbles are present.	This step confirms that air is out of the IV tubing.
12. Close roller clamp. If removed earlier, cover distal end with sterile dead-ender or sterile protective cover. Hang tubing on IV pole to prevent from touching the ground.	Keep the distal end sterile prior to connecting IV to patient.
13. Label tubing and IV bag with date, time, and initials.	Label IV solution bag as per agency policy. Do not write directly on the IV bag. 

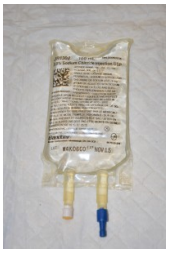
14. Perform hand hygiene.	This reduces the transmission of microorganisms.
Data sources: Fulcher & Frazier, 2007; Perry et al., 2018.	

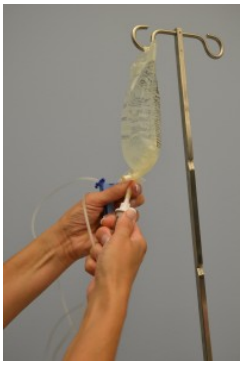
Watch the video *Priming IV Lines* developed by Renée Anderson and Wendy McKenzie TRU School of Nursing (2018).

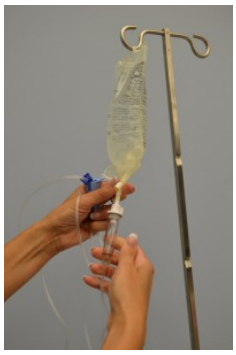
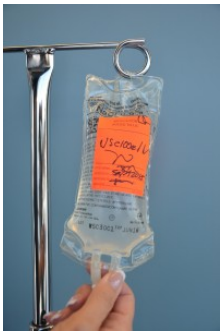
IV solutions are considered sterile for 24 hours. An IV solution may be changed if the physician's order changes, if an IV solution has been running slowly and has been hanging for 24 hours, or if the IV solution becomes contaminated. To change an IV solution bag, follow Checklist 67.

Checklist 67: Changing an IV Bag

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Steps	*Additional Information*
1. Verify and select correct IV solution bag, and compare to the medication administration record (MAR) or prescriber's orders.	IV solutions are considered a medication and must be checked using the SEVEN rights and THREE checks, as per agency policy.  *Sterile IV solution*
2. Introduce yourself, identify patient, and explain procedure.	Proper identification of a patient prevents medication errors. Explaining the procedure provides an opportunity for the patient to ask questions.
3. Perform hand hygiene.	Hand hygiene prevents the transmission of microorganisms.

4. Remove IV solution from outer packaging and gently squeeze. Check expiration date. Assess for precipitates or cloudiness. Hang new IV solution on IV pole.	Expiry dates on IV bags are reported by month and year. The product is valid for the entire month. 
5. If infusing the IV by EID, pause the device. If infusing the IV via gravity, close the roller clamp on the infusion set.	Stops the infusion to prevent air bubbles from forming in IV tubing.
6. Remove the protective cover from the IV solution (new bag) port.	Keep all ports sterile.
7. Remove the old IV solution bag from the IV pole. Turn old IV bag upside down, grasping the bag with the non-dominant hand and the spike with the dominant hand. With a twisting motion, carefully remove IV tubing spike from old IV solution bag.	Removing old solution from IV pole and inverting it prevents spilling of solution. Ensure IV tubing spike remains sterile during removal to avoid contaminating IV tubing.
8. Using a gentle back and forth twisting motion, firmly insert the spike into the new IV bag.	This ensures that principles of asepsis are followed. 

9. If necessary, fill the drip chamber by compressing it between your thumb and forefinger. Ensure the drip chamber is one-third to one-half full. Check IV tubing for air bubbles.	Fluid in the drip chamber helps prevent air from being introduced into IV tubing. 
10. If using gravity: Open clamp and regulate IV infusion rate with the roller clamp. If using EID: Confirm rate and volume to be infused, press start to resume the infusion.	If using gravity, count the drops per minute in the drip chamber If using an EID follow the prompts on the screen to ensure the IV is running at the correct rate.
11. Label new IV solution bag as per agency policy.	Labelling IV solutions provides easy viewing of infusing solutions, additives and when the bag was hung. 
12. Dispose of used supplies, perform hand hygiene, and document IV solution bag change according to agency policy.	Document time, date, type of solution, rate, and total volume.

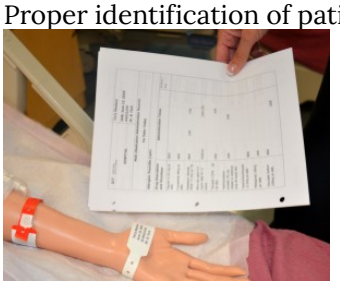
Data sources: Fulcher & Frazier, 2007; Perry et al., 2018.

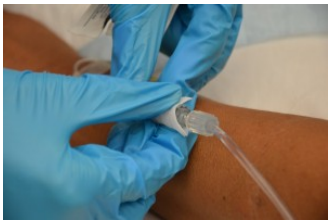
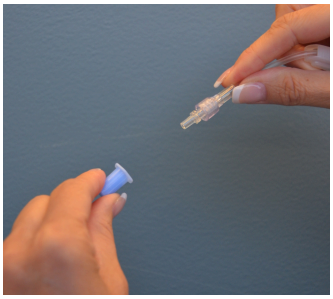
Watch the video *Changing IV bags* developed by Renée Anderson and Wendy McKenzie TRU School of Nursing (2018)

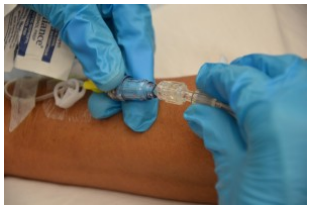
Checklist 68 describes how to change the IV administration set and IV solution at the same time.

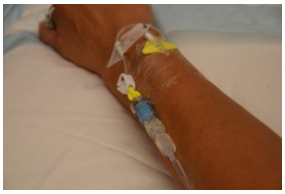
Checklist 68: Changing IV Tubing

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Steps	*Additional Information*
1. Verify prescriber's orders for the type of solution, rate, and duration. Collect necessary supplies.	This step verifies the patient's need for IV fluids or medications. It also confirms the correct rate and solution for patient safety.
2. Perform hand hygiene.	Hand hygiene prevents the transmission of microorganisms.
3. Identify yourself, identify the patient using two identifiers, and explain the procedure to the patient.	Proper identification of patient prevents errors. 
4. Prime new administration set using a new IV solution bag and new IV tubing. Label IV solution and IV tubing as per agency policy. If necessary, add an extension set including a needleless cap.	IV solutions are considered a medication. Prime as per Checklist 66. If possible, keep distal protective cap attached to IV tubing to ensure sterility of distal end. Labelling ensures communication between staff. Extension sets help to reduce micromovements at the cannula insertion site and protect from BBF exposure during IV tubing changes. Note: Some CVADs have extension tubing as a permanent part of their structure.

5. Hang new administration set (primed primary line and IV solution) on IV pole.	This prepares the equipment and adheres to the principles of aseptic technique.
6. Stop the infusion. If using an EID, remove IV tubing from the device.	Stop the flow of infusion during tubing and solution change.
7. Perform point of care risk assessment; donne non-sterile gloves. Clean the connection between the distal end of old IV tubing and the needleless cap. Scrub the area for 15 to 30 seconds using friction, and let it dry.	Proper disinfection of equipment decreases bacterial load and prevents infections.  *Clean the connection between the IV tubing and needleless cap using friction*
8. Remove the protective cap on the distal end of the new IV administration set.	 *Remove sterile cap*

9. If the extension is present and you are NOT changing it, leave extension and needleless cap in place. If the extension isn't present and/or you are changing the extension set, loosen the IV tubing from the IV cannula. • PVAD-short: Occlude the vein. • CVAD – open ended: Use clamps. • CVAD – closed ended: Lumens have valves to prevent reflux.	Understanding the structure and function of different IV access devices helps to determine risk of air emboli / exposure to BBF and subsequent safety considerations and need for clamping. PVAD-short: Occluding vein reduces risk of BBF exposure. CVAD – open ended: Clamps reduce risk of air emboli and/or BBF exposure.
10. Carefully disconnect the old tubing and Luer lock the new IV tubing into the cap.	 *Disconnect old IV tubing from the needleless cap, and Luer lock new tubing* Luer locks reduce risk of air emboli and provide security for keeping IV lines and connections intact. Maintain principles of asepsis.
11. If using gravity: Open clamp and regulate IV infusion rate. If using EID: Confirm rate and volume to be infused, press start to resume the infusion.	This step ensures the IV solution is infusing at the correct rate.  *Regulate IV tubing using a roller clamp*  *Ensure IED is programmed with correct rate and volume to be infused*

12. Check IV site for patency and evidence of complications.	IV site should be free from redness, swelling, pain and leaking. Transparent semipermeable dressing on IV site should be dry and intact. 
13. Discard old supplies and perform hand hygiene.	This step prevents the spread of microorganisms.
14. Document procedure as per agency policy.	Document the date and time of IV tubing and solution change.
Data sources: BCIT, 2015b; Fulcher & Frazier, 2007; Perry et al., 2018	

Watch the videos *Converting an IV to a saline lock – Extension Present* AND *Converting an IV to a saline lock – No Extension Present* developed by Renée Anderson and Wendy McKenzie (2018) of Thompson Rivers University School of Nursing.

Critical Thinking Exercises

1. What is the purpose of removing air from IV tubing?
2. You come on shift and notice the patient's IV tubing is not labeled. Describe your next actions.

8.8 Flushing and Locking PVAD-Short, Midlines, CVADs (PICCs, Percutaneous Non Hemodialysis Lines)

In Chapter 7.6 we discussed flushing before and after administration of an IV direct medication. Recall that the rationale for the initial flush was to ensure IV patency so that the medication would be administered via the correct route. The flush following the medication administration was to clear the extension tubing and to maintain patency of the venous access device until the next time it required access.

In this section we discuss flushing and locking of PVAD-short catheters and CVADs (PICCs and percutaneus non hemodialysis catheters) as part of routine care and maintenance. Flushing and locking of IVADs, CVAD hemodialysis lines, and tunnelled catheters require additional education and training beyond the scope of this textbook.

If IVs are not being infused, they are often locked. Locked lumens require care and maintenance to allow them to remain patent until the next time they are needed. PVAD-short cannulas that are locked are commonly referred to as a *saline lock* (Figure 8.21) . CVADs that are locked are referred to as being either *capped* or *locked*; for example "a *locked* PICC," "a *capped* percutaneous non hemodialysis CVAD," or "a PICC with one *capped* lumen and two accessed lumens." (See Figure 8.6.)

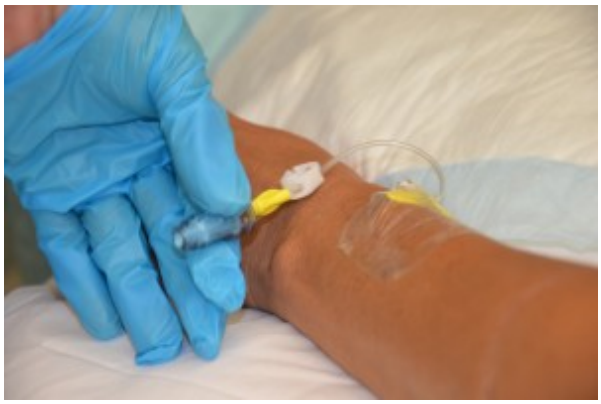


Figure 8.21 PVAD short saline lock with needleless cap

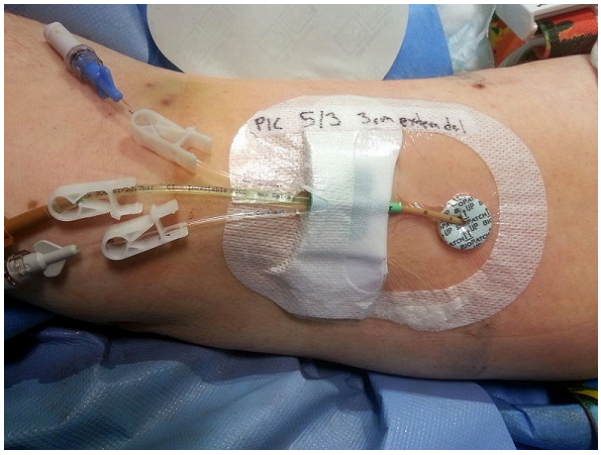


Figure 8.6 PICC with one capped lumen (blue) and two accessed lumens.

Routine flushing and locking of IV catheters is meant to prevent catheter occlusion (Goossens, 2015). Besides mechanical reasons, IV catheter occlusion can result from blood clot (fibrin) in the lumen or at the catheter tip and/or build up of precipitates in the lumen from medications and parenteral nutrition. Flushing and locking protocols are meant to maintain patent lumens. In addition, proper flushing and locking might eliminate potential nesting material for microorganisms and as such reduce the risk of catheter related blood stream infections (Ferroni et al., 2014).

Historically a **positive pressure** technique was used to prevent back flow of blood into the IV catheter; thus posing a risk of occlusion. Manual ways of achieving positive pressure include disconnecting the syringe from the needleless cap while still exerting pressure on the plunger during the last 0.5 ml. Another technique involves clamping the catheter while injecting the last 0.5 ml. Fast forward to the present and we now have technology to help us. Neutral displacement and positive pressure valves (caps) can be used and some IV catheters have valves built into their structure to prevent back flow of blood into the lumen. In addition, some syringes are specifically designed and if used correctly (remove the syringe before bottoming out) create the necessary positive pressure to prevent blood reflux into the catheter (Goossens, 2015).

Understanding the available IV equipment will direct the nurse to the proper flushing and locking protocols. This includes knowing what kind of venous access device the patient has, what solutions are being infused and how often, if the device is peripheral or centrally located, the number of lumens, and if the lumens are open (non-valved) or closed (valved).

Flushing and locking protocols are developed based on knowledge of the IV catheters (the type, size, and structure) and the patient condition (prescribed IV medications). Check your agency

guidelines for specifics, but know that some general guidelines do apply for PICC and percutaneous non hemodialysis CVAD flushing and locking procedures (Gorski et al., 2016):

- Follow principles of asepsis to reduce risk of infection.
- Before use, CVADs should be checked for patency using a 10 ml or larger syringe containing saline.
- Patency is checked by aspirating. On a PICC, midline, and percutaneous non hemodialysis CVAD aspirating should reveal blood flashback into the tubing.
- Aspirating on a PVAD-short often does not result in blood flashback due to small size of the veins. As such, patency will be assessed during the forward flush observing for resistance, leaking, and pain at the site.
- 10 ml syinges of 0.9% NS should be used to flush CVADs to reduce the risk of catheter fracture.
- Always follow the manufacturer's instructions when using needleless caps, as different techniques are required for different caps.
- The volume of the flush solution will depend on the volume of the catheter and any add on devices. The goal of locking an IV line is to fill the catheter entirely and preserve its integrity for future use (Goossens, 2014).
- The solution and frequency depends on whether the catheter is open-ended or valved, and what solution is being infused (i.e., blood, PN, etc.).
- Follow the agency guidelines. Recognize that guidelines for specific patient populations may vary.
- When using heparin, use the lowest possible dose that will maintain patency. Heparin always presents risk of bleeding. The goal is to heparinize the line not the patient.
- Some lines require the heparin locking solution to be removed prior to using the line.
- Turbulent flush is a rapid stop-start or push-pause technique that is meant to clear the catheter of blood or drugs that may adhere to the inner lumen of the catheter.
- Closed-ended or valved CVCs usually have no external clamps. Open-ended or non-valved CVCs usually have external clamps (non-removable) present. Check the patient chart.
- Cleanse the needleless cap before attaching and after detaching any syringe to reduce risk of infection.

Table 8.11 is a sample of a flushing and locking protocol. Your agency should have a protocol available for you to follow. It may not be exactly like this one, but the principles are still the same.

Table 8.11 Sample Flushing and Locking Protocol

Vascular Access Device	*Flushing and Locking Solution, and Volume*	*Frequency*
PVAD-short	Flush and lock with 3 to 5 ml, 0.9% sodium chloride	After each access, or daily if not in use When retrograde blood observed
Peripheral midline catheter **(non-valved)**	Flush: 5 to 10 ml, 0.9% sodium chloride followed by Lock: Heparin 3 ml of 100 units/ml	Flush before and after each med or access. When retrograde blood observed Lock after each access, or weekly if not in use.
CVAD, **non-valved** (e.g., percutaneous, tunneled, PICC)	Flush: 10 to 20 ml, 0.9% sodium chloride followed by Lock: Heparin 3 ml of 100 units/ml	Flush before and after each IV medication or access. When retrograde blood observed Lock after each access, or weekly if not in use.
CVAD **valved** (e.g., Groshong, PASV)	Flush and lock with 10 to 20 ml, 0.9% sodium chloride	Flush before and after each IV med or access. When retrograde blood observed Lock after each access, or weekly if not in use.

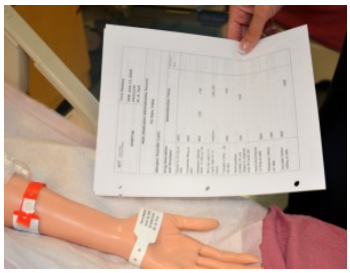
Data sources: Interior Health, 2012; RNAO, 2005/2008

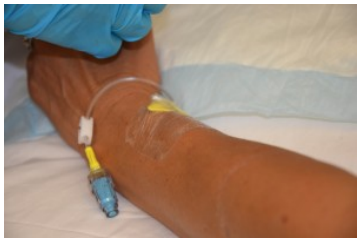
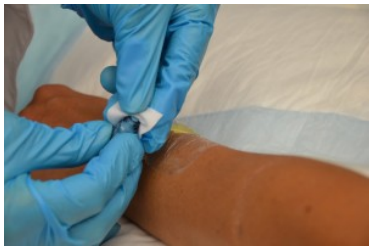
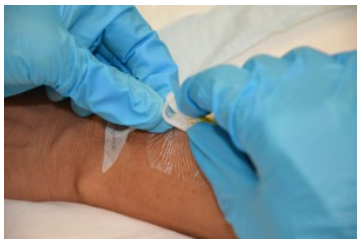
Checklist 69: Flushing a PVAD-Short Saline Lock

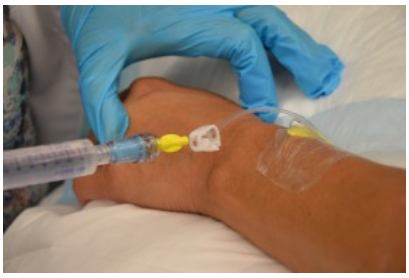
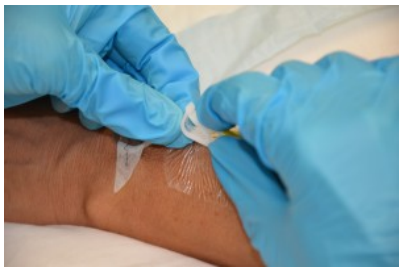
Disclaimer: Always review and follow your agency policy regarding this specific skill.

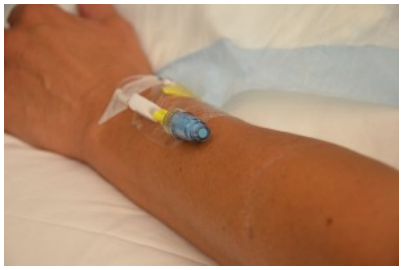
Safety considerations:

- Poor standards of aseptic technique are the primary cause of healthcare infections. Be diligent with disinfecting and sterile technique. Sterile technique must be used with all IV procedures.
- Never attempt to flush a "blocked" saline lock. If unable to flush, remove the PVAD-short cannula.
- Attach 10 ml Luer lock syringe to the needleless cap to flush.

Steps	*Additional Information*
1. Perform hand hygiene; gather supplies.	You will need alcohol swabs and a 3 – 5 ml syringe with 0.9% normal saline. Some agencies have prefilled saline syringes.
2. Compare MAR to patient's wristband, identify patient using two identifiers, and explain procedure to patient.	Follow agency policy for proper patient identification. 
3. Sanitize work surface. Let dry.	This prevents the spread of microorganisms.
4. Perform hand hygiene.	This prevents and minimizes the spread of microorganisms.

5. Assess IV site for evidence of complications. See Checklist 65.	If IV site is red, tender, or swollen, the SL needs to be discontinued; do not flush.  *Assess site for evidence of complications*
6. Clean the top of the needleless cap for 15 to 30 seconds with alcohol and friction. Allow to dry.	Aseptic technique is required for all IV procedures. All access ports must be disinfected to decrease the bacterial load prior to use. 
7. Open clamp on extension tubing.	
8. If using a prefilled normal saline syringe for flushing, the air must be "purged" from the syringe. To remove air from a syringe, loosen the cap. Apply gentle pressure to the syringe plunger until air is removed.	Purging the air prevents it from being injected into the patient. 

9. Luer lock syringe onto the needleless cap. Follow agency guidelines for volume of flush. Usually 3 to 5 ml of solution using turbulent stop-start technique. Flush until visibly clear. Do not bottom-out syringe (leave 0.2 to 0.5 ml in the syringe).	3 to 12 ml syringes can be used to flush a PVAD-short. Turbulent stop-start flush exerts cleansing pressure on the catheter lumen. Observe the site for infiltration, leaking, pain, or resistance. If resistance is felt, do not force the flush.  *Flush the saline lock* Bottoming-out the saline syringe with the plunger negates the positive pressure and can result in reflux of blood back into the catheter and plugging the catheter.
10. Remove syringe from needleless cap; THEN clamp the extension tubing. Wipe end of needleless cap with alcohol again.	Positive displacement occurs in a neutral displacement cap when the syringe is disconnected from the cap before the syringe is completely emptied and the line clamped following removal of the syringe  *Close clamp on saline lock*

11. Ensure dressing is dry and intact, and the extension tubing is properly secured with tape.	Properly secured extension tubing prevents accidental dislodgement and micro-movements of IV cannula.  *Dry and intact dressing*
12. Discard supplies and perform hand hygiene.	Proper disposal of equipment prevents the spread of microorganisms.
13. Document procedure.	Document IV site assessment, location of PIV, procedure, date, and time.
Data sources: Perry et al., 2018; Vancouver Coastal Health, 2012	

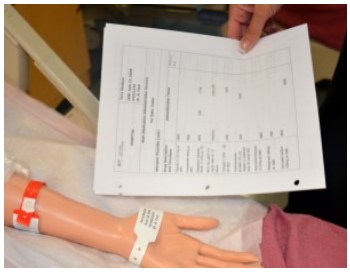
Watch the video PVAD – *short Flush (aka saline lock flush)* by Renée Anderson & Wendy McKenzie Thompson Rivers University

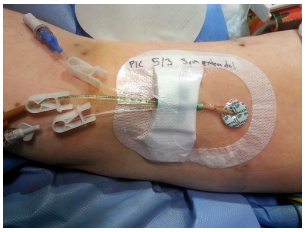
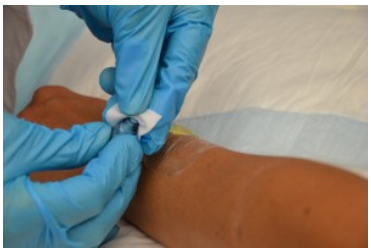
Checklist 70: Flushing a CVAD (PICC and Percutaneous CVC Non Hemodialysis)

Disclaimer: Always review and follow your agency policy regarding this specific skill.

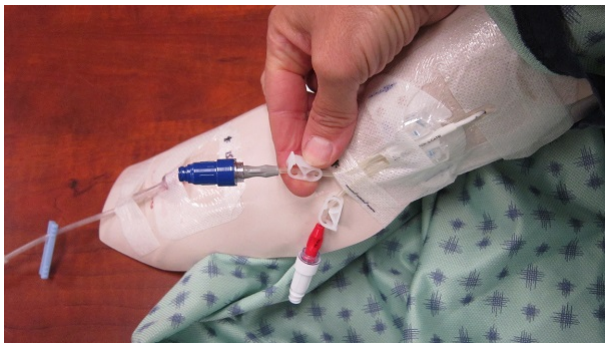
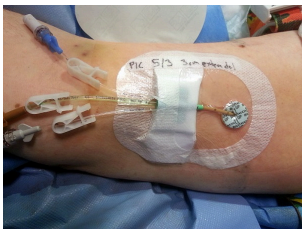
Safety considerations:

- Poor standards of aseptic technique are the primary cause of healthcare infections. Be diligent with disinfecting and sterile technique. Sterile technique must be used with all IV procedures.
- Never attempt to flush a "blocked" lumen. If unable to flush, consult the PICC / IV team for possible declotting.
- Know what kind of CVAD your patient has; determine the number of lumens and the presence or absence of valves. Use agency flushing and locking protocols to guide your decisions about solutions and volumes to be used.

Steps	*Additional Information*
1. Perform hand hygiene; gather supplies.	You will need alcohol swabs, 10 ml syringe prefilled with 0.9% normal saline.
2. Compare MAR to patient's wristband, identify patient using two identifiers, and explain procedure to patient.	Follow agency policy for proper patient identification. 
3. Sanitize work surface. Let dry.	This prevents the spread of microorganisms.

4. Assess IV site for signs and symptoms of complications.	If IV site is red, tender, swollen, and/or leaking, the site needs to be discontinued; do not flush. Consult the IV team or PICC nurse if necessary.  *Figure 8.6 Assess IV site and dressing*
5. Scrub the top of the needleless cap(s) for 15 to 30 seconds using alcohol and friction. Allow to dry.	Aseptic technique is required for all IV procedures. All access ports must be disinfected to decrease the bacterial load prior to use. **All** lumens require care and attention in relation to routine flushing to prevent occlusion and risk of infection.  *Clean the needleless cap prior to use*

6. Luer lock 10 ml saline filled syringe to the needleless port. Aspirate for blood. Follow your agency's trouble shooting guide but here are some tips that might help to establish patency of a CVC: • If no aspirate, reposition the patient's arm (for PICC) or neck (other CVCs); assess the line for kinks; request patient take deep breaths, turn head and cough and/or perform Valsalva maneuver. • If still no aspirate, change positive / neutral pressure cap. • If still no aspirate consult PICC / IV team for possible declotting. Do not forward flush due to risk of dislodging thrombus from the lumen.	Try to aspirate blood only into the IV line (not syringe) to reduce risk of clotting in the event of poor flushing technique.  *Figure 8.22 Aspirating for blood on a PICC*
7. Follow agency guidelines for volume of flush (usually 10 to 20 ml). Inject using turbulent stop-start technique. Flush until line is visibly clear. At the end of the procedure, do not bottom-out syringe (leave 0.2 to 0.5 ml in the syringe).	No less than 10 ml syringe should be used to flush a CVAD or PVAD midline in order to prevent catheter damage from excess pressure (PSI) while flushing. Turbulent flush cleans the lumen of the catheter of fibrin and any medication particulate. Observe site for leaking, pain, resistance. Bottoming-out the saline syringe with the plunger can render the positive pressure ineffective and cause reflux of blood back into the catheter resulting in a plugged catheter. If resistance is felt, do not force flush. Doing so can fracture the catheter or introduce an emboli into the patient. If resistance is felt, consult the IV team / PICC nurse for declotting.

8. If necessary, inject 3 ml of 100 unit/ml heparin. Do not bottom-out syringe.	Non-valved CVADs require heparin to remain in the lumen to prevent clot formation. Valved CVADs have technology to prevent reflux of blood into the lumen. **Understand the different venous access devices and the associated technology.** **Check your agency's flushing protocols.**
9. Remove syringe from needleless cap; THEN if present, clamp the extension tubing. Cleanse the needleless cap again for 15 seconds.	Always clamp after removing syringe from the needleless cap. Positive displacement occurs in a neutral displacement cap when the syringe is disconnected from the cap before the syringe is completely emptied.  *Figure 8.23 Close clamp after the syringe is removed* Cleansing injection ports before and after access reduces risk of infection.
10. Ensure transparent semi-permeable dressing is dry and intact, and the extension tubing is properly secured with tape.	Properly secured extension tubing prevents accidental migration of CVAD and micromovement at the insertion site.  *Figure 8.6*
11. Discard supplies and perform hand hygiene.	Proper disposal of equipment prevents the spread of microorganisms.
12. Document procedure.	Document IV site assessment, location of PIV, procedure, date, and time.
Data sources: Interior Health, 2012; Perry et al., 2018; RNAO, 2005/2008	

Watch the video *CVAD Care and Maintenance—Lumens with Valves* by Shari Caputo and Wendy McKenzie of TRU School of Nursing (2018).

Watch the video *CVAD Care and Maintenance—Lumens without Valves* by Shari Caputo and Wendy McKenzie of TRU School of Nursing (2018).

Watch the video Blood Draw through a CVAD by Shari Caputo and Wendy McKenzie Thompson Rivers University School of Nursing (2018).

Critical Thinking Exercises

1. Describe your thought process as you determine what flushing protocol is necessary for a valved percutaneous CVAD non hemodialysis CVCs.
2. What is the purpose of using heparin to lock a non-valved (open) CVC?

Attributions

Figure 8.21 PVAD short from BCIT is used under a CC BY-SA 4.0 international license.

Figure 8.6. Omläggning av PICC [Conversion of PICC] by Nurseirie is used under a CC BY-SA 3.0 unported license.

Figure 8.22 Aspirating for blood (PICC) by author is licensed under a CC BY-SA 4.0 international license.

Figure 8.23 Close clamps (PICC) by author is licensed under a CC BY-SA 4.0 international license.

8.9 Removal of a PVAD-Short, Midline Catheter, Percutaneous Non Hemodialysis CVC, and PICC

PVAD-short, midline catheters, percutaneous non hemodialysis CVCs, and PICCs may be discontinued if ordered by a physician, a nurse practitioner, or by an RN working within their independent scope of practice (which must include agency policy). Some reasons to remove IV access include: The patient is discharged from a health care facility; signs of phlebitis, infiltration, or extravasation; the site is leaking; or IV fluids and/or medications are no longer necessary (Fulcher & Frazier, 2007). Peripheral IVs should be removed promptly when no longer needed to avoid a catheter-related bloodstream infection (CR-BSI), as well as unnecessary pain and trauma (Infusion Nurses Society, 2012). CVCs might remain in situ longer simply because its presence suggests that the client's health status was severe and thus a potential for change in health status requiring IV access.

Agencies may have guidelines about how often to change PVAD short cannulas. While some agencies have prescriptive time frames, some research shows that peripheral IV cannulas should not be routinely changed but rather replaced based on whether the site is functioning, whether or not the saline lock is required, whether or not the insertion site is patent, and/or if the insertion site is a source of infection (CDC, 2017; Infusion Nurses Society, 2011).

Before IV access is discontinued, the nurse should consider:

- Is the patient drinking enough fluids?
- Is the patient voiding, passing gas, and having bowel sounds?
- Is there a need for the IV (IV meds)?
- Are the lab values within normal limits (Hgb, K)?
- Is the patient using an epidural/PCA and needs IV access as part of safety protocols?
- Do you have an order from the prescriber, or are you doing this under your independent scope of practice? If the later, is this in agreement with agency policy?

Review the steps in Checklist 71 for removing a PVAD-short cannula.

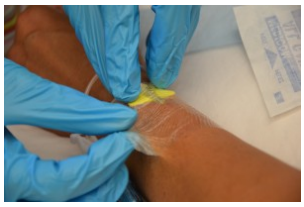
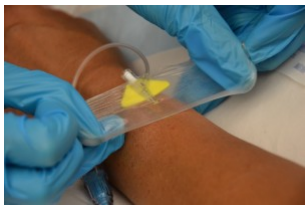
Checklist 71: Removing a PVAD-Short Cannula / Peripheral Midline Catheter

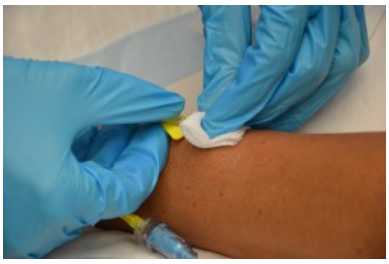
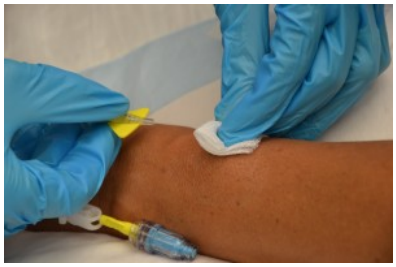
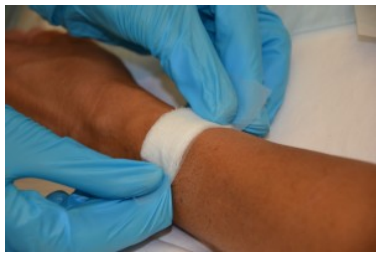
Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Assess the patient and be sure they are medically stable prior to removing the saline lock.
- Check the following: lab values, ongoing need for fluids or IV medications, inability to eat or drink, presence of nausea or vomiting.
- If patient has ongoing medical concerns requiring an IV, alert the prescriber.

Steps	*Additional Information*
1. Confirm prescriber's order or the reason to remove the PVAD-short.	This step prevents errors in the healthcare setting.
2. Perform hand hygiene and point of care risk assessment and collect supplies.	You will need sterile gauze (2×2s), clean gloves, tape, alcohol swab as required, C&S swab if purulent drainage present.
3. Identify yourself; identify the patient using two identifiers. Explain the procedure to the patient.	Proper identification prevents errors. Explaining the procedure educates the patient and allows patient to ask questions.
4. Apply clean gloves. Open up sterile gauze for easy access and place close by.	Gloves are necessary because of risk of BBF exposure. Preparing gauze allows for easy access whilst the cannula is removed.
5. Turn off IV infusion. Remove tape on extension tubing.	Turning off the infusion prevents a mess. Tape must be removed to free the equipment.

6. Remove transparent dressing: • Stabilize the IV cannula. • Loosen one edge of transparent dressing toward the IV site by stretching the dressing in the direction of loosened edge. • Loosen the other edge of the dressing and repeat previous step.	 *Removing transparent dressing*  *Completely remove dressing from IV site*
7. If purulent drainage is present, consider obtaining a swab for C&S. Report using the agency's patient safety learning system (incident report).	This provides follow-up data for potential infection. Reporting of events contributes to the culture of patient safety.

8. With non-dominant hand, hold sterile gauze above the insertion site; do not apply pressure. With dominant hand keeping the cannula parallel to the skin, pull out in a straight, slow, steady motion.	 *Gauze over insertion site*  *Remove saline lock*
9. Apply gentle pressure until bleeding stops, usually for 2 to 3 minutes. Assess catheter tip and discard cannula as per agency policy.	Once removed, pressure on the insertion site promotes coagulation. If patient is on anti coagulation therapy, extended pressure will be required to stop bleeding at IV site (e.g., 5 minutes). Observing cannula tip is a safety step to rule out potential catheter embolism
10. Tape sterile gauze or apply bandaid to create occlusive dressing on old IV site.	This prevents bacteria from entering the old IV site.  *Apply pressure over site*
11. Discard supplies, remove gloves, and perform hand hygiene.	These steps prevent the spread of microorganisms.
12. Document procedure as per agency policy.	Document date, time, condition of cannula, appearance of IV site, and type of dressing applied.

Data sources: Perry et al., 2018; Phillips, 2005

Watch the video *Removing a PVAD-Short Cannula* by Renée Anderson and Wendy McKenzie Thompson Rivers University School of Nursing (2018)

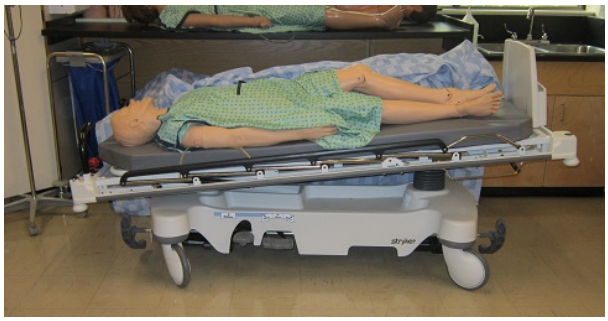
Checklist 72: Removing a Percutaneous Non Hemodialysis CVC / PICC

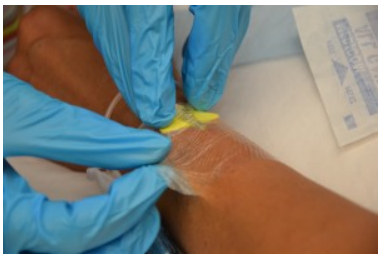
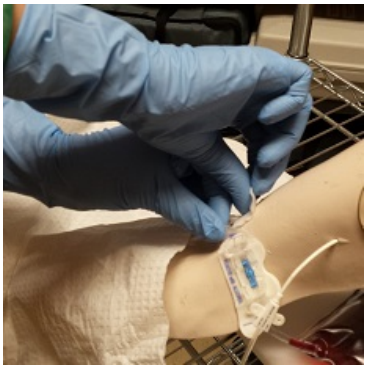
Disclaimer: Always review and follow your agency policy regarding this specific skill.

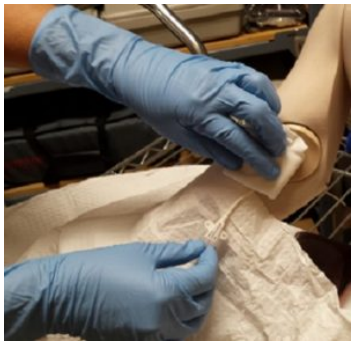
Safety considerations:

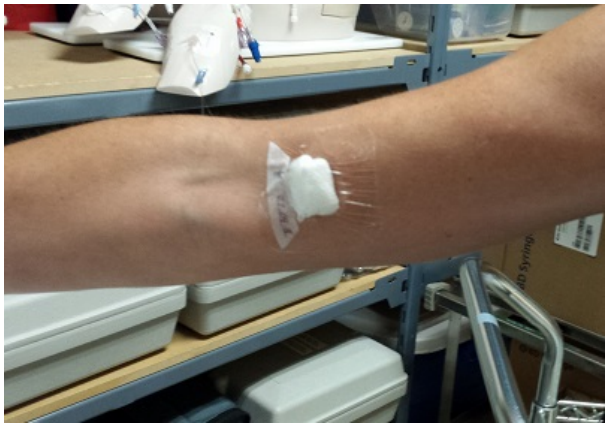
- Assess the patient and be sure they are medically stable prior to removing SL. Check the following: lab values, ongoing need for fluids or IV medications, inability to eat or drink, presence of nausea or vomiting.
- If patient has ongoing medical concerns requiring an IV, alert the physician.
- Consider if PVAD-short access is necessary before removing the CVC.

Steps	*Additional Information*
1. Confirm prescriber's order or the reason to remove the PICC / percutaneous non hemodialysis CVC.	This step prevents errors.
2. Perform hand hygiene. Perform point of care risk assessment and collect supplies.	You will need sterile gauze (two 4×4s), clean gloves, sterile gloves, alcohol swabs (2), C&S swab if purulent drainage present, chlorhexidine (CHG) swab, suture removal equipment if suture present, and TSM dressing. Some agencies will have CVAD dressing change kits, suture removal kits.
3. Identify yourself; identify the patient using two identifiers. Explain the procedure to the patient. Sanitize working surface.	Proper identification prevents errors. Explaining the procedure educates the patient and allows patient to ask questions. Sanitizing work surfaces reduces risk of infection.

4. Position patient flat or 10 degrees Trendelenberg (unless contraindicated) Open up sterile gauze for easy access and place close by.	 *Figure 8.24 Trendelenburg position* Trendelenburg position reduces risk of air emboli during catheter removal by decreasing negative pressure in the intrathoracic cavity. If you aren't able to position the client as such, have the patient perform the Valsalva maneuver just prior to catheter removal. If they can't do that either, remove the catheter at the end of inspiration. Gloves are necessary to reduce risk of BBF exposure. Preparing gauze allows for easy access whilst the cannula is removed.
5. Turn off IV infusions. Prepare equipment using principles of asepsis. Apply non sterile gloves.	You can open a sterile dressing kit and put items into it, or open packages in a way that will allow easy access and maintains principles of asepsis.

6. Gently remove transparent dressing and securement device: • Stabilize the IV cannula. • Loosen one edge of transparent dressing toward the IV site by stretching the dressing in the direction of loosened edge. • Loosen the other edge of the dressing and repeat previous step.	 *Remove transparent dressing* Some TSM dressings have specific directions for removal (i.e., pull horizontally to release adhesive). Some securement devices require alcohol for removal.  *Figure 8.25 Remove securement device with alcohol*
7. If purulent drainage is present, consider obtaining a swab for C&S. Report using the agency's patient safety learning system (incident report).	Follow agency procedure for wound C&S (usually involves cleansing the site with normal saline prior to the swab). This provides follow-up data for potential infection. Reporting of events contributes to the culture of patient safety.

8. Cleanse the insertion site with agency approved solution (usually 2% chlorhexidine with 70% isopropyl alcohol) swab using multi-directional friction. Allow to dry. Remove non sterile gloves. Perform hand hygiene and apply sterile gloves.	Antiseptic solution and multi-directional friction reduce microorganisms to decrease risk of site and bloodstream infection. If patient is allergic, consult agency guidelines (usually povidone iodine is the next choice, and if that is contraindicated use saline). Sterile gloves decrease risk of transmitting microorganisms.  *Figure 8.25 PICC Removal*
9. Maintaining principles of asepsis, grab 4×4 gauze. Fold into 2×2 size. With non-dominant hand, place above the insertion site; do not apply pressure.	Applying pressure may cause discomfort. The gauze helps to absorb any blood and provides a barrier between the insertion site and the healthcare provider.
10. Ask the patient to perform the Valsalva maneuver (forced exhalation) as the catheter is removed.	The Valsalva maneuver (along with Trendelenburg positioning decreases negative pressure in the respiratory system, thus reducing risk of air emboli as the catheter is removed). If the patient is unable to do this, remove the catheter at the end of expiration.
11. With dominant hand, keep the cannula parallel to the skin and pull out in a straight, slow, steady motion. Assess catheter tip and discard cannula as per agency policy.	Observing cannula tip is a safety step to rule out risk of catheter embolism. If required, cut the tip of the CVC, place in sterile C&S container, label appropriately, requisition and send to lab for processing.
12. Hold sterile gauze over insertion site, and apply gentle pressure until bleeding stops, usually for 2 to 3 minutes.	If patient is on coagulation therapy, extended pressure will be required to stop bleeding at IV site for 5 minutes. Check agency policy, as some require frequent checks of sites (i.e., every 5 minutes×3)

13. Apply sterile occlusive dressing (i.e., TSM). Label dressing with date, time, and your initials.	This prevents bacteria from entering the old IV site. Remove after 48 hours.  *Figure 8.26 Sterile occlusive dressing over site.*
14. Advise the patient to remain supine for 30 minutes following.	Reduces risk of air emboli.
15. Discard supplies, remove gloves, and perform hand hygiene.	These steps prevent the spread of microorganisms.
16. Document procedure as per agency policy.	Document date, time, condition of cannula, appearance of IV site, and type of dressing applied.
Data sources: Interior Health, 2012; Perry et al., 2018; Phillips, 2005	

Critical Thinking Exercises

1. What is the purpose of applying pressure to the site after the cannula has been removed?
2. Name five factors to consider prior to discontinuing an IV.
3. What is the purpose of Trendelenburg positioning and the Valsalva maneuver during CVC (percutaneous non hemodialysis central catheter, PICC) removal?

Attributions

Figure 8.24 Trendelenburg position by author is licensed under a CC BY-SA 4.0 international license.

Figure 8.25 PICC removal by author is licensed under a CC BY-SA 4.0 international license.

Figure 8.26 Sterile occlusive dressing by author is licensed under a CC BY-SA 4.0 international license.

8.10 IV Site Dressing Changes

IV site dressings are intended to stop the introduction of microorganisms at the IV insertion site, which can lead to blood infection, and to help to stabilize IVs to prevent micro-movements, which can lead to phlebitis. Some principles of IV site dressing changes are:

Table 8.12 Principles of IV Site Dressing Changes

Aseptic techniques must be maintained while doing dressing change. Tape or other securement devices that are used under the dressing must be sterile.	• Preventing microorganisms into the client's vascular system = ↓ risk of infection at site / systemic. • Remove old dressing with clean gloves. • Sterile gloves or a non-touch technique to be used when taking off sterile securement strips or device.
Transparent semi-permeable (TSM) dressings. Changed every time the site is changed and prn.	Semi-permeable allows sites to "breathe." Transparency allows clear visualization of insertion site. Dressings provide protective function to prevent catheter migration via stabilizing and protection from microorganisms. If the patient's skin is not intact and/or there is allergy, consult agency guidelines for appropriate IV site dressing.
If gauze is needed under the dressing, change dressing q48 hours. If excess hair needs to be removed, clip hair with scissors.	Excess moisture and gauze act as a reservoir for bacteria. Shaving may cause micro-abrasions, and intact skin is the body's first line of defense against bacterial migration.
When cleaning use multi-directional friction: • Use 2% chlorhexidine / 70% isopropyl alcohol • Clean beyond the size of the dressing • Allow cleaning solution to dry (approx. 30 seconds)	Reduce the microbes at the insertion site. Drying allows for maximum antiseptic activity. Packaged swab sticks are not considered sterile, thus don't put them into your sterile field. The effectiveness of antimicrobial agents is reliant on completely drying.
Stabilizing devices—sutures, skin closure strips, or a securement device—these devices must be sterile. • Change q7 days. • Do not occlude the insertion site with SteriStrips. • Label the dressing with the date of dressing change.	Prevents the catheter from moving, getting damaged, or occluding. Prevent microbes from transferring onto the insertion site and skin.

Ensure catheter tip is not migrating

For central lines or midlines, measure external length of the catheter from the insertion site to where the catheter enters or attaches to the connector.

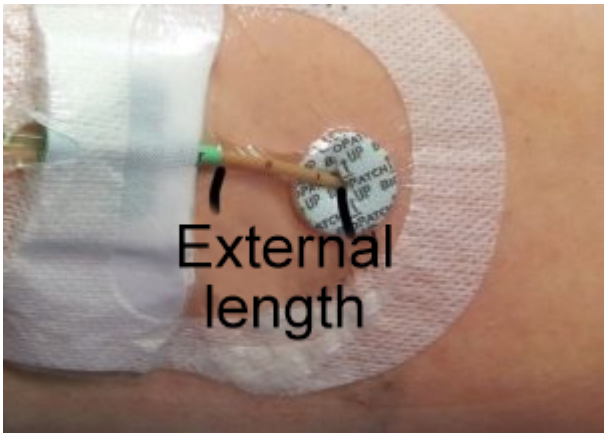


Figure 8.27 Measure external length from the insertion site to the hub. Some PICCs have a visible "O" ring on it…in which case measure from the insertion site to the "O" ring

Topical dressing should be centred over the securement device.

Provides maximum coverage and helps keep the securement device securely in place.

Measure external length.

Data sources: Interior Health, 2012; RNAO, 2005/2008

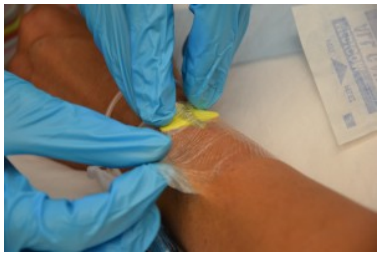
Review the steps in Checklist 73 for changing an IV site dressing with no additional securement device.

Checklist 73 Changing an IV Site Dressing—No Additional Securement Devices

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Always follow the guidelines of the agency when performing this skill

Steps	*Additional Information*
1. Perform hand hygiene, perform point of care risk assessment, and collect supplies.	You will need a semi-transparent dressing, alcohol swabs, CHG swabs ×3 (2% chlorhexidine / 70% isopropyl alcohol), and clean gloves
2. Identify yourself; identify the patient using two identifiers; explain the procedure to the patient.	Proper identification prevents errors. Explaining the procedure educates the patient and allows patient to ask questions.
3. Sanitize working surface	Reduces microorganisms and risk of transmission.
4. Perform hand hygiene. Open up packages for easy access and place close by. Donne non-sterile gloves.	Preparing packages allows for easy access. Gloves are necessary because of risk of BBF exposure.
5. Remove transparent dressing: • Stabilize the IV cannula. • Loosen one edge of transparent dressing toward the IV site by stretching the dressing in the direction of loosened edge. • Loosen the other edge of the dressing and repeat previous step.	 *Removing transparent dressing*

6. With non-dominant hand stabilizing the catheter, use the dominant hand to hold a CHG swab.	PVAD-short cannulas are rarely secured with a suture. Using swabs allows no touch technique while cleaning the site and surrounding skin. If allergy to CHG, consult agency policy.
7. Use multi-directional friction to clean the site including surrounding skin to area beyond the size of the dressing. Allow skin to dry.	Multi-directional friction reduces microorganisms. Cleaning beyond the size of the dressing reduces microorganisms under the dressing thus reducing risk of infection. The antiseptic must be dry for it to have antiseptic properties and to allow the dressing to adhere to the skin.
8. Apply TSM dressing with insertion site approximately in the centre of the window. Use additional tape to ensure security and include date and time	TSM dressings allow observation of site, skin breathability.
9. Ensure IV remains patent. Assess IV system.	Ongoing assessment ensures proper functioning. During dressing change, position of cannula may have changed and may affect patency.
10. Discard supplies, remove gloves, and perform hand hygiene.	These steps prevent the spread of microorganisms.
11. Document procedure as per agency policy.	Document date, time, condition of IV site, and type of dressing applied. **Note**: Some agencies require the cannula size, vein location and external length to be documented.
Data sources: Interior Health, 2012; Perry et al., 2018; Phillips, 2005	

Watch the following video *PVAD-Short Dressing Change* by Renée Anderson and Wendy McKenzie (2018) of Thompson Rivers University School of Nursing.

Checklist 74: Changing an IV Site Dressing Involving a Securement Device

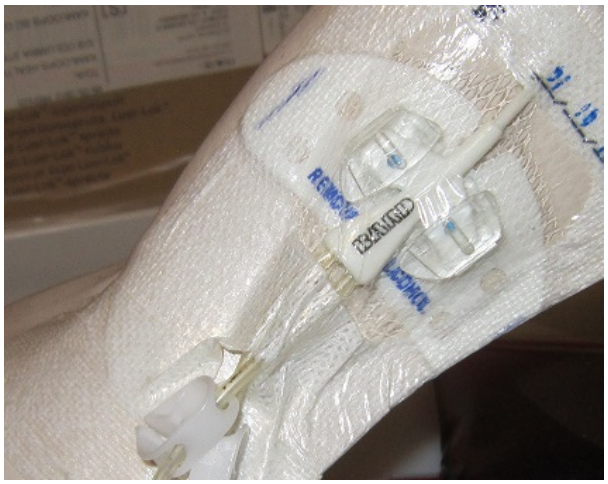


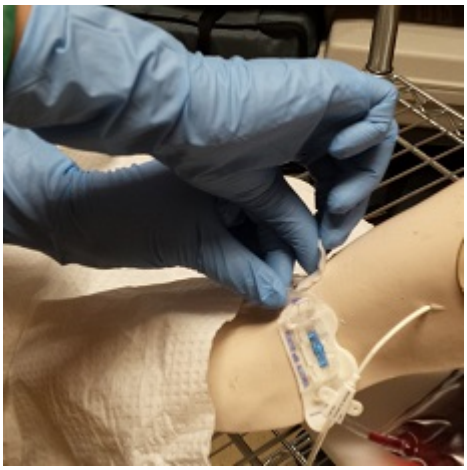
Figure 8.28 PICC dressing with securement device

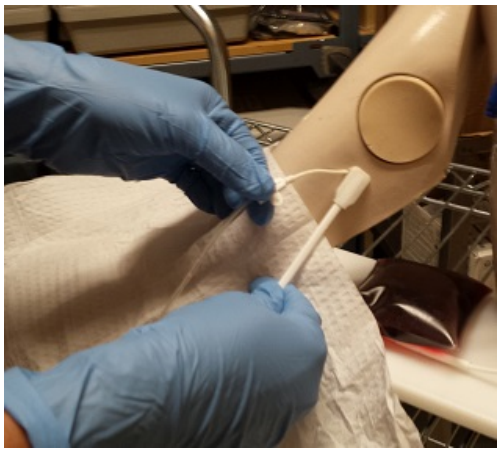
Disclaimer: Always review and follow your agency policy regarding this specific skill.

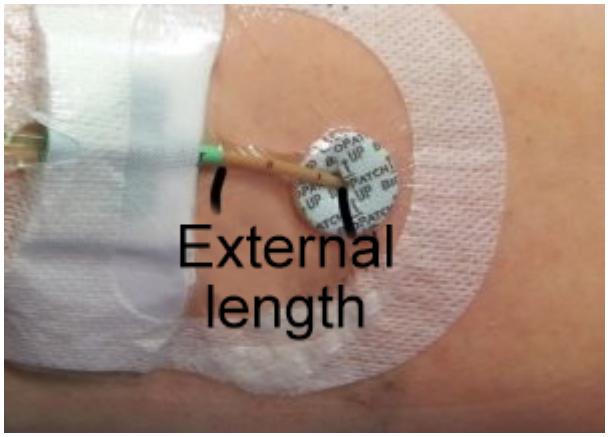
Safety considerations:

- Always follow the guidelines of the agency when performing this skill

Steps	*Additional Information*
1. Perform hand hygiene. Perform point of care risk assessment and collect supplies.	You will need a semi-transparent dressing, alcohol swabs, CHG swabs ×3 (2% chlorhexidine / 70% isopropyl alcohol), clean gloves, sterile gloves, dressing kit, securement device, and SteriStrips. Note: some agency protocols suggest to include changing needleless caps at the same time dressings are changed. Check agency guidelines.

2. Identify yourself; identify the patient using two identifiers; explain the procedure to the patient. Perform point of care risk assessment.	Proper identification prevents errors. Explaining the procedure educates the patient and allows patient to ask questions.
3. Sanitize working surface.	Reduces microorganisms and risk of transmission.
4. Perform hand hygiene. Open the sterile field. Add sterile items into the field.	Items that are remaining under the dressing must be sterile. If using CGH swabs, know if they are sterile. If not sterile, use a no touch technique to clean the site and surrounding skin.
5. Donne non-sterile gloves. Remove transparent dressing and securement device: • Stabilize the IV cannula. • Loosen one edge of transparent dressing toward the IV site by stretching the dressing in the direction of loosened edge. • Loosen the other edge of the dressing and repeat previous step. • Remove old securement device	Gloves are necessary because of risk of BBF exposure.  *Figure 8.29 Removing securement device with alcohol*

6. Place a sterile drape under the CVC ensuring the drape area that comes into contact with the CVC remains sterile. With non-dominant hand stabilizing the catheter, use the dominant hand to hold a CHG / alcohol swab (assuming swab handles are not sterile).	Draping reduces risk of contaminating CVC with more microorganisms. Stabilizing helps to prevent catheter migration and micro-movements at insertion site. Using swabs allows no touch technique while cleaning the site and surrounding skin.  *Figure 8.30 Stabilize the catheter. Clean site and surrounding area with multi-directional friction* If allergy to CHG, consult agency policy.

7. Use multi-directional friction to clean the site including surrounding skin to beyond the size of the dressing. Allow skin to dry. Measure external length.	Multi-directional friction reduces microorganisms. Cleaning beyond the size of the dressing reduces microorganisms under the dressing, thus reducing risk of infection. Assessing external length determines if catheter migration has happened.  *Figure 8.27 Measure external length from the insertion site to the hub.*
8. Remove non sterile gloves. Perform hand hygiene. Apply sterile gloves. Situate new securement device in place.	Securement device will remain under the dressing, thus it must be sterile.
9. Apply TSM dressing with insertion site approximately in the centre of the window. Use additional tape to ensure security and include date and time	You might want to remove your gloves for this step. Otherwise, be careful; gloves stick to the dressing.
10. Ensure IV remains patent. Assess IV system.	Ongoing assessment ensures proper functioning. During dressing change, position of cannula may have changed and may affect patency.
11. Discard supplies, remove gloves, and perform hand hygiene.	These steps prevent the spread of microorganisms.
12. Document procedure as per agency policy.	Document date, time, condition of cannula, appearance of IV site, and type of dressing applied.
Data sources: Interior Health, 2012; Perry et al., 2018; Phillips, 2005	

Watch the video *PICC Dressing Change* by Shari Caputo and Wendy McKenzie of Thompson Rivers University School of Nursing (2018).

Critical Thinking Exercises

1. When are sterile gloves required during a CVC dressing change?
2. Why does the securement device for a CVC have to be sterile?

Attributions

Figure 8.27. Omläggning av PICC [Conversion of PICC] (modified) by Nurseirie is used under a CC BY-SA 3.0 unported license.

Figure 8.28. PICC dressing securement device by author is licensed under a CC BY-SA 4.0 international license.

Figure 8.29 Remove securement device by author is licensed under a CC BY-SA 4.0 international license.

Figure 8.30 Stabilize catheter by author is licensed under a CC BY-SA 4.0 international license.

8.11 Transfusion of Blood and Blood Products

All healthcare practitioners who administer blood or blood products must complete specific training for safe transfusion practices and be competent in the transfusion administration process. Always refer to your agency policy for guidelines for preparing, initiating, and monitoring blood and blood product transfusions. These guidelines apply to adult patients only.

The transfusion of blood or blood products (see Figure 8.31) is the administration of whole blood, its components, or plasma-derived products. The primary indication for a red blood cell (RBC) transfusion is to improve the oxygen-carrying capacity of the blood (Canadian Blood Services, 2017a). An order from a healthcare provider is required for the transfusion of blood or blood products. RBC transfusions are indicated in patients with anemia who have evidence of impaired oxygen delivery. For example, individuals with acute blood loss, chronic anemia and cardiopulmonary compromise, or disease or medication effects associated with bone marrow suppression may be candidates for RBC transfusion. In patients with acute blood loss, volume replacement is often more critical than the composition of the replacing fluids (Canadian Blood Services, 2017a). Transfusions can restore blood volume, restore oxygen-carrying capacity of blood with red blood cells, and provide platelets and clotting factors. The most common type of blood transfusion is blood that is donated by another person (allogeneic). Autologous transfusion is the transfusion of one's own blood (Perry et al., 2018).

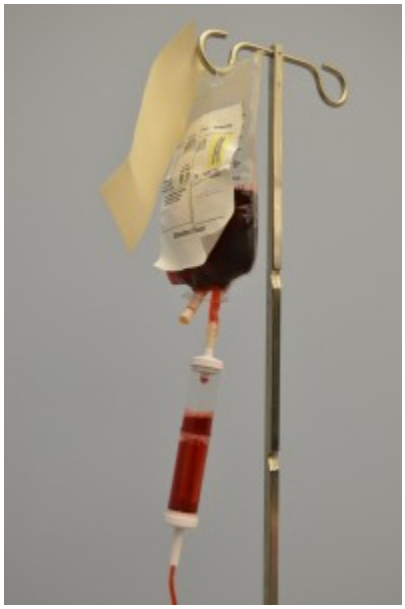


Figure 8.31 Red blood cells and blood IV tubing. Note the filter is the bottom half of the drip chamber

Transfusion therapy is considered safe, and stringent precautions are followed in the collection, processing, and administration of blood and blood components. However, transfusions still carry risks such as incompatibility, human error, and disease transmission, and blood transfusion must be taken seriously at all times. Incompatibility can be decreased by using irradiated red blood cells or leukocyte-reduced blood. The majority of blood transfusion complications are a result of human error (Perry et al., 2018).

Compatibility testing is vital for all recipients of blood or blood products. Recipients must be transfused with an ABO group specific to their own blood type or ABO group-compatible. There are three types of blood typing systems: ABO, Rh, and human leukocyte antigen (HLA). For more information on these, refer to the online resources at the end of this chapter. It is vital to understand what types of blood groups are compatible for transfusions (Canadian Blood Services, 2017b).

When administering blood and blood products, it is important to know the patient's values and beliefs regarding blood products. Some groups of individuals, mainly Jehovah's Witnesses, may refuse blood transfusions or blood products based on religious beliefs. These individuals sometimes refuse transfusion of whole blood and primary blood components but may accept transfusion of derivatives of primary blood components such as albumin solutions, clotting factors, and immunoglobulins. Always assess each individual's preference to establish if a blood

component is an acceptable treatment to manage their illness or condition (Canadian Blood Services, 2017a).

When managing blood transfusions, it is important to identify issues promptly to manage reactions effectively. Transfusion reactions (mild to life-threatening) may occur despite all safety measures taken. All transfusion reactions and transfusion errors must be reported to the agency's transfusion medical services (TMS, a.k.a. the "blood bank"). It is imperative to know what signs and symptoms to look for, and to educate your patient on what to report and when to report potential transfusion reactions. Mild to severe reactions may include the following (Canadian Blood Services, 2017b):

- Temperature ≥ 38.0°C or change of 1°C from pre-transfusion value
- Acute or delayed hemolytic transfusion reaction
- Hypotension/shock
- Rigors
- Anxiety
- Back or chest pain
- Nausea/vomiting
- Shortness of breath (dyspnea)
- Hemoglobinuria
- Bleeding/pain at IV site
- Tachycardia/arrhythmia
- Generalized flushing
- Rash ≥ 25% of body
- Urticaria and other anaphylaxis reactions
- Hemolysis after transfusion
- Cytopenias after transfusion
- Virus, parasite, and prion infections
- Non-immunological reactions including infection
- Circulatory overload
- Hypothermia

It is important to note that some reactions can occur one or more days after a transfusion (Canadian Blood Services, 2017b). As such, patients going home after a transfusion require education about what to watch for and what do do in the event of a reaction. For more information on types of reactions, signs and symptoms, and treatments, review the article adverse events related to blood transfusions, or see the online resources at the end of this chapter. If patient has a blood transfusion reaction, always follow agency policy to manage mild to severe blood reactions. This text will cover pre transfusion preparation (Checklist 75), transfusion of blood

and blood products (Checklist 76) and then managing a blood transfusion / blood product reaction (Checklist 77).

The steps in Checklist 75 must be completed *before* obtaining the blood or blood product from the blood bank (Alberta Health Services, 2015a, 2015b; Perry et al., 2018; Vancouver Coastal Health, 2008).

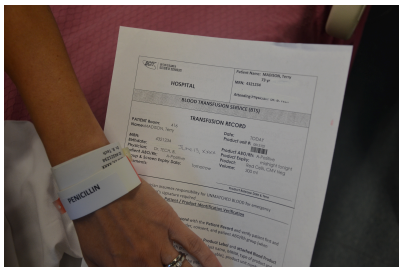
Checklist 75: Pre transfusion Preparation

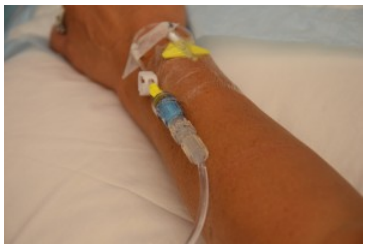
Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

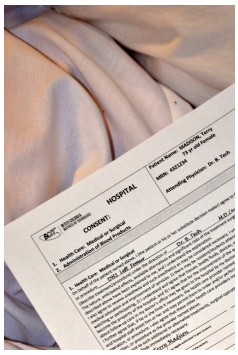
- Some blood products require refrigeration. Complete the preparation BEFORE calling for delivery of the blood / blood product.
- If the product does require refrigeration and cannot be administered immediately, return it to TMS (transfusion medical services) for safe storage.
- If there is any discrepancy between patient information, group and screen, product ordered, etc., do not proceed. Stop and verify any discrepancies.
- Be diligent when preparing to infuse blood. Distractions may lead to errors when verifying information.

Steps	*Additional Information*

1. Verify prescribers' order for the specific blood or blood product order	Order must verify the type of product; amount; date, time, rate or duration of the infusion; any modifications to the blood component; specific transfusion requirements; and sequence in which multiple components are to be transfused (if multiple components are ordered).  *Physician orders for a blood transfusion*
2. Verify the prescriber's orders for any pre- or post-transfusion medications to be administered.	Medications given prior to transfusion are only considered for persons with documented moderate to severe reactions. Typically medications are administered 30 minutes prior to the transfusion. Examples of meds might include diphenhydramine, acetaminophen, and furosemide. **Remember**: These medications can also mask a potential reaction.
3. Obtain the patient's transfusion history, and note any known allergies and previous transfusion reactions.	Past complications may require patient to have pre- and post-transfusion medications to prevent further transfusion reactions.

4. Check that the correct patient facility identification and TMS identification band are on the person. If no facility identification band, apply one. If no TMS (a.k.a. blood band) present, STOP. Notify TMS. If any discrepancies STOP. Do not proceed until the discrepancy is resolved.	Group, screen, and cross match must be completed within 96 hours of the transfusion to establish any new antibody formation and to ensure current compatibility. If group and screen are outdated, initiate processes for new testing. Only TMS can apply blood product related bands.
5. Establish IV site or verify patency of current site.	IV sites must be patent and without complications. Blood and blood products cannot be mixed with IV medications. If necessary, establish a site specifically for the blood product. The IV cannula must be large enough to allow flow of product at the correct rate. Generally for adults 20 to 22 gauge. Large cannulas are necessary for rapid infusion (i.e., 16 or larger).  *Assess patency of IV site* CVCs with multiple lumens may allow blood or blood products to be given simultaneously when medications and other solutions infuse through separate lumens.

6. Verify correct infusion equipment. Prime an IV line following Checklist 66. Initiate primary IV @ 30 cc/hr. Ensure a back up line of 0.9% NS with a standard IV administration set is available at the bedside in the event of emergency.	Blood components require filter tubing to remove clots, debris, and coagulated protein. A straight blood administration set is used for all transfusions (we no longer use Y'd blood tubing). Glass bottles containing albumin and IVIG require vented tubing. If using a pressure infusion device, ensure it is safe to use with transfusions. Some infusion devices can cause mechanical hemolysis. • 0.9% NS for RBC • D5W for IVIG Refer to blood product fact sheets for all other products. If this is an elective transfusion, an alternate approach is to prime the IV administration set with the blood product just prior to administration.
7. Assess laboratory values to confirm rationale for transfusion.	For example Hgb, hematocrit, coagulation values, platelent count. This ensures the transfusion is appropriate.

8. Check that the prescriber has obtained the necessary consent.	It is the prescriber's responsibility to obtain consent for blood or blood products. 
9. The nurse confirms consent by ensuring the patient understands the procedure, rationale and by providing an opportunity for the patient's concerns / questions to be answered. RN to document confirmation of consent.	Blood products require consent prior to administration. Notify the prescriber if patient is unable to provide indication of understanding the proposed blood or blood product transfusions.

10. Obtain and record the pre-transfusion baseline vitals including temperature, pulse, respirations, blood pressure, and SpO_2. In addition, assess for other symptoms that may be confused with transfusion reaction.	Fever, rashes, flank pain, or shortness of breath may be preexisting and thus difficult to differentiate from a transfusion reaction. This assessment should be done within 30 minutes of initiating the transfusion. These serve as a baseline in which to compare any changes that may suggest transfusion reaction. 
11. Have emergency equipment available at the bedside (oxygen, suction, etc.).	Be prepared for potential complications, as prompt intervention may be required to prevent serious complications.  *Emergency equipment check at bedside*
12. Complete all documentation as required per agency policy.	Proper documentation provides evidence that all required procedures have been followed to prepare for a transfusion. You have completed bedside check #1. You are now ready to call for the blood product.

Data sources: Alberta Health Services, 2015b; Canadian Blood Services, 2017c; Interior Health, 2018; Perry et al., 2018; Vancouver Coastal Health, 2008

Checklist 76: Transfusion of Blood and Blood Products

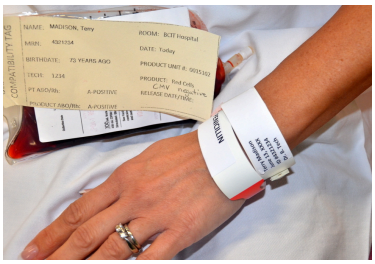
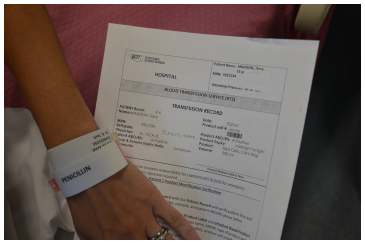
Disclaimer: Always review and follow your agency policy regarding this specific skill.

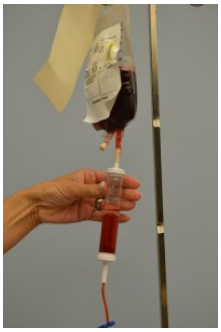
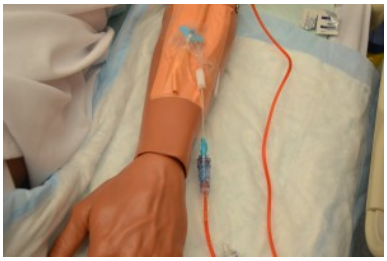
Safety considerations:

- Blood and blood products cannot be mixed with any IV medications
- Specific blood administration tubing is required for all blood transfusions. New tubing / filter is required after 4 hours.
- See agency policy for using EID for the administration of blood products. EIDs should have a sticker on them to indicate their safe use with blood products.
- Intravenous immunoglobulin (IVIG) is only compatible with D5W.
- All blood products taken from the blood bank must be hung within 30 minutes and administered (infused) within 4 hours due to the risk of bacterial proliferation in the blood component at room temperature. If the product cannot be infused within 4 hours, stop the transfusion and return the remaining blood component to the TMS.

Steps	*Additional Information*

1. Verify prescribers' order and pre-transfusion preparation. Checklist 75 is complete.	Reduces risk to patient. Promotes safety.
2. Obtain blood product from TMS within 30 minutes of planned transfusion.	Plan for pickup or delivery of blood and blood products. Do not request blood or blood products if pre-transfusion preparation is not complete.
3. Complete visual inspection of product. Assess blood bag for any signs of leaks or contamination, such as clumping, clots, gas bubbles, or a purplish discoloration.	Ensures integrity of the product. If any concerns, return product to TMS.  *Figure 8.32 Blood product example*
4. Document any clinical sign or symptom that may be confused with a transfusion reaction (e.g., existing fever).	Serves as baseline to which further assessments can be compared.

5. Complete bedside check with two healthcare providers: **Transfusionist**: Leads and verbalizes all of the necessary elements. **2nd person verifier**: Verbally confirms after each element is checked. • Confirm prescriber's order. • Patient identification: Patient to state full name and DOB. Must be an exact match on patient facility ID and TMS documents • TMS ID band number (a.k.a. blood band) • Blood component: Read out the name of the component on the TMS document and the blood component container label. • Patient ABO group: From the TMS documents • Blood component ABO group: From the TMS document and blood component container label • Blood component serial number: From the TMS document and blood component label • Blood component expiry date	All verification numbers/information must match exactly. Must be completed by two trained staff members competent in blood transfusion administration process as set out by the agency.  *Confirm patient identity*  *TMS record* If there are any discrepancies, STOP the process and contact the TMS for resolution and direction. Do not proceed.
6. Perform hand hygiene.	Decreases risk of transmitting microorganisms. Do not remove the product from the presence of the patient; prime at bedside. If product is removed from bedside, the final verification process must be completed again.

7. Invert product 5 to 10 times and insert spike of the blood administration set into the blood product container. Squeeze the drip chamber. Completely cover the filter with product. Fill the top of the drip chamber 1/2 to 1/3 full.	 Priming blood tubing is very similar to priming IV tubing.
8. Initiate transfusion. Stay at the patient's bedside for the first 5 minutes ensuring the blood enters the patient's circulation. Obtain vitals after 15 minutes. Assess for other signs of reaction. If stable, increase transfusion rate as per orders or as per the nurse's judgment of patient risk. Advise patient on the signs and symptoms of transfusion reaction and what and when to report.	Adults: Initiate infusion as per agency guidelines. Infusions always start out slowly because most transfusion reactions occur within first 15 minutes of a transfusion. Infusing small amounts of blood component initially minimizes volume of blood to which patient is exposed, thereby minimizing severity of reaction. For example: Packed RBCs: 50 ml/hour for 15 minutes. Platelets / plasma: 50 to 100 ml/hour for 15 minutes  *Infusion of packed RBC* For all units to be infused, remain with the patient for the first 5 minutes and assess for clinical signs of transfusion reaction. Recommended best practice is to transfuse each unit of packed RBCs over 2 hours as long as no medical contraindications are evident OR as per prescribers' orders.

9. Continue to monitor vitals signs q1h up to and including 1 hour post transfusion or until patient is stable. Ongoing patient assessment and monitoring is necessary.	
10. In the event of a transfusion reaction, stop the infusion.	• Manage transfusion reactions as per agency protocol. • Complete required transfusion reaction form. • Return remaining blood to blood bank for further investigation.
11. For additional units, repeat steps 2 to 9.	Follow the same process to ensure patient safety. Blood tubing must be discarded after 2 units or 4 hours, whichever comes first.
12. At the end of the transfusion, flush lines according to agency flushing protocol.	CVCs often require 20 saline turbulent flush after a transfusion to maintain lumen patency. See agency flushing and locking protocols.

13. Discard waste in biohazard waste container.	This prevents the spread of biohazard waste.
14. Complete all documentation as required by agency.	Documentation may include: • Transfusion record form • All vital signs and reactions • Any significant findings, initiation and termination of transfusion • Record of transfusion on the in-and-out sheet • Blood component tags filled out and returned to TMS
Data sources: Alberta Health Services, 2015a, 2015b; Canadian Blood Services, 2017; Interior Health, 2018; Perry et al., 2018; Vancouver Coastal Health, 2008	

Checklist 77: Managing a Blood or Blood Product Transfusion Reaction

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Always review your agency's algorithm for managing mild to severe reactions. For example, if a reaction is mild (e.g., fever), and without any other complications, a patient may continue the transfusion if monitored closely. Most other transfusion reactions require the transfusion to be stopped immediately.
- A blood transfusion reaction may occur 24 to 48 hours post-transfusion.
- Each separate unit presents a potential for an adverse reaction.
- Follow emergency transfusion guidelines when dealing with an emergency blood or blood product transfusion.
- Be aware of which types of blood or blood products cause the most types of transfusion reactions.
- Be aware of the types of patients at high risk for blood or blood product transfusion reactions.
- Always have emergency equipment and medications available during a transfusion. For example, epinephrine IV should always be readily available.

Steps	*Additional Information*
1. Stop transfusion immediately.	The severity of a blood transfusion reaction is related to the amount of product infused and the amount of time it has been infusing.
2. Disconnect blood administration set from the extension set. Turbulent flush the VAD as per agency protocol. Attached new IV administratoin set (primed with 0.9% NS) and keep IV line open with 0.9% saline.	Do not allow blood in tubing to be transfused. IV access is necessary in the event emergency medications are needed.
3. Complete assessment including vitals signs, respiratory assessment, and which parts of the body are affected (i.e., hives or rash).	Assessment findings may inform the type and severity of reaction. Provide supportive measures as required (oxygen, etc.).
4. Report symptoms to prescriber for medical assessment, identification of type of reaction, and instructions for treatment.	The prescriber responsible for the patient must be informed of all transfusion reactions. Treat signs and symptoms as ordered.
5. Frequent monitoring. Check vital signs every 15 minutes until stable.	Frequent assessment helps to determine improved or worsening condition.

6. Check all labels, tags, forms, blood order, and patient's identification band to determine if there is a clerical discrepancy.	Clerical errors account for the majority of blood transfusion reactions.
7. Notify the TMS / lab to report the reaction and steps taken. Document as per agency policy.	Notify TMS when any adverse reaction occurs, even if transfusion is continued.
7a. Allergic transfusion reactions (except anaphylaxis): TMS will determine need for further bloodwork.	Transfusion may be resumed if: • Physician order to do so; AND • Transfusionist confirms ID with blood product tag and label as correct; AND • Vigilant monitoring by transfusionist is possible; AND • Product can be reasonably infused within 4 hours of issuance from TMS.
7b. All other transfusion reactions including anaphylaxis: monitor renal function / fluid balance, vital signs. Document as per agency policy. Anticipate need for blood work. Collect urinalysis and microscopic urinalysis on first voided sample. Send to lab. If sepsis suspected: obtain blood cultures. Return blood bag with sterile capped tubing attached with completed reaction report form in a biohazard bag.	Blood and urine samples can help identify the type of blood transfusion reaction. All blood products and IV tubing are investigated by the transfusion services and reported to Canadian Blood Services and Public Health Agency of Canada. These professional bodies are responsible for reporting and recording incidents of reactions.
8. Document as per agency policy.	Document time, date, signs and symptoms, type of product, notification to the physician and management of reaction, and patient response to management of reaction. Documentation includes, but is not limited to: • Transfusion reaction form • Patient chart • Report for transfusion services (blood bank) • Patient Safety Learning System (PSLS) report

Data Sources: Alberta Health Services, 2015a, 2015b; Canadian Blood Services, 2017; Interior Health, 2018;

Critical Thinking Exercises

1. How long can blood or blood products be at room air temperature before being considered at risk for infusion?
2. You are about to initiate an infusion of packed red blood cells. What patient teaching is important to include about possible signs and symptoms of reaction?

Attributions

Figure 8.31. Red Blood Cells from BCIT is used under a CC BY-SA 4.0 international license.

Figure 8.32 Blood Product Example by author is licensed under a CC BY-SA 4.0 international license.

8.12 Parenteral Nutrition (PN)

Parenteral nutrition (PN) is a form of nutritional support given intravenously. PN includes proteins, carbohydrates, fats, vitamins, and minerals. It aims to prevent and restore nutritional deficits, allowing bowel rest while supplying adequate caloric intake and essential nutrients, and removing antigenic mucosal stimuli (Perry et al., 2018; Triantafillidis & Papalois, 2014). PN may be short-term or long-term nutritional therapy, and it may be administered in hospital or even at home following extensive patient education. The caloric requirements of each patient are individualized according to the degree of stress, organ failure, and percentage of ideal body weight. PN may be administered as peripheral parenteral nutrition (PPN) or via a central line, depending on the components and osmolality. Central veins are the veins of choice because there is less risk of thrombophlebitis and vessel damage (Chowdary & Reddy, 2010). According to Chowdary & Reddy (2010), candidates for PN are:

- Patients with paralyzed or nonfunctional GI tract, or conditions that require bowel rest, such as small bowel obstruction, ulcerative colitis, or pancreatitis
- Patients who have had nothing by mouth (NPO) for seven days or longer
- Critically ill patients
- Babies with an immature gastrointestinal system or congenital malformations
- Patients with chronic or extreme malnutrition, or chronic diarrhea or vomiting with a need for surgery or chemotherapy
- Patients in hyperbolic states, such as burns, sepsis, or trauma

PN is made up of two components: amino acid/dextrose solution and a lipid emulsion solution (see Figure 8.33). The ratios are determined by the dietitian in consultation with the physician and vary depending on the patient's metabolic needs, clinical history, and blood work. Medications can be added depending on compatibility (for example heparin and insulin are common additives). The solutions are available premixed by the manufacturer. Orders are reviewed daily to ensure the patient receives the solution best suited to their changing needs. The specific mixture, strength, volumes, and any additives must be confirmed by the health care provider every time a new bag is hung.

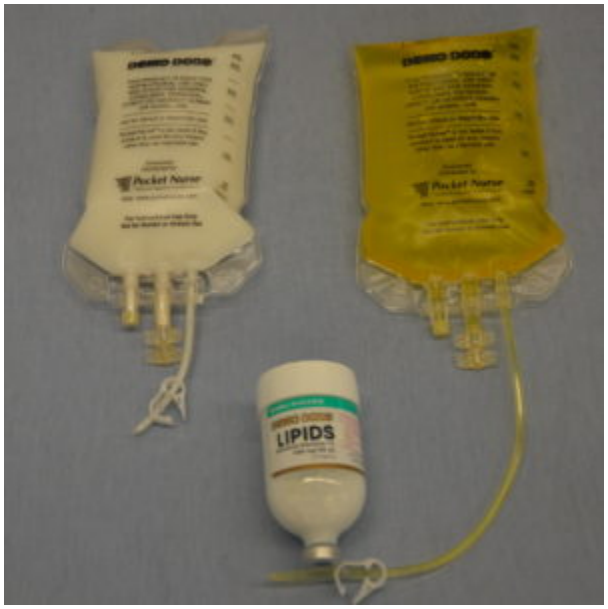


Figure 8.33 Types of PN (amino acids and lipids)

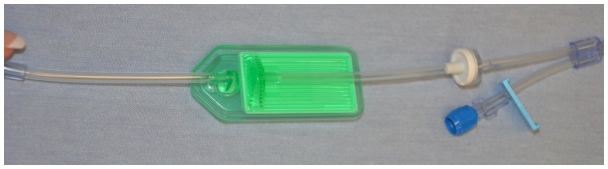


Figure 8.34 PN tubing with special filter

PN is not compatible with other IV solutions, nor is it compatible with many medications. As such, PN should have a dedicated IV line. PN must be administered using an EID (IV pump), and requires special IV filter tubing (see Figure 8.34) for the amino acids and lipid emulsion to reduce the risk of particles entering the patient. Agency policy may allow amino acids and lipid emulsions to be infused together above the filters. PN tubing will not have any access ports and must be changed according to agency policy (usually every 24 hours). Always review agency policy on setup and equipment required to infuse PN.

A prescriber may order a total fluid intake (TFI) for the amount of fluid to be infused per hour to prevent fluid overload in patients receiving PN. It is important to keep track of all the fluids infusing (IV fluids, IV medications, and PN) in order to determine intake and anticipate risk of fluid overload (Perry et al., 2018). Do not abruptly discontinue PN (especially in patients who are on insulin) because this may lead to hypoglycemia. If, for whatever reason, the PN solution runs out while awaiting another bag, hang D5W at the same rate of infusion while waiting for the new PN bag to arrive (North York General Hospital, 2013). Do not obtain blood samples or central venous

pressure readings from the same port as PN infusions. To prevent severe electrolyte and other metabolic abnormalities, the infusion rate of PN should be increased gradually, starting at a rate of no more than 50% of the energy requirements (Mehanna, Nankivell, Moledina, & Travis, 2009). Likewise when discontinuing PN, the prescriber might order it to be "weaned" or the rate reduced slowly to prevent hypoglycemia.

Complications Related to PN

There are many complications related to the administration of PN (Perry et al., 2018). Because PN is administered primarily via a CVC, complications associated with CVADs must be considered. See table Table 8.3 Potential Systemic Complications of IV Therapy and Table 8.4 Potential Complications Associated Specifically with CVADs.

Table 8.13 lists PN specific potential complications, rationale, and interventions.

Table 8.13 PN Specific Potential Complications, Rationale, and Interventions

Complication	*Rationale and Interventions*
Catheter-related bloodstream infection (CR-BSI), also known as sepsis	There's an increased risk of CR-BSI with PN, due to the high dextrose concentration of PN. Symptoms include tachycardia, hypotension, elevated or decreased temperature, increased breathing, decreased urine output, and disorientation. Interventions: Strict adherence to aseptic technique with insertion, care, and maintenance; avoid hyperglycemia to prevent infection complications; closely monitor vital signs and temperature. IV antibiotic therapy is required. Monitor white blood cell count and patient for malaise. Replace IV tubing as per agency policy (usually every 24 hours).
Hyperglycemia	Related to sudden increase in glucose after recent malnourished state. After starvation, glucose intake suppresses gluconeogenesis by leading to the release of insulin and the suppression of glycogen. Excessive glucose may lead to hyperglycemia, with osmotic diuresis, dehydration, metabolic acidosis, and ketoacidosis. Excess glucose also leads to lipogenesis (again caused by insulin stimulation). This may cause fatty liver, increased CO_2 production, hypercapnea, and respiratory failure. Interventions: Monitor blood sugar frequently QID (four times per day), then less frequently when blood sugars are stable. Follow agency policy for glucose monitoring with PN. Be alert to changes in dextrose levels in amino acids and the addition/removal of insulin to PN solution.
Refeeding syndrome	**Refeeding syndrome** is caused by rapid refeeding after a period of malnutrition. It can result in metabolic and hormonal changes, and it is characterized by electrolyte shifts (decreased phosphate, magnesium, and potassium in serum levels) that may lead to widespread cellular dysfunction. Phosphorus, potassium, magnesium, glucose, vitamin, sodium, nitrogen, and fluid imbalances can be life-threatening. High-risk patients include the chronically undernourished and those with little intake for more than 10 days. Patients with dysphagia are at higher risk. The syndrome usually occurs 24 to 48 hours after refeeding has started. The shift of water, glucose, potassium, phosphate, and magnesium back into the cells may lead to muscle weakness, respiratory failure, paralysis, coma, cranial nerve palsies, and rebound hypoglycemia. Interventions: PN infusion rate should be based on the severity of undernourishment for moderate- to high-risk patients. PN should be initiated slowly and titrated up for four to seven days. All patients require close monitoring of electrolytes (daily for one week, then usually three times/week). Always follow agency policy. Blood work may be more frequent depending on the severity of the malnourishment.

Data sources: Chowdary & Reddy, 2010; Mehanna et al., 2009; O'Connor et al., 2013; Perry et al., 2018

Agencies should have a PN protocol to follow for blood work and other monitoring. Common blood work includes CBC (complete blood count), electrolytes (with special attention to magnesium, potassium, and phosphate), liver enzymes (total and direct bilirubin, alanine aminotransferase [ALT], aspartate aminotransferase [AST], alkaline phosphatase [ALP], gamma-glutamyl transferase [GGT], total protein, albumin), and renal function tests (creatinine and urea). It is important to compare daily values to baseline values, and investigate and report any rapid changes in any values (Chowdary & Reddy, 2010; Perry et al., 2018). Table 8.14 outlines a plan of care for someone receiving PN.

Table 8.14 Plan of Care for Someone Receiving PN

Assessment	*Additional Information*
CVC/ peripheral IV line	Intravenous line should remain patent, free from infection. Dextrose in PN increases risk of infection. Assess for signs and symptoms of infections at site (redness, tenderness, discharge) and systemically (fever, increased WBC, malaise). Dressing should be dry and intact.
Daily or biweekly weights	Monitor for evidence of edema or fluid overload. Over time, measurements will reflect weight loss/gain from caloric intake or fluid retention.
Capillary or serum blood glucose levels	QID (4 times a day) capillary blood glucose initially to monitor glycemic control, then reduce monitoring when blood sugars are stable or as per agency policy. May be done more frequently if glycemic control is difficult. Indicates metabolic tolerance to dextrose in PN solution and patient's glycemic status.
Monitor intake and output	Monitor and record every eight hours or as per agency policy. Monitor for signs and symptoms of fluid overload (excessive weight gain) by completing a cardiovascular and respiratory assessment. Assess intakes such as IV (intravenous fluids), PO (oral intake), NG (nasogastric tube feeds). Assess outputs: NG (removed gastric content through the nasogastic tube), fistula drainage, BM (liquid bowel movements), colostomy/ileostomy drainage, closed suction drainage devices (Penrose or Jackson-Pratt drainage) and chest tube drainage.
Daily to weekly blood work	Review lab values for increases and decreases out of normal range. Lab values include CBC, electrolytes, calcium, magnesium, phosphorus, potassium, glucose, albumin, BUN (blood urea nitrogen), creatinine, triglycerides, and transferrin.
Mouth care	Most patients will be NPO. Proper oral care is required as per agency policy. Some patients may have a diet order.
Vital signs	Vital signs are more frequently monitored initially in patients with PN.
Data sources: BCIT, 2015a; Perry et al., 2018	

Generally, patients receiving PN are quite ill and may require a lengthy stay in the hospital. The administration of PN must follow strict adherence to aseptic technique, and includes being alert for complications, as many of the patients will have altered defence mechanisms and complex conditions (Perry et al., 2018). To administer PN, follow the steps in Checklist 78.

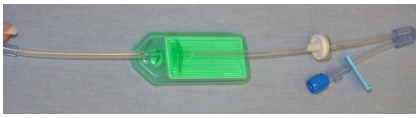
Checklist 78: PN Administration

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Compare the patient's baseline vital signs; electrolyte, glucose, and triglyceride levels; weight; and fluid intake and output with treatment values; and investigate any rapid change in such values.
- To identify signs of infection early, be aware of the patient's recent temperature range.
- Use strict aseptic technique when caring for central venous catheters and PICC lines.
- Do not use PN solution if it has coalesced, as evidenced by formation of a thick, dense layer of fat droplets on its surface. If the solution appears abnormal in any way, request a replacement from the pharmacy.
- Never try to catch up a delayed infusion.

Steps	*Additional Information*
1. Perform hand hygiene. Review prescribers' orders and compare to content label on PN solution bag(s) and for rate of infusion. Each component of the PN solution must be verified with the physician's orders.	Check date and time of last PN tubing change, lab values, and expiry date of PN to prevent medication error. Assess CVC, WBC, and patient for malaise. Medications may be added to the PN. Ensure the rate of infusion is verified in the doctor's order each time new PN bag is initiated.

2. Collect supplies, prepare PN solution, and prime IV tubing with filter as per agency protocol. PN requires special IV tubing with a filter.	Generally, new PN tubing is required every 24 hours to prevent catheter-related bacteremia. Follow agency policy. Ensure tubing is primed correctly to prevent air embolism.  *TPN tubing with special filter*
3. Perform hand hygiene, identify yourself, and identify patient using two patient identifiers. Compare the label on the PN bag to the patient's wristband. Explain the procedure to the patient.	Hand hygiene prevents the spread of microorganisms. Proper identification prevents patient errors.  *Compare MAR to patient wristband*
4. Complete all safety checks for CVC as per agency policy.	This adheres to safety policies related to central line care.
5. Complete the flushing protocol as per agency policy. When changing tubing, sanitize connections and change IV tubing as per agency policy.	Ensure patency of all CVCs by completing flushing protocols. Change PN IV tubing as per agency policy. High dextrose solutions increase risk of developing infections.
6. Insert new PN solution and IV tubing into EID.	EID must be used with all PN administration.
7. Start PN infusion rate as ordered.	Prevents medication errors.
8. Discard old supplies as per agency protocol, and perform hand hygiene.	These steps prevent the spread of microorganisms.
9. Monitor for signs and symptoms of complications related to PN.	See Table 8.13 for list of complications related to PN.

10. Complete necessary assessments as per agency guidelines and nursing judgement.	This will include flushing protocols, PN specific potential complications, possible complications related to IV meds (Table 7.10), Potential local complications of IV therapy (Table 8.1), Potential systemic complications of IV therapy (Table 8.3), Potential complications associated specifically with CVADs (Table 8.4) and others.
11. Document the procedure in the patient chart as per agency policy.	Note time when PN bag is hung, number of bags, and rate of infusion, assessment of CVC site and verification of patency, status of dressing, vital signs and weight, client tolerance to PN, client response to therapy, and understanding of instructions.
Data sources: North York General Hospital, 2013; Perry et al., 2018	

Critical Thinking Exercises

1. Describe refeeding syndrome and state one method to reduce the risk of refeeding syndrome.
2. A patient receiving PN for the past 48 hours has developed malaise and hypotension. What potential complication are these signs and symptoms related to?

Attributions

Figure 8.33 Types of PN from BCIT is used under a CC BY-SA 4.0 international license.

Figure 8.34 PN tubing from BCIT is used under a CC BY-SA 4.0 international license.

8.13 Summary

Infusion therapy is a common treatment in the hospital setting, and vital for patient recovery. The safe management of IV equipment and procedures related to IV therapy is an essential skill for safe patient care. This chapter reviewed the skills necessary to care for a patient receiving IV therapy, and the benefits and complications related to peripheral intravenous therapy, central venous catheters, blood and blood products, and PN.

Key Takeaways

- Use strict aseptic technique when preparing and maintaining all IV solutions and equipment. Most complications related to IV therapy can be prevented.
- Be alert and vigilant, and assess for complications as per agency policy.
- Keep up to date with recommendations for safe care with IV therapy from the Centers for Disease Control and Canadian Patient Safety Institute.
- There are many types of equipment and procedures related to IV therapy. Educate yourself on the various types of equipment and devices to care for your patient safely.
- Receive the appropriate training for initiating IVs, CVC care and maintenance, and blood and blood product transfusions.
- Remember that patients on IV therapy are at an increased risk for fluid overload. These patients include the elderly, young, and those with cardiac and/or renal disease.
- Follow all transfusion policies to avoid transfusion errors. Be alert to the potential complications of blood and blood product transfusions.
- Complete all daily assessments related to a patient receiving PN. These patients are generally quite ill and have a diminished ability to tolerate complications.

Suggested Online Resources

1. Canadian Blood Services: Clinical Guide to Transfusion. These educational materials provide guidelines for the care of patients receiving blood or blood products. This information includes blood administration, adverse reactions, blood components, emergency transfusions, pediatric and neonatal transfusions, and more.

2. Drug Calculations. This medication calculation website reviews how to calculate the dosages for parenteral and non-parenteral medications, and IV fluids. It also includes metric conversions and IV drop rate calculations.

3. Fraser Health: Central Venous Catheters in Adult Patients. This self-learning online module is designed for health care professionals and covers central venous catheter (CVC) care and maintenance.

4. Fraser Health: Peripheral Intravenous Initiation. This self-study online module covers initiating intravenous (IV) therapy.

5. Intravenous Fluid Selection. This sample chapter from a textbook describes the selection of IV fluids and solutions, and includes study questions as well.

6. Nursing Made Incredibly Easy: The Nurse's Quick Guide to IV Drug Calculations. This article provides a simple and concise way to perform accurate IV drug calculations.

References

Alberta Health Services. (2015a). *Transfusion of blood and blood components*. Retrieved from https://extranet.ahsnet.ca/teams/policydocuments/1/clp-prov-transfusion-blood-product-policy-ps-59.pdf.

Alberta Health Services. (2015b) (2017) . *Transfusion of blood and blood components—Acute adult*. Retrieved from https://extranet.ahsnet.ca/teams/policydocuments/1/clp-prov-transfusion-blood-product-adult-acute-procedure-ps-59-01.pdf.

Baskin, J. L., Pui, C. H., Reiss, U., Wilimas, J. A., Metzger, L. M., Ribeiro, R. C., & Howard, S. C. (2009). Management of occlusion and thrombosis associated with long-term indwelling central venous catheters. *Lancet*, 374(9684), 159. doi: 10.1016/S0140-6736(09)60220-8.

British Columbia College of Nursing Professionals (BCCNP). (2018). *Scope of practice for registered nurses*. Retrieved from https://www.crnbc.ca/Standards/Lists/StandardResources/433ScopeforRegisteredNurses.pdf.

British Columbia Institute of Technology (BCIT). (2015a). CVC complications worksheet. In, *NURS 3020. BCIT BSN program*. Vancouver, BC: BCIT.

British Columbia Institute of Technology (BCIT). (2015b). Checklist: IV tubing administration set and IV solution change. In, *NURS 2020. BCIT BSN program*. Vancouver, BC: BCIT.

Brunce, M. (2003). Troubleshooting central lines. *ModernMedicine Network*. Retrieved from http://www.modernmedicine.com/modern-medicine/content/troubleshooting-central-lines.

Canadian Blood Services (2017a). *Blood administration*. Retrieved

from https://professionaleducation.blood.ca/en/transfusion/clinical-guide/blood-administration.

Canadian Blood Services. (2017b). *Clinical guide to transfusions. Adverse reactions*. Retrieved from https://professionaleducation.blood.ca/en/transfusion/clinical-guide/adverse-reactions.

Canadian Blood Services. (2017c). *Clinical guide to transfusions. Blood components*. Retrieved from https://professionaleducation.blood.ca/en/transfusion/clinical-guide/blood-components.

Center for Disease Control (2017). *Guidelines for the prevention of intravascular catheter-related infections: Summary of recommendations*. Retrieved from https://www.cdc.gov/infectioncontrol/guidelines/bsi/recommendations.html.

Chowdary, K. V. R., & Reddy, P. N. (2010). Parenteral nutrition: Revisited. *Indian Journal of Anaethestic*, 54(2), 95-103. doi: 10.4103/0019-5049.63637.

Crawford, A., & Harris, H. (2011). IV fluids: What nurses need to know. *Nursing* 2018, 41(5), 30-38. Retrieved from http://journals.lww.com/nursing/Fulltext/2011/05000/I_V__fluids_What_nurses_need_to_know.10.aspx?WT.mc_id=HPxADx20100319xMP.

Earhart, A. (2013). Central lines: Recognizing, preventing, and troubleshooting complications. American Nurse Today, 8(11). https://www.americannursetoday.com/central-lines-recognizingpreventing-and-troubleshooting-complications/

Ferroni, A., Gaudin, F., Guiffant, G., Flauad, P., Durussel, J., Descamps, P., … Merckx, J. (2014). Pulsative flushing as a strategy to prevent bacterial colonization of vascular access devices. *Medical Devices* (AUCKL), 7, 379-383. https://doi.org/10.2147/MDER.S71217

Fraser Health Authority. (2014). *Clinical practice guidelines: Intravenous therapy*. Retrieved from http://physicians.fraserhealth.ca/media/2014%2005%2015%20IV%20Therapy%20CPG%20FINAL.pdf.

Fraser Health Authority. (2007). *Central venous catheters in adult patients. A self-learning module*. Retrieved from https://www.fraserhealth.ca/media/CentralVenousCatheters.pdf.

Fulcher, E. M., & Frazier, M. S. (2007). *Introduction to intravenous therapy for health professionals*. St. Louis, MO: Elsevier.

Goossens, G. (2015). Flushing and locking of venous catheters: Available evidence and evidence deficit [article ID 985686]. *Nursing Research and Practice*, 2015, 1-12. http://dx.doi.org/10.1155/2015/985686.

Gorski, L., Hadaway, L. Hagle, M. E., McGoldrick, M., Orr, M., & Doellman, D. (2016). Infusion

therapy standards of practice. *Journal of Infusion Nursing*, 39(1S). Retrieved from http://source.yiboshi.com/20170417/1492425631944540325.pdf.

Gorski, L., Hallock, D., Kuehn, S., Morris, P., Russell, J., & Skala, L. (2012). *INSposition paper: Recommendations for frequency of assessment of the short peripheral catheter site*. Retrieved from https://e58f7f8fa122555ac87a-8a1d6df4618501341882ba7daeabdf40.ssl.cf2.rackcdn.com/ins_913b61c0470f3e329882c67480b6fb4f.pdf.

Ho, C. & Spry, C. (2017). Central venous access devices (CVADs) and peripherally inserted central catheters (PICCs) for adult and pediatric patients: A review of clinical effectiveness and safety. *Canadian Agency for Drugs and Technologies in Health*. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK470804/.

Infusion Nurses Society. (2011). Infusion nursing standards of practice. *Journal of Infusion Nursing*, 34(1S). Retrieved from http://piccteam.se/onewebmedia/DownloadDocumentFile.pdf.

Infusion Nurses Society. (2012). INS position paper: Recommendations for frequency of assessment of the short peripheral catheter site. *Journal of Infusion Nursing*, 35(5), 290 -292. https://doi.org/10.1097/NAN.0b013e318267f636.

Interior Health. (2012). *Parenteral practices manual*. Retrieved from http://insidenet.interiorhealth.ca/Clinical/parenteralccr/Pages/Manual.aspx.

Interior Health. (2018). *Transfusion practices manual*. Retrieved from http://insidenet.interiorhealth.ca/Clinical/transfusionccr/Pages/manual.aspx.

McCallum L., & Higgins, D. (2012). Care of peripheral venous cannula sites. *Nursing Times*, 108(34-35), 12-15.

Mehanna, H., Nankivell, P. C., Moledina, J., & Travis, J. (2009). Refeeding syndrome — awareness, prevention and management. *Head and Neck Oncology*, 1(4). https://doi.org/10.1186/1758-3284-1-4.

North York General Hospital. (2013). *Care of the patient receiving total parenteral nutrition* (TPN). Retrieved from http://www.nygh.on.ca/cernercbt/files%5CCONTENT_Day_2%5CTPN%202013%5CTPN%20learning%20pkg%20revised%20July%202013.pdf.

O'Connor, A., Hanly, A. M., Francis, E., Keane, N., & McNamara, D. (2013). Catheter associated blood stream infections in patient receiving parenteral nutrition: A prospective study of 850 patients. *Journal of Clinical Medical Research*, 5(1),18-21. https://dx.doi.org/10.4021%2Fjocmr1032w.

Perry, A. G., Potter, P. A., & Ostendorf, W. R. (2018). *Clinical nursing skills and techniques* (9th ed). St. Louis, MO: Elsevier-Mosby.

Phillips, L. D. (2005). *Manual of IV therapies*. Philadelphia, PA: F.A. Davis Company.

Prabaharan, B., & Thomas, S. (2014). Spontaneous migration of central venous catheter tip following extubation. *Saudi Journal of Anaesthesia*, 8(1), 131–133. doi: 10.4103/1658-354X.125975.

Registered Nurses' Association of Ontario (RNAO). (2005) N*ursing best practice guideline: Care and maintenance to reduce vascular access complications* [Revised 2008 supplement]. Retrieved from http://rnao.ca/sites/rnao-ca/files/Care_and_Maintenance_to_Reduce_Vascular_Access_Complications.pdf.

Rosenthal, K. (2007). Bridging the I.V. access gap with midline catheters. N*ursing Made Incredibly Easy*, pp.18-20. Retrieved from https://www.rch.org.au/uploadedFiles/Main/Content/anaes/bridging_the_IV_access_gap_with_midline_catheters.pdf.

Royal Children's Hospital Melbourne (RCH). (n.d.). *Peripheral intravenous (IV) device management*. Retrieved from https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Peripheral_Intravenous_IV_Device_Management/.

Safer Healthcare Now. (2012). *Interventions*. Retrieved from http://www.patientsafetyinstitute.ca/en/toolsResources/pages/interventions-default.aspx.

Singh, A., Kaur, A., Singh, M., & Kaur, S. (2015). CT guided removal of iatrogenic foreign body: a broken intravenous cannula. *Journal of Clinical & Diagnostic Research*, 9(9), PD28-PD29. https://dx.doi.org/10.7860%2FJCDR%2F2015%2F14344.6549.

Triantafillidis, J. K., & Papalois, A. E. (2014). The role of total parenteral nutrition in inflammatory bowel disease: Current aspects. *Scandinavian Journal of Gastroenterology*, 49(1), 3-14. https://doi.org/10.3109/00365521.2013.860557.

Vancouver Coastal Health. (2008). *Administration of blood components and blood products*. Vancouver, BC: Vancouver Health Authority.

Vancouver Coastal Heath. (2012). *Saline locks: Care and maintenance*. Vancouver, BC: Vancouver Health Authority.

Waitt, C., Waitt, P., & Pirmohamed, M. (2004). Intravenous therapy. *Postgraduate Medicine*, 80(939), 1-6. http://dx.doi.org/10.1136/pmj.2003.010421.

CHAPTER 9. BLOOD GLUCOSE MONITORING

9.1 Introduction

Blood glucose monitoring allows people with diabetes to monitor their blood glucose levels and manage their condition accordingly.

Types of Diabetes

Type 1 diabetes usually develops in childhood or adolescence and used to be called juvenile-onset diabetes. It occurs when the beta cells of the pancreas are destroyed by the immune system and no longer produce insulin, or produce very little insulin. People with this form of diabetes need injections of insulin every day in order to control the levels of glucose in their blood. If they do not have access to insulin, they will die. There is no known way to prevent type 1 diabetes.

Type 2 diabetes used to be called non-insulin-dependent diabetes or adult-onset diabetes. It accounts for at least 90% of all cases of diabetes and can occur at any age. With type 2 diabetes, the body does not make enough insulin or does not respond well to the insulin it makes. Either or both of these characteristics—relative insulin deficiency and insulin resistance—may be present at the time diabetes is diagnosed.

Type 2 diabetes may remain undetected for many years, and the diagnosis is often made when a complication appears or a routine blood or urine glucose test is done. It is often, but not always, associated with being overweight or obese, which itself can cause insulin resistance and lead to high blood glucose levels. People with type 2 diabetes can often initially manage their condition through exercise and diet. However, over time most people will require oral drugs and/or insulin.

Gestational diabetes is a form of diabetes that develops in women during pregnancy and disappears after delivery. Gestational diabetes affects about 4% of all pregnancies and increases the risk of developing type 2 diabetes.

Other specific types of diabetes also exist, and more information can be found at the Diabetes Canada website.

Managing Diabetes

One element of diabetes management includes regular monitoring of blood glucose levels. To

measure blood glucose levels, blood is obtained through a skin puncture using a specified needle system, which is less painful and invasive than venipuncture. The ease of this skin puncture method makes it possible for patients to perform this procedure themselves.

In the hospital setting, a blood glucose machine (glucometer) is used to provide an accurate blood glucose level in less than a minute using a reagent strip with a drop of blood dropped or wicked onto a new, dry, specifically indicated portion of the reagent strip. These machines must be regularly calibrated according to agency policy, and each machine should be cleaned between use on different patients.

Ensure that you read and understand the manufacturer's instructions and your agency policy for the blood glucose monitoring machines used in your clinical setting.

Learning Outcomes

- State the normal ranges for blood glucose levels in Canadian (SI) values.
- Demonstrate the safe use of a glucometer (quality control check, cleaning, glucose testing).
- Identify signs and symptoms of hypoglycemia and hyperglycemia.
- Discuss the management of hypoglycemia using a hypoglycemic protocol.

9.2 Glucometer Use

People with diabetes require regular monitoring of their blood glucose to help them achieve as close to normal blood glucose levels as possible for as much of the time as possible. The benefits of maintaining a blood glucose level that is consistently within the range of 4 to 7 mmol/L will reduce the short-term, potentially life-threatening complications of hypoglycemia as well as the occurrence rate and severity of the long-term complications of hyperglycemia (Canadian Diabetes Association, 2018).

Patients in the acute care settings are likely to have inconsistent blood glucose levels, as they are affected by changes in diet and lifestyle, surgical procedures, the stress of being in a hospital and the stress of an acute illness. The prescriber will often prescribe the frequency of blood glucose monitoring, and sometimes this is left to the nurse's discretion. In acute situations, a sliding-scale for insulin will be prescribed. The sliding scale provides direction for the type and dose of insulin in response to specific blood glucose readings.

At home, the frequency of blood glucose monitoring will depend on many factors including the type of diabetes, the type of antidiabetic medication, changes to medications, adequacy of glycemic control, literacy and numeracy skills, patterns of hypoglycemia, awareness and recognition of hypoglycemic symptoms, occupational requirements, and acute illness (Canadian Diabetes Association, 2018). The diabetes educator and/or prescriber may suggest frequency of blood glucose monitoring.

In hospital, it is usually the responsibility of the nurse to perform blood glucose readings. As with any clinical procedure, ensure that you understand the patient's condition, the reason for the test, and the possible outcomes of the procedure. Prior to performing a blood glucose test, ensure that you have read and understood the manufacturer's instructions and your agency's policy for the blood glucose monitoring machines used in your clinical setting, as these vary. It is also important that you determine the patient's understanding of the procedure and the purpose for monitoring blood glucose level. Before you begin, you should also determine if there are any conditions present that could affect the reading. For example, is the patient fasting? Has the patient just had a meal? Is the patient on any medications that could affect the reading? In these situations, draw on your knowledge and understanding of diabetes, the medication you are administering, the uniqueness of your patient, and the clinical context. Use your knowledge and critical thinking to make a clinical judgment.

Figure 9.1 Blood glucose monitoring

Inspect the area of skin that will be used as the puncture site, and ask the patient if they are in agreement with the site you have identified to use for the skin puncture. Your patient may have a preference for the puncture site. For example, some patients prefer not to use a specific finger for the skin puncture. Or a particular site may be contraindicated. For example, you shouldn't use the hand on the same side as a mastectomy.

Patients who do their own blood glucose testing at home may prefer to handle the skin-puncturing device themselves and continue self-testing while they are in the hospital.

Checklist 79 outlines the steps for taking a skin-puncture blood sample and using a blood glucose monitor (glucometer) to measure a patient's blood glucose level.

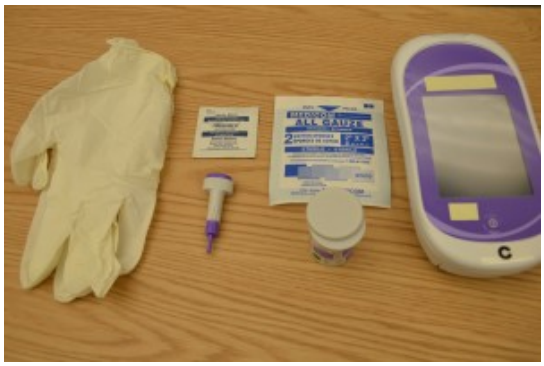
Checklist 79: Blood Glucose Monitoring

Disclaimer: Always review and follow your agency policy regarding this specific skill.

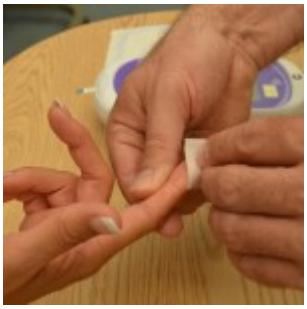
Safety considerations:

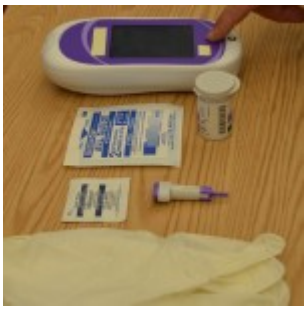
- Perform hand hygiene.
- Check room for additional precautions.
- Perform point of care risk assessment for PPE.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Complete necessary focused assessments and/or vital signs and document on MAR.
- Provide patient education as necessary.

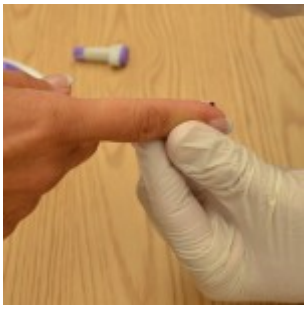
Steps	*Additional Information*
1. Review the patient's medical history for diabetes type, medications, and/or anticoagulant therapy.	A thorough knowledge of the patient's medical history is important even when the test performed is a relatively simple procedure. Anticoagulant therapy may result in prolonged bleeding at the skin-puncture site and require pressure to the site.

2. Determine if the test requires special timing; for example, before or after meals. Blood glucose monitoring is usually done prior to meals and the administration of antidiabetic medications.	Blood glucose levels are affected by diet, and the test may be scheduled at very specific intervals. Diet and medication orders are based on the assumption that the test results are accurate.
3. Gather equipment needed: • Non sterile disposable gloves • Face cloth and warm water, or alcohol swab • Lancet or automatic lancing device • 2 × 2 gauze • Reagent strips • Blood glucose meter	Having equipment prepared and available promotes organization, safety, and timeliness. Check your agency guidelines about the use of alcohol or soap and warm water to clean puncture site prior to puncture. Alcohol use on the skin over time may cause the skin to dry out and become more fragile.  *Gloves, lancet, gauze, reagent strips, glucometer*
4. Determine if blood glucose meter needs to be calibrated.	Calibration / quality control checks should be done regularly according to agency policy to ensure accuracy of readings.

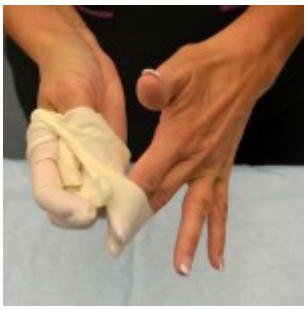
5. Assess patient's sites for skin puncture.	Skin that is intact at the puncture site minimizes the risk of infection and promotes healing. Usually fingers are used for glucose testing.
6. Perform hand hygiene.	Hand hygiene prevents the transfer of microorganisms.

7. Have patient wash hands with soap and warm water, and position the patient comfortably in a semi-upright position in bed or upright in a chair. Encourage patient to keep hands warm. Hospital policy may require use of an alcohol swab only, not water, to clean the puncture site. Ensure that puncture site is completely dry prior to skin puncture.	Washing reduces transmission of microorganisms and increases blood flow to the puncture site.  *Have patient wash hands with warm water*  *Or clean with an alcohol swab if that is agency policy*
8. Remove a reagent strip from the container and reseal the container cap. Do not touch the test pad portion of the reagent strip.	Tight closure of the container keeps strips from damage due to environmental factors.  *Remove reagent strip from container and close container tightly*

9. Follow the manufacturer's instructions to prepare the meter for measurement.	This prepares meter for accurate readings.  *Prepare the glucometer*
10. Place the unused reagent strip in the glucometer or on a clean, dry surface (e.g., paper towel) with the test pad facing up. This step is dependent on the manufacturer's instructions.	 *Prepare the reagent strip according to the manufacturer's instructions* Moisture may alter the test results.
11. Apply non-sterile gloves.	 *Apply non-sterile gloves* Gloves protect health care provider from BBF exposure.

12. Keep area to be punctured in a dependent position. Do not milk or massage finger site.	The finger in a dependent position will increase blood flow to the area. Milking or massaging the finger may introduce excess tissue fluid and hemolyze the specimen.
13. Select appropriate puncture site and perform skin puncture.	Your patient may have a preference of site used. For example, the patient may prefer not to use a specific finger for the skin puncture. Avoid fingertip pads; use sides of finger.  *Perform skin puncture using a lancet*
14. Gently squeeze above the site to produce a large droplet of blood.	Do not contaminate the site by touching it. The droplet of blood needs to be large enough to cover the test pad on the reagent strip.  *Gently squeeze site to produce a large droplet of blood*

15. Transfer the first drop of blood (or second drop depending on the manufacturer's instructions) to the reagent strip and apply following the manufacturer's instructions.	The test pad must absorb the droplet of blood for accurate results. Smearing the blood will alter results.  *The test pad must absorb the droplet of blood for accurate results* The timing and specific instructions for measurement will vary between blood glucose meters. Be sure to read the instructions carefully to ensure accurate readings.
16. Immediately press the timer on the meter (unless it starts automatically with insertion of reagent strip).	Timing is critical to produce accurate results. Always check the manufacturer's instructions because the technique varies between meters.
17. Apply pressure, or ask patient to apply pressure, to the puncture site using a 2 × 2 gauze pad or clean tissue.	 *Apply pressure to the puncture site* This will stop the bleeding at the site.

18. Read the results on the unit display.	Each meter has a specified time for the reading to occur.  *Read the blood glucose results on the glucometer*
19. Turn off the meter and dispose of the test strip, 2 × 2 gauze, and lancet according to agency policy.	This reduces contamination by blood to other individuals.
20. Remove non-sterile gloves and place them in the appropriate receptacle.	This reduces transmission of microorganisms.  *Remove non-sterile gloves*

21. Perform hand hygiene.	This reduces the transmission of microorganisms.
22. Review test results with the patient.	This promotes patient participation in health care.
23. Document results according to agency policy.	Results will be used to determine the patient's treatment plan.
Data source: Accu-Chek, n.d.; BCIT, 2015; Hortensius et al., 2011; Kaiser Permanente, n.d.; Pagana & Pagana, 2011; Perry et al., 2018; VCH & PHC Professional Practice, 2013; Weiss Behrend et al., 2004.	

Converting to Canadian (SI) Measurements

Many nursing resources are from the United States, where glucose values are reported as mg/dl. Canadian laboratories use the international system of units (SI), which are mmol/L. Therefore, you may need to convert your patient's laboratory values to SI units. For glucose, divide the mg/dl by 18 to find the comparable SI unit (e.g., 65 mg/dl = 3.61 mmol/L). This conversion chart shows specific conversions.

Blood Glucose Readings that Require Follow-up

The concerns listed in Table 9.1 *must* be attended to and reported immediately to the relevant health care provider. Please consult hospital or unit-specific recommendations for exact values. The concerns and actions in Table 9.1 are guidelines only.

Table 9.1 Blood Glucose Readings that Require Follow-up

Always follow your agency's protocols for excessively high or low blood glucose readings

Concern	*Action*
Blood sugar outside "acceptable range" (<2.2 mmol/L or >20 mmol/L)	Repeat capillary test to confirm. Initiate the agency's hypoglycemic protocol if indicated. Report if reading remains out of range. Consider evaluation of blood glucose meter.
Blood sugar <2.2 mmol/L or >20 mmol/L	Order a stat blood glucose (venous sample) by laboratory staff . Initiate hypoglycemia if indicated. Consider evaluation of blood glucose meter.
Blood sugar <4 mmol/L	Initiate hypoglycemia protocol according to agency policy.
Preoperative blood sugar <4 mmol/L or >20 mmol/L	Initiate hypoglycemic protocol. Call prescriber.
Post-operative blood sugar >13.5 mmol/L (acceptable post-operative range = 8 to 13 mmol/L)	Notify prescriber.
Data source: BCIT, 2015; Canadian Diabetes Association, 2013; Perry et al., 2018	

Critical Thinking Exercises

1. Describe two methods for increasing blood flow to a patient's finger prior to lancing the finger.
2. What is meant by sliding scale?
3. If a patient is ordered insulin by sliding scale, when is the best time to check the glucose level?

Attributions

Figure 9.1. Glucometer by Bruce Blaus (2013) is used under a Creative Commons Attribution 3.0 Unported license.

9.3 Hypoglycemia and Hyperglycemia

The overlapping symptoms of hypo- and hyperglycemia (e.g., hunger, sweating, trembling, confusion, irritability, dizziness, blurred vision) make the two conditions difficult to distinguish from one another (Pardalis, 2005). Since the treatment is different for each condition, it is critical to test the patient's blood glucose when symptoms occur. The risk factors that may have led to the condition and the recent medical history of the patient also help to determine the cause of symptoms.

Hypoglycemia

Hypoglycemia is a condition occurring in diabetic patients with a blood glucose of less than 4 mmol/L. If glucose continues to remain low and is not rectified through treatment, a change in the patient's mental status will result. Patients with hypoglycemia become confused and experience headache. Left untreated, they will progress into semi-consciousness and unconsciousness, leading rapidly to brain damage. Seizures may also occur.

Common initial symptoms of hypoglycemia include:

- Cold, clammy skin
- Weakness, faintness, tremors
- Headache, irritability, dullness
- Hunger, nausea
- Tachycardia, palpitations

These symptoms will progress to mood or behaviour changes, vision changes, slurred speech, and unsteady gait if the hypoglycemia is not properly managed.

The hospitalized patient with type 1 or type 2 diabetes is at an increased risk for developing hypoglycemia. Potential causes of hypoglycemia in a hospitalized diabetic patient include:

- Receiving insulin and some oral antidiabetic medications (e.g., glyburide)
- Fasting for tests and surgery
- Not following prescribed diabetic diet
- New medications or dose adjustments
- Missed snacks

Hypoglycemia is a medical emergency that must be treated immediately. An initial blood glucose reading may confirm suspicion of hypoglycemia. If you suspect that your patient is hypoglycemic, obtain a blood glucose level through skin puncture. A 15 g oral dose of glucose should be given to produce an increase in blood glucose of approximately 2.1 mmol/L in 20 minutes (Canadian Diabetes Association, 2013). Table 9.2 outlines an example of a protocol that may be used in the treatment of hypoglycemia.

Table 9.2 Hypoglycemia Treatment

Disclaimer: This is one example of a hypoglycemia protocol. Always follow the protocol of your agency.

Capillary Blood Gas (CBG)	*Able to Swallow*	*Patient Is Not Able to Swallow but Has **IV Access***	*Patient Is Able to Swallow but Has No IV Access*
≥ 4 mmol/L	No treatment necessary	No treatment necessary	No treatment necessary
2.2 to 3.9 mmol/L	Give 15 g of glucose in the form of: • 3 to 5 dextrose/glucose tabs (check the label) (best choice), OR • 175 ml of juice or soft drink (containing sugar), OR • 1 tablespoon of honey, OR • 3 tablespoons of table sugar dissolved in water **Note:** Milk, orange juice, and glucose gels increase blood glucose (BG) levels more slowly and are not the best choice unless the above alternatives are not available. Repeat CBG every 15 to 20 minutes and repeat above if BG remains below 4 mmol/L. Once BG reaches 4 mmol/L, give patient 6 crackers and 2 tablespoons of peanut butter. If meal is less than 30 minutes away, omit snack and give patient meal when it is available.	Notify physician. Give 10 to 25 g (20 to 50 ml) of **D50W** (dextrose 50% in water) of glucose intravenously over 1 to 3 minutes, OR as per agency policy. Repeat CBG every 15 to 20 minutes until 4 mmol/L. Continue with BG readings every 30 minutes for 2 hours.	Notify physician. Give glucagon 1 mg subcutaneously (SC) or intramuscularly (IM). Position patient on side. Repeat CBG every 15 to 20 minutes. Give second dose of glucagon 1 mg SC or IM if BG remains below 4 mmol/L.
≤ 2.2 mmol/L	Call lab for STAT BG level. Continue as above.	Call lab for STAT BG level. Continue as above.	Call lab for STAT BG level. Continue as above.

Data source: Canadian Diabetes Association, 2013; Pardalis, 2005; Rowe et al., 2015; Vancouver Coastal Health, 2009

Hyperglycemia

Hyperglycemia occurs when blood glucose values are greater than 7 mmol/L in a fasting state or greater than 10 mmol/L two hours after eating a meal (Pardalis, 2005). Hyperglycemia is a serious complication of diabetes that can result from eating too much food or simple sugar; insufficient insulin dosages; infection, illness, or surgery; and emotional stress. Surgical patients are particularly at risk for developing hyperglycemia due to the surgical stress response (Dagogo-Jack & Alberti, 2002; Mertin et al., 2007). Classic symptoms of hyperglycemia include the three Ps: polydipsia, polyuria, and polyphagia.

The common symptoms of hyperglycemia are:

- Increased urination/output (polyuria)
- Excessive thirst (polydipsia)
- Increased appetite (polyphagia), followed by lack of appetite
- Weakness, fatigue
- Headache

Other symptoms include glycosuria, nausea and vomiting, abdominal cramps, and progression to diabetic ketoacidosis (DKA).

Potential causes of hyperglycemia in a hospitalized patient include:

- Infection
- Stress
- Increased intake of calories (IV or diet)
- Decreased exercise
- New medications or dose adjustments

Note that testing blood glucose levels too soon after eating will result in higher blood glucose readings. Blood glucose levels should be taken one to two hours after eating.

If hyperglycemia is not treated, the patient is at risk for developing DKA. This is a life-threatening condition in which the body produces acids, called ketones, as a result of breaking down fat for energy. DKA occurs when insulin is extremely low and blood sugar is extremely high.

DKA presents clinically with symptoms of hyperglycemia as above, Kussmaul respiration (deep, rapid, and laboured breathing that is the result of the body attempting to blow off excess carbon dioxide to compensate for the metabolic acidosis), acetone-odoured breath, nausea, vomiting, and abdominal pain (Canadian Diabetes Association, 2013). Patients in DKA also undergo osmotic

diuresis. They pass large amounts of urine because of the high solute concentration of the blood and the body's attempts to get rid of excess sugar.

DKA is treated with the administration of fluids and electrolytes such as sodium, potassium, and chloride, as well as insulin. Be alert for vomiting and monitor cardiac rhythm. Untreated DKA can be fatal.

Patients with hyperglycemia may also exhibit a non-ketotic hyperosmolar state, also known as hyperglycemic hyperosmolar syndrome (HHS). This is a serious diabetic emergency that carries a mortality rate of 10% to 50%. Hyperosmolarity is a condition in which the blood has a high sodium and glucose concentration, causing water to move out of the cells into the bloodstream.

Further information on the treatment of DKA and HHS can be found on the Canadian Diabetes Association clinical guidelines website.

Critical Thinking Exercises

1. At 0930 hours, your diabetic patient complains of feeling faint. You check his blood sugar and get a reading of 2.8 mmol/L. What actions will you take?
2. What blood glucose level range do you expect immediately post-operatively from your patient who has type 2 diabetes? Why?

9.4 Summary

Blood glucose monitoring is an important procedure that allows people with diabetes to monitor their blood glucose level and manage their condition. Each blood glucose monitor is slightly different, and it is essential that you read and follow the manufacturer's instructions for each monitor you are using.

When working with patients with diabetes, it is also important to be able to recognize and manage patients with hypoglycemia and hyperglycemia.

Key Takeaways

- Understand the condition of diabetes and how it affects blood glucose levels.
- Always read the manufacturer's instructions for using specific blood glucose machines.
- Know how to recognize and manage patients with hypoglycemia and hyperglycemia.

Suggested Online Resources

1. Accu-Chek. (n.d.). *How to test your blood sugar*. Retrieved from https://www.accu-chek.com/management-tips/how-test-your-blood-sugar.
2. Canadian Diabetes Association: Clinical practice guidelines. Organization of diabetes care. This resource covers the prevention and management of diabetes in Canada. It was developed under the auspices of the Clinical and Scientific Section of the Canadian Diabetes Association in 2013.
3. Canadian Diabetes Association: Diabetes. This fact sheet outlines the risk factors, symptoms, treatments, and other important information for patients.
4. Canadian Diabetes Association: Diabetes Toolkit. This website provides a number of resources to provide information about many diabetes related topics.
5. Registered Nurses Association of Ontaio (RNAO): Reducing Foot Complications for People with Diabetes. This clinical guideline focuses on best practices to help practitioners reduce foot complications for patients with diabetes. The information included in this resource: how to conduct a risk assessment of foot ulcers, basic education for patients, and appropriate interventions.

References

Accu-Chek. (n.d.). *How to test your blood sugar*. Retrieved from https://www.accu-chek.com/management-tips/how-test-your-blood-sugar.

British Columbia Institute of Technology (BCIT). (2015). In, NURS 2020: *Clinical techniques*. Vancouver, BC: BCIT.

Canadian Diabetes Association. (2013). Canadian diabetes association clinical practice guidelines expert committee. Clinical practice guidelines for the prevention and management of diabetes in Canada. *Canadian Journal of Diabetes*, 37(1), S1-S212.

Canadian Diabetes Association. (2018). *Clinical practice guidelines*. Retrieved from http://guidelines.diabetes.ca/cpg/chapter9#sec2.

Dagogo-Jack, S., & Alberti, K. G. (2002). Management of diabetes mellitus in surgical patients. *Diabetes Spectrum*, 15(1), 44-48.

Hortensius, J., Slingerland, R. J., Kleefstra, N., Logtenberg, S. J. J., Groenier, K. H., Houweling, S. T., & Bilo, H. J. G. (2011). Self-monitoring of blood glucose: The use of the first or the second drop of blood. *Diabetes Care*, 34(3), 556-560.

Kaiser Permanente. (n.d.). *Living well with diabetes: How to use your blood glucose meter*. Retrieved from https://provider.ghc.org/open/caringForOurMembers/patientHealthEducation/conditionsDiseases/diabetes/bloodGlucoseMeter.pdf.

Mertin, S., Sawatzky, J., Diehl-Jones, W., & Lee, T. (2007). Roadblock to recovery: The surgical stress response. *Dynamics*, 18(1), 14-22.

Pagana, K., & Pagana, T. (2011). *Mosby's diagnostic and laboratory test reference* (10th ed.). St. Louis, MO: Mosby.

Pardalis, D. (2005). Diabetes: Treatment of hyper- and hypoglycemia. *Tech Talk CE*. Retrieved from http://www.canadianhealthcarenetwork.ca/files/2009/10/TTCE_Sept05_Eng.pdf.

Perry, A., Potter, P., & Ostendorf, W. (2014). *Clinical nursing skills and techniques* (8th ed.). St. Louis, MO: Elsevier-Mosby.

Perry, A., Potter, P., & Ostendorf, W. (2018). *Clinical nursing skills and techniques* (9th ed.). St. Louis, MO: Elsevier-Mosby.

Pickering, D., & Marsden, J. (2014). How to measure blood glucose. *Community Eye Health*, 27(87), 56-57. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4322747/.

Rowe, B. H., Singh, M., Villa-Roel, C., Leiter, L. A., Hramiak, I., Edmonds, M. L., … Campbell, S. (2015). Acute management and outcomes of patients with diabetes mellitus presenting to Canadian emergency departments with hypoglycemia. *Canadian Journal of Diabetes*, 39(1), 55-64. doi:10.1016/j.jcjd.2014.04.001.

Vancouver Coastal Health (VCH). (2009). *Hypoglycemia algorithm.* Vancouver: Vancouver Coastal Health.

VCH & PHC Professional Practice. (2013). *Capillary blood glucose monitoring using the Accu-Chek blood glucose meter.* Vancouver: Vancouver Coastal Health & Providence Health Care.

Weiss Behrend, S., Kelley, K., & Randoloph, S. (2004). Measuring blood-glucose levels. In G. Altman (Ed.), *Delmar's fundamental and advanced nursing skills* (2nd ed.). Clifton Park, NY: Thomson Delmar Learning.

CHAPTER 10. TUBES AND DEVICES

10.1 Introduction

Patients in acute care and community settings often have various tubes to assist their recovery from surgeries or procedures and to help manage medical conditions. Health care providers must understand how these tubes and devices work—their purpose, function, insertion, or removal—and how to manage them in a way that prevents complications.

Learning Outcomes

- Describe five principles related to the function of tubes and drainage systems.
- Identify four factors that affect the flow of fluid through tubes.
- Describe five general guidelines used while caring for patients with drainage systems.
- Discuss the purposes, types, special precautions, potential complications, and interventions when caring for persons with:
    - Nasogastric tubes
    - Indwelling catheters
    - Closed chest drainage systems
    - Tracheostomy tubes

10.2 Caring for Patients with Tubes and Devices

The following five principles apply to the care of drainage tubes. Knowledge of these principles should help the nurse to provide appropriate care to clients who have these kinds of tubes.

1. *Closed cavities of the body are sterile cavities.* Insertion of any tube must be performed with adherence to the principles of asepsis.
2. *A portal of entry that comes into contact with a non-sterile surface immediately becomes non-sterile.* When disconnecting drainage tubes, such as a urinary catheter or a T-tube, the ends must be kept sterile.
3. *Gravity promotes the flow of drainage from a cavity.* Keep drainage tubes and collection bags at a lower level than the cavity being drained.
4. *Drainage will flow out of the tubing if the lumen is not occluded.* Avoid kinks and coils in the tubing and watch that the person does not lie on the tubing. Do not clamp tubes without a prescriber's order.
5. *Properly cleanse the site before accessing any tubing to reduce possible introduction of microorganisms into a cavity.* Sometimes contrast media and radiopharmaceuticals are injected via the tubing. An alcohol swab may be used to clean the entry point prior to accessing the tubing.

The following four factors affect the flow of fluid through tubes.

1. Pressure difference

    - A fluid will flow through a tube only when a pressure difference occurs between the two ends. In other words fluid moves from an area of higher pressure to an area of lower pressure. The larger the pressure difference, the more flow there will be. For example an abscess that is full of fluid will have higher pressure than the drain that is inserted into it and attached to a drainage bag for passive drainage.
    - A liquid in an enclosed container produces pressure by virtue of its weight. Weight, in turn, is determined by the density of the liquid and by the height of the liquid column from its surface to its outlet. For example, a large volume IV bag will have more pressure and, thus, greater potential for flow than a small volume IV bag.

2. Diameter

- The diameter of a tube is the width of its lumen or inside opening. This diameter has a significant effect on the resistance to fluid flow. Increasing a tube's diameter increases the flow rate, and vice versa. For example, IV fluids can be infused more quickly through large lumen IV cannulas as compared to small lumen IV cannulas.

3. Length

    - The length of a tube affects the rate of fluid flow. Fluid is slowed down by the friction of its molecules against the walls of the tube. The longer the tube, the more surface area there is for the fluid to rub against. As well, the friction is greater in narrow tubes because the fluid is near the walls. Tubes should be as short as possible, but long enough to achieve their purpose without unduly restricting the person's movement. For example, drains should have relatively short drainage tubing, and IV tubing for IVs run by gravity should not be excessively long.

4. Viscosity

    - Viscosity refers to the tendency of a fluid to resist flow because of the friction of its molecules rubbing against each other. This lack of slipperiness causes the fluid to flow slowly. The rate of a slowly flowing fluid can be increased by raising the height of the container to increase the pressure difference; opening the clamp more or using a larger tube so there is a wider diameter; or diluting the fluid to make it less viscous. For example, blood run by gravity may require the height of the bag to be raised.

Caring for patients with multiple tubes and attachments can be challenging. Follow the guidelines in Table 10.1 to help you care for patients with tubes and attachments.

Table 10.1 Guidelines for Caring for Patients with Tubes and Devices

Guideline	*Rationale*
Secure tubes to the skin with securement device or tape (non-allergenic).	When tension is applied to the tube, the stress will be taken by the tape rather than by the tube.
Drainage bags should be secured to stretcher's frame, patient gowns, etc., as appropriate.	This prevents undue stress on the drainage tube and/or accidental removal from the wound or body cavity.
Connect tube to sterile tubing and drainage receptacle. Do *not* clamp tubing unless ordered.	This helps keep wound or body cavity sterile and promotes flow of drainage.
To ensure continuous drainage, be sure tubing is not kinked, not caught in the bed rails, not underneath the patient, and free from tension when turning, etc.	Any kinks in tubing can stop drainage from the patient and cause further complications.
Dressing around tube, if any, should be clean and dry. Sterile technique is used if it is necessary to change the dressing.	This avoids irritation from tube rubbing the skin or from excessive drainage.
Dressings around tubes should not be cut if the frayed fibres have the potential to get into the wound.	Frayed fibres that enter wounds present increased risk of infection.
Record and report patency of tube and amount, colour, character, and odour of drainage and if an unusual situation occurs in your department. If the contents of a drainage tube are spilled, the approximate amount must be reported.	The character and volume of drainage provide insight into wound healing. Decisions about drain removal are often made in consideration of these things.
If you are unsure how to empty the container or how to close, seek help.	Most drainage tubes must have the ends kept sterile. Always follow agency regulations on how to clean up a blood or body fluid spill.
Know the purpose and location of the tube to understand the function and what to expect.	Some tubes are meant for drainage (JP, Hemovacs, penrose, T-tube, percutaneous drains, Foley catheters, nephrostomy), others for feeding. Feeding tubes can be nasogastric (NG) , nasojejunum (NJ) , percutaneous endoscopic gastrostomy (PEG), percutaneous endoscopic jejunostomy (PEJ).
Always follow tubes back to the point of origin	Know where tubes originate and where they end to facilitate understanding of function and care.

Data sources: BCIT, 2015a; Perry et al., 2018

Critical Thinking Exercises

1. You observe a patient carrying their urinary catheter drainage bag on their shoulder. What should you do?
2. A patient is ambulating in the hall with their JP drain dragging on the floor. What is your response?

10.3 Nasogastric Tubes

Using a Nasogastric Tube

A nasogastric (NG) tube is a hollow flexible plastic or silicone tube inserted through a nare, past the nasopharynx, oropharynx and into the stomach or the upper portion of the small intestine (the later referred to as naso-jejunum). NG tubes are used for feeding, gastric decompression, or gastric lavage.

An NG tube used for feeding is usually softer and has a smaller lumen than tubes used for gastric suctioning / decompression. NG feeding tubes are used for patients who may have swallowing difficulties or require additional nutritional supplements. Placement of blindly inserted enteral tubes must be verified by x-ray before initial use for feedings or medication administration (Bourgault et al., 2014). Blindly inserted means there has not been direct visualization that the tube in the correct position.

Sometimes normal peristalsis is interrupted (i.e., post op, in association with certain conditions). In these situations a **naso gastric tube is used for gastric decompression**. Removal of gastric contents can be done either by gravity or by being connected to a suction pump. In these situations, the NG tube is used to relieve gastric distention and in doing so prevent nausea and vomiting. In the event a patient swallows toxic substances, a nasogastric tube can be inserted and used to lavage or wash the stomach of its contents. NG tubes for these purposes generally have a larger lumen than tubes used for feeding purposes (Perry et al., 2018). Sometimes referred to as a Salem Sump or Levin, these tubes are double lumen. The main lumen is attached to suction, the second lumen acts as an air vent which prevents suctioning of gastric mucosa when the stomach is empty.

When working with people who have nasogastric tubes, remember the following care measures:

- There is potential for pressure injury at the nares and in the mucosa. The tube constantly irritates the nasal mucosa. Ensure that the tube is securely anchored to the patient's nose to prevent excess tube movement, and is secured to the gown to avoid excessive pulling or dragging.
- There is potential for nasal and mouth dryness and discomfort. Because one nostril is blocked, patients tend to mouth breathe. This can cause drying of the nasal and oral mucosa, and patients will complain of thirst, but they are usually NPO (*nil per os*, or nothing by mouth). Provide mouth care frequently. This can include rinsing the mouth with cold water

or mouthwash as long as the patient does not swallow. Silicone based mouth care products are helpful for some. Some patients may be allowed to suck on ice chips.

- Potential for tube obstruction resulting in abdominal pain, discomfort, nausea, or vomiting. In such cases the nurse must investigate complaints of these things immediately, ensuring the drainage flow is not obstructed and to determine if the tube needs to be irrigated.
- Risk of aspiration. Persons with these tubes should *never* be allowed to lie completely flat. Lying flat increases the patient's risk of aspirating stomach contents. The head of bed should always be raised 30 degrees or higher (consult agency policy).
- Potential for tube migration. Ensure tape is secure on the tube and nose or face. Measure and record the external length and compare to previous measurements.
- If used for decompression, assess GI function including secretion volume, character, and pH (Perry et al., 2018).
- NG tubes used for decompression: Set suction as ordered or low if not specifically ordered
- Tubes that appear plugged from medications or tube feed may require declogging (consult agency guidelines).

- Check agency policy for checking tube placement, which may include:

    - X-ray. This is the gold standard for NG tube verification (Stewart, 2014).
    - Gentle aspiration with a syringe to observe gastric contents for amount, colour, and quality. Gastric contents can be green, off white, tan, bloody, brown, or yellow.
    - Use pH paper to measure pH of aspirate. Keep in mind that certain medications can alter gastric pH making this part of the assessment unreliable for some patients (Lilley et al., 2016). pH alone cannot accurately distinguish between gastric and respiratory placement. Radiographic confirmation may still be necessary (Perry et al., 2018).
    - External length when recorded, assessed frequently and compared with current readings helps to establish tube migration.

- Know the patient's history: Persons with recent gastric surgery cannot have NG tubes inserted or reinserted blindly.

Checklist 80 outlines the steps for inserting a nasogastric tube.

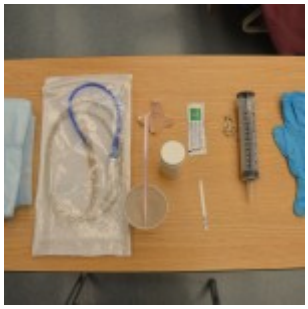
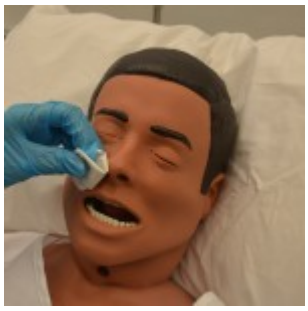
Checklist 80: Inserting a Nasogastric Tube—Adult

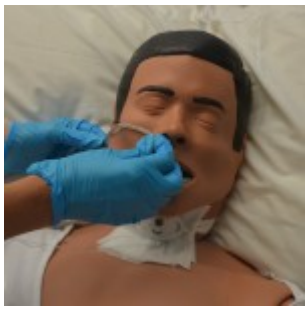
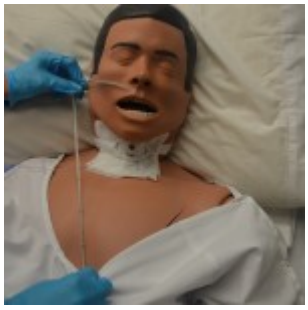
Disclaimer: Always review and follow your agency policy regarding this specific skill.

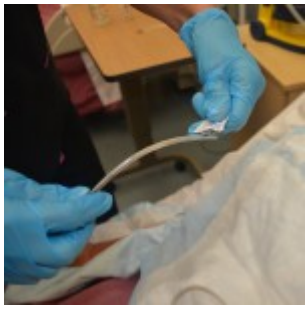
Safety considerations:

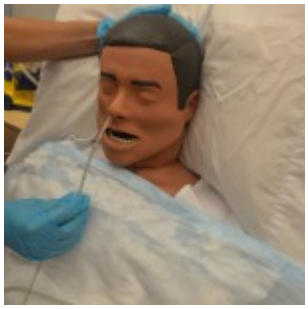
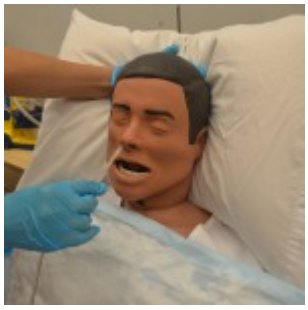
- Perform hand hygiene.
- Check room for additional precautions.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Know the patient history for nasal problems, facial trauma, anticoagulant therapy, basilar skull fracture, conditions involving the esophagus (varices, strictures, surgery).
- Know the rationale for the NG.
- Explain process to patient; offer analgesia, bathroom, etc.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Complete QPA including safety
- Apply principles of asepsis
- Check vital signs.
- Complete necessary focused assessments.

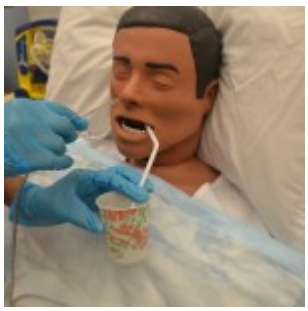
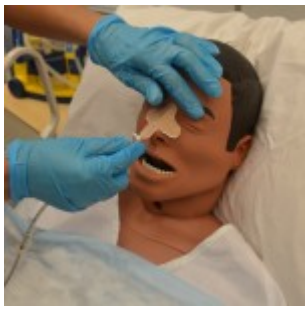
Steps	*Additional Information*

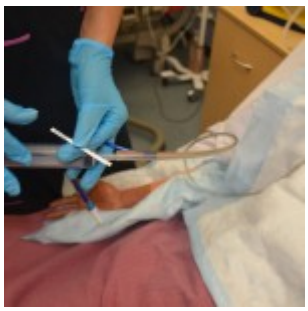
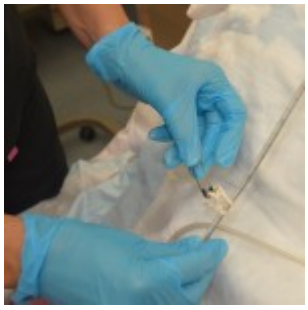
1. Perform hand hygiene. Check prescriber's orders for type of NG tube to be placed and reason for placement. Gather supplies.	This prevents the transmission of microorganisms. Check appropriate orders relevant to patient safety. Supplies include NG tube, lubricant, towel, tape securement device, catheter tip syringe, cup of water with straw. If no specific order for NG tube size, use your nursing judgment: large lumens→decompression; small lumens→feeding.  *Gather supplies*
2. Assess patient's level of consciousness and understanding of procedure.	Patient must be able to follow instructions related to NG insertion to allow for passage of tube through nasal and gastrointestinal tracts.
3. Visually inspect condition of patient's nasal and oral cavities.	Check for signs of infection or skin breakdown. If the patient is at risk for intracranial passage of the tube (i.e., basilar skull fracture) avoid the nasal route. Consult prescriber for alternate route.
4. Palpate patient's abdomen for distension, pain, and/or rigidity. Auscultate for bowel sounds.	Document assessment findings and determine appropriateness of NG tube insertion related to reason for insertion and patient's physical assessment.
5. Apply clean gloves. Assess for the best nostril before you begin. Do this by occluding one side and asking the patient to sniff. Ask the patient about previous injuries or history of a deviated septum.	If either nostril is equally suitable, select the nostril closest to the suction.  *Assess for most patent nostril*

6. Position patient sitting up at 45 to 90 degrees (unless contraindicated by the patient's condition), with a pillow under the head and shoulders.	This position allows the NG tube to pass more easily through the nasopharynx and into the stomach.
7. Raise bed to a comfortable working height.	This helps prevent biomechanical injury to the healthcare provider.
8. Explain the procedure to the patient. Agree on a signal the patient can use if they wish you to pause during the procedure.	This procedure can be anxiety-provoking and uncomfortable for many patients. Providing a means for the patient to communicate discomfort and a desire to pause during the procedure helps alleviate anxiety.
9. Place a towel on the patient's chest and provide facial tissues and an emesis basin.	Nasal and oral secretions may be evident during the procedure.
10. Provide patient with drinking water and a straw if the patient is not fluid restricted and can hold the cup.	Sipping water through a straw helps to initiate the swallowing reflex and facilitate passing of NG tube.
11. Stand on patient's right side if you are right-handed and the left side if you are left-handed.	You will use your dominant hand to insert the tube.
12. Measure distance of the tube from: • The tip of the nose, to… • The earlobe, to… • The xiphoid process, and then mark the tube at this point. **Note:** Add 20 to 30 cm for an NJ tube.	This determines the appropriate length of NG tube to be inserted.  *Measure from tip of nose to earlobe*  *Measure from earlobe to xiphoid process*

13. Curve 10 to 15 cm of the end of the NG tube around your gloved finger, and then release it.	Curling the NG tube around your finger helps it conform to the normal curve of the nasopharynx. 
14. Lubricate NG tube tip according to your agency policy (often approx 10 cm). If inserting a weighted feeding tube with a stylet or guidewire, follow manufacturer's instructions for lubrication (often involves injecting water into in) Prepare securement device.	 *Lubricate tip of tube as per agency policy* Never use non-water-soluble lubricant (e.g., Vaseline), as it will not dissolve and may cause respiratory complications if it enters the lungs. Agency policy might restrict who can insert a weighted feeding tube.
15. Have patient drop head forward and breathe through the mouth.	Dropping the head forward closes the trachea and opens the esophagus, which allows the NG tube to pass more easily through the nasopharynx and into the stomach.

16. Insert NG tube tip slowly into the patient's nostril and advance it steadily, in a downward direction, along the bottom of the nasal passage, with the curved end pointing downward in the direction of the ear on the same side as the nostril.	This follows the natural anatomical alignment of the nasopharynx.  *Insert nasogastric tube slowly into patient's nostril*
17. You may feel slight resistance as you advance along the nasal passage. Twist the tube slightly, apply downward pressure, and continue trying to advance the tube. If significant resistance is felt, remove the tube and allow the patient to rest before trying again in the other nostril.	It is common for the patient to feel discomfort, and this may be expressed with light coughing and gagging. More aggressive coughing and gagging may indicate that the tube has entered the airways, in which case you should STOP and wait for the coughing to stop. If it doesn't stop, withdraw the NG tube.  *Advance the tube gently*

18. If the patient has difficulty in passing the NG tube, you may ask the patient to sip water slowly through a straw unless oral fluids are contraindicated. If oral fluids are not allowed, ask the patient to try dry swallowing while you advance the tube.	If patient continues to gag or cough, check that the tube is not coiled in the back of the mouth, using a tongue blade and a flashlight to check the back of the mouth. If tube is coiled, withdraw the tube until only the tip of the tube is seen in the back of the mouth. Then try advancing the tube again while the patient tries to swallow.  *Patient may sip water slowly through a straw*
19. Continue to advance NG tube until you reach the mark/tape you had placed for measurement.	This ensures accurate placement.
20. Temporarily anchor the tube to patient's cheek with a piece of tape until you can check for correct placement.	This prevents displacement of the NG tube while checking placement.  *Anchor tube*

21. Verify tube placement according to agency policy. This may include ◦ X-ray (gold standard) ◦ Gentle aspiration with a syringe to observe gastric contents for amount, color, and quality. Gastric contents can be green, off white, tan, bloody, brown, or yellow. ◦ Use pH paper to measure pH of aspirate. Color-coded pH paper is usually used, as an initial and interim check, to confirm that acidic contents are present. Then an X-ray is taken to confirm placement prior to using NG tube for feeding.	The contents aspirated from the tube should be acidic with a pH < 5. If the pH is more than 6, it may indicate the presence of respiratory fluids or small bowel content, and the tube should be removed. Note: some medications alter gastric pH thus making this method of assessing placement NOT 100% reliable.  *Verify tube placement using pH paper* Auscultation of air being injected into the stomach is not a reliable means to determine position of a feeding tube . It cannot distinguish between gastric and small bowel placement nor if the tube tip is in the esophagus.
22. Once the tube placement has been confirmed, secure the tube to the patient's nose with tape or a securement device. Determine **external length** (the length of tubing extending from the nose to the outer end of the tube).	This aids in timely recognition and identification of tube displacement or migration.
23. Secure the tube to the patient's gown with a safety pin, allowing enough tube length for comfortable head movement. Help the patient to a comfortable position.	This keeps the NG tube in place.  *Secure the tube to the patient's gown to avoid tugging and pulling* Persons with tube feeds require the head of bed elevated at 30 degrees (or as per agency policy) unless contraindicated to ↓ risk of aspiration.

24. Document the procedure according to agency policy, and report any unexpected findings to the appropriate healthcare provider.	Timely and accurate documentation promotes patient safety. Sample documentation: *date / time: Abdomen distended, firm. Reports ++ nausea. Frequent vomiting throughout morning. No bowel sounds. Reported to Dr GI. Orders received. #16 levine inserted right nare for 800 ml dark green returns. Attached to low suction. Tolerated well with reports of less nausea following.——RLeaf RN*
Data sources: BCIT, 2015c; Berman & Snyder, 2016; Bourgault et al., 2014; Potter et al., 2018; Simons & Abdallah, 2012.	

Special Considerations with NG Tubes:

- Always assess correct placement of the NG tube prior to infusing any fluids or tube feeds as per agency policy. Check external length, color and pH of the fluid aspirated from the tube. Routine evaluation of tube placement will promote patient safety by reducing risk of aspiration. Do not instill air to test location of tube.
- Do not give the patient anything to eat or drink without knowing that the patient has passed a swallowing assessment.
- If changing the gown or re-positioning the patient, take care not to pull on the NG tube. Remember to unfasten the tube from the gown and refasten the tube afterward.
- If the NG tube falls out of the patient, it is not an emergency. *But* be sure to assess your patient.
- A patient who appears to be in respiratory distress should be considered an emergency, and emergency procedures should be followed. Respiratory distress may present as coughing, choking, or reduced oxygen saturation.

Watch the video *Insertion of a NG Tube* developed by Renée Anderson and Wendy McKenzie (2018) of Thompon Rivers University School of Nursing.

Removing a NG Tube

A NG tube should be removed if it is no longer required. The process of removal is usually very quick. Prior to removing the NG tube, verify physician orders. If the NG tube is ordered to remove gastric contents, the physician's order may state to "trial" clamping the tube for a number of hours

to see if the patient tolerates oral intake or their own accumulation of gastric secretions prior to the tube removal. During the trial, the patient should not experience any nausea, vomiting, or abdominal distension. If they do experience these things, simply reattach the NG to suction. To review how to remove a NG tube, refer to Checklist 81.

Checklist 81: Removal of a NG Tube

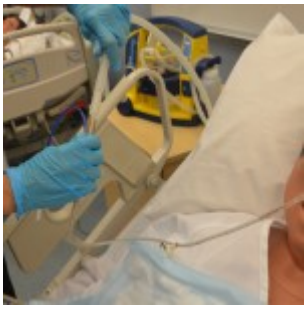
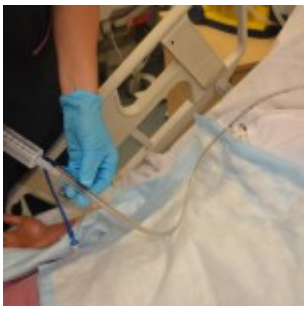
Disclaimer: Always review and follow your agency policy regarding this specific skill.

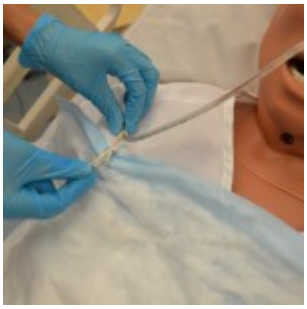
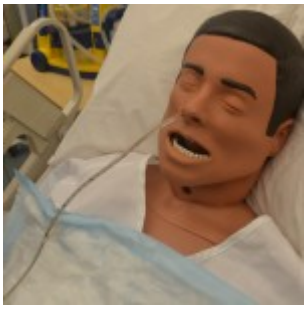
Safety considerations:

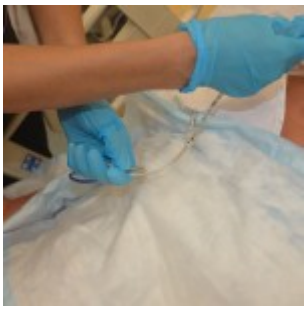
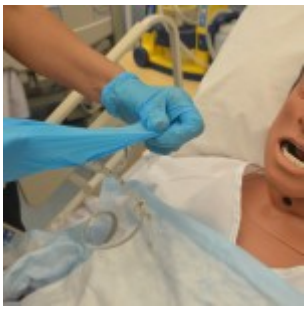
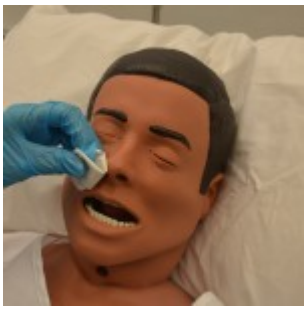
- Perform hand hygiene.
- Check room for additional precautions.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Know the rationale for the NG.
- Explain process to patient; offer comfort measures ie. bathroom, etc.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Complete QPA including safety.
- Apply principles of asepsis and safety.
- Complete necessary focused assessments.

Steps	*Additional Information*

1. Verify healthcare provider's orders to remove NG tube.	An order is required to remove an NG tube.
2. Collect supplies.	Supplies include waterproof pads, 20 ml catheter tip syringe, tissues, non-sterile gloves, and plastic garbage bag.
3. Verify patient using two identifiers. Explain procedure to patient and place patient in high Fowler's position.	Follow agency policy for proper patient identification.
4. Perform hand hygiene. Place waterproof pad on patient's chest.	This reduces the transmission of microorganisms.  *Perform hand hygiene*

5. Depending on the purpose of the tube either: • stop the tube feed and disconnect from feeding tube tubing; or • disconnect from suction tubing.	This reduces risk of aspiration of tube feed and makes disposal of equipment easier.  *Disconnect tube from feed or suction*
6.Flush tube with air and then kink tube	 *Flush tube with air to clear tube feed / secretions* Flushing the tube with air and kinking prevents leakage of fluid from the tube and prevents aspiration of tube feed or residual gastric secretions.

7. Unclip NG tube from patient's gown.	This allows for tube to be easily removed and disposed of immediately.  *Unclip NG tube from patient's gown*
8. Remove securement device from nose (this is the last step prior to removing the tube thus preventing accidental tube removal before either the nurse or client are ready)	
9.Instruct patient to take a deep breath and hold it.	Holding the breath closes the glottis, decreases risk of aspiration, and distracts the patient.

10. Hold the NG tube near the naris and gently pull out tube in a swift, steady motion. Dispose of tube in garbage bag.	 *Pull out tube in a swift, steady motion*  *Wrap tube in glove and dispose as per agency policy*
11. Offer tissue or clean the nares for the patient, and offer mouth care as required.	This clears the nares/nasal passages of any remaining secretions.  *Offer tissue or clean the nares for the patient*

12. Remove gloves and place patient in a comfortable position. Assess patient's level of comfort. Perform hand hygiene.	This promotes patient comfort and reduces the transmission of microorganisms.
13. Document procedure according to agency policy	Document removal of NG tube and patient response to the removal.
Data source: BCIT, 2015b; Perry et al., 2018	

Critical Thinking Exercises

1. You are inserting a nasogastric tube and the patient begins to cough and turn red in the face. Explain your next steps.
2. Your patient has a nasogastric tube and is requesting water because her throat feels dry. Describe your next actions.
3. Your patient calls you to say they've accidentally pulled out the NG. Explain your next steps.

10.4 Urinary Catheters

Urinary elimination is a basic human function that can be compromised by illness, surgery, and other conditions. Urinary catheterization may be used to support urinary elimination in patients who are unable to void naturally. Urinary catheterization may be required:

- In cases of acute urinary retention
- When intake and output are being monitored
- For postoperative management
- To enhance healing in incontinent patients with open sacral and perineal wounds
- For comfort measures during end-of-life care

Catheter-Associated Urinary Tract Infections

Catheter-associated urinary tract infections (CAUTI) are a common complication of indwelling urinary catheters and have been associated with increased morbidity, mortality, hospital cost, and length of stay (Gould et al., 2009). Urinary drainage systems are often reservoirs for multidrug-resistant organisms (MDROs) and a source of the transmission of microorganisms to other patients (Gould et al., 2009). The most important risk factor for developing a CAUTI, a healthcare-associated infection (HAI), is the prolonged use of a urinary catheter (Centers for Disease Control and Prevention [CDC], 2015). Urinary tract infections (UTIs) are the most commonly reported HAIs in acute care hospitals and account for more than 30% of all reported infections (Gould et al., 2009). Catheters in place for more than a few days place the patient at risk for a CAUTI. A healthcare provider must assess patients for signs and symptoms of CAUTIs and report immediately to the primary healthcare provider. Signs and symptoms of a CAUTI include:

- Fever, chills
- Lethargy
- Lower abdominal pain
- Back or flank pain
- Urgency, frequency of urination
- Painful urination
- Hematuria
- Change in mental status (confusion, delirium, or agitation), most commonly seen in older adults

The following are practices for preventing CAUTIs (Perry et al., 2018):

- Insert urinary catheters using sterile technique.
- Only insert indwelling catheters when essential, and remove as soon as possible.
- Use the smallest tube size (gauge) possible.
- Provide daily cleansing of the urethral meatus with soap and water or perineal cleanser, following agency policy.
- Ensure a closed drainage system.
- Ensure that no kinks or blockages occur in the tubing.
- Secure the catheter tube to prevent urethral damage.
- Avoid routine use of antiseptic solutions on the urethral meatus and/or in the urinary bag.
- Ensure urine bags are positioned to allow gravity to drain urine.

Urinary Catheterization

Urinary catheterization refers to the insertion of a catheter tube through the urethra and into the bladder to drain urine. Although not a particularly complex skill, urethral catheterization can be difficult to master. Both male and female catheterizations present unique challenges.

Having adequate lighting and visualization is helpful, but does not ensure entrance of the catheter into the female urethra. It is not uncommon for the catheter to enter the vagina. Leaving the catheter in the vagina can assist in the correct insertion of a new catheter into the urethra, but you must remember to remove the one in the vagina.

For some women, the supine lithotomy position can be very uncomfortable or even dangerous. For example, patients in the last trimester of pregnancy may faint with decreased blood supply to the fetus in this position. Patients with arthritis of the knees and hips may also find this position extremely uncomfortable. Catheterization may also be accomplished with the patient in the lateral to Sims position (three-quarters prone).

The male urinary sphincter may create resistance when passing a urinary catheter, particularly for older men with prostatic hypertrophy.

Urethral catheterization might be intermittent indwelling.

Intermittent catheterization (single-lumen catheter) is used for:

- Immediate relief of urinary retention
- Long-term management of incompetent bladder

- Obtaining a sterile urine specimen
- Assessing residual urine in the bladder after voiding (if a bladder scanner is not available)

Indwelling catheterization (double- or triple-lumen catheter) is used for:

- Promoting urinary elimination for persons requiring prolonged bed rest due to certain other health conditions (i.e., spinal cord injury)
- Measuring accurate urine output
- Preventing skin breakdown caused by urinary incontinence
- Facilitating wound management for wounds in perineum, coccyx
- Allowing surgical repair of urethra, bladder, or surrounding structures
- Instilling irrigation fluids or medications
- Assessing abdominal or pelvic pain
- Investigating conditions of the genitourinary system

The steps for inserting an intermittent or an indwelling catheter are the same, except that the indwelling catheter requires a closed drainage system and inflation of a balloon to keep the catheter in place. Indwelling catheters may have two or three lumens (double or triple lumens). Double-lumen catheters comprise one lumen for draining the urine and a second lumen for inflating a balloon that keeps the catheter in place. Triple-lumen catheters are used for continuous bladder irrigation and for instilling medications into the bladder; the additional lumen delivers the irrigation fluid into the bladder.

Indwelling urinary catheters are made of latex or silicone. Intermittent catheters may be made of rubber or polyvinyl chloride (PVC), making them softer and more flexible than indwelling catheters (Perry et al., 2018). The size of a urinary catheter is based on the French (Fr) scale, which reflects the internal diameter of the tube. Recommended catheter size is 12 to 16 Fr for females, and 14 to 16 Fr for males. Smaller sizes are used for infants and children. The balloon size also varies with catheters: smaller for children (3 ml) and larger for continuous bladder irrigation (30 to 60 ml). The size of the catheter is usually printed on the side of the catheter port.

Insertion of a Foley catheter is within the RN scope of practice, and as such an RN can insert a catheter within their independent scope of practice if the agency policy is supportive and the RN is competent to do so (BCCNP, 2018).

An indwelling catheter is attached to a drainage bag to allow for unrestricted flow of urine. Make sure that the urinary bag hangs below the level of the patient's bladder so that urine flows out of the bladder. The bag should not touch the floor, and the patient should carry the bag below the level of the bladder when ambulating. To review how to insert an indwelling catheter, see Checklist 82.

Checklist 82: Insertion of an Intermittent or Indwelling Urinary Catheter

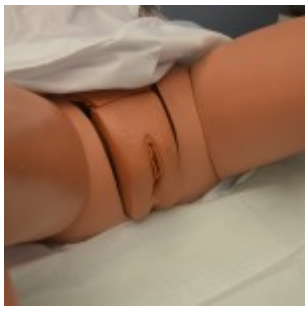
Disclaimer: Always review and follow your agency policy regarding this specific skill.

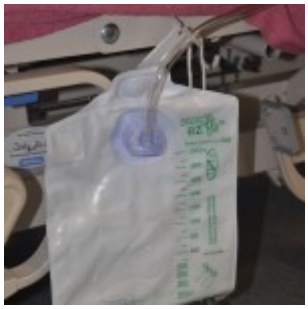
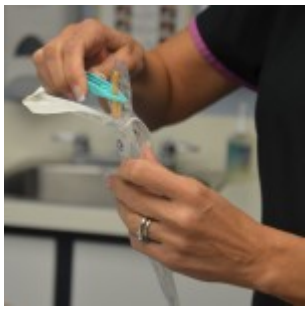
Safety considerations:

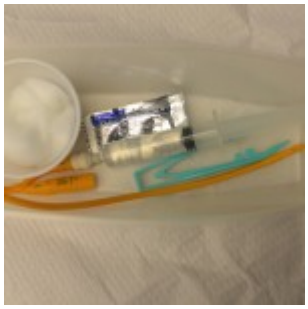
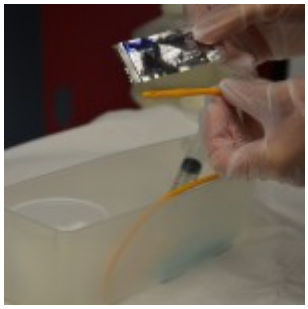
- Some agencies allow nurses to insert catheters within their independent scope of practice (ie. without an order). Check your agency guidelines.
- Perform hand hygiene.
- Check room for additional precautions.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient; offer analgesia, bathroom, etc.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Complete QPA including safety.
- Apply principles of asepsis.
- Complete necessary focused assessments.
- Recognize the personal nature of this procedure and provide culturally sensitive care.

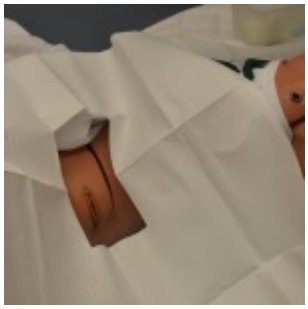
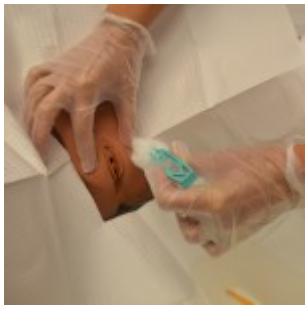
Steps	*Additional Information*
1. Verify physician order for catheter insertion. Assess for bladder fullness and pain by palpation or by using a bladder scanner.	Palpation of a full bladder will cause an urge to void and/or pain.

2. Position patient prone to semi-upright with knees raised; apply gloves; and inspect perineal region for erythema, drainage, and odor. Also assess perineal anatomy. Apply non-sterile gloves. Washed perineal area with warm water and soap or perineal cleanser according to agency policy.	Assessment of perineal area allows for determination of perineal condition and position of anatomical landmarks to assist with insertion.  *Apply non-sterile gloves* Washing the perineum reduces microorganisms and reduces risk of urinary tract infection.
3. Remove gloves and perform hand hygiene.	This prevents transmission of microorganisms.
4. Gather supplies: **Note:** A catheterization kit may include most of these items. • Sterile gloves • Cleaning solution (usually povidone iodine swabs × 3) • Lubricant • Prefilled syringe for balloon inflation as per catheter size • Sterile drape • Urinary bag • Foley catheter (usually 14 to 16) • Catheter securement device • Flashlight (helpful to visualize meatus on some women)	When selecting catheter size, consider the patient's history. If hematuria is present, select a larger catheter that will allow clots to pass. If bladder irrigation is necessary select a 3-way Foley. Larger catheter size increases the risk of urethral trauma. Preparation ahead of time enhances patient comfort and safety.
5. Ensure adequate lighting.	Adequate lighting helps with accuracy and speed of catheter insertion. If using flashlight, position it to illuminate perineum.

6. Place waterproof pad under patient.	This step prevents soiling of bed linens.  *Place waterproof pad under patient*
7. Positioning of patient depends on gender. *Female patient*: On back with knees flexed and thighs relaxed so that hips rotate to expose perineal area. Alternatively, if patient cannot abduct leg at the hip, patient can be side-lying with upper leg flexed at knee and hip, supported by pillows. *Male patient*: Supine with legs extended and slightly apart.	Patient should be comfortable as possible, with perineum or penis exposed, for ease and safety in completing procedure.
8. Place a blanket or sheet to cover patient and expose only required anatomical areas.	This step helps protect patient dignity.
9. Perform hand hygiene.	This reduces the transmission of microorganisms.  *Perform hand hygiene*

10. If using indwelling catheter and closed drainage system, attach urinary bag to the bed and ensure that the clamp is closed.	Urinary bag should be closed to prevent urine drainage leaving bag. A closed system also reduces risk of urinary tract infection  *Urine drainage bag*
11. Prepare sterile field following principles of asepsis. Add supplies to sterile field.	This step ensures preparation and organization for procedure.  *Add catheter to the sterile field.*

12. Apply sterile gloves following principles of asepsis. Arrange items in the urine collection tray. Attach the water filled syringe to the pigtail of the catheter.	Sterile gloves reduce the transmission of microorganisms.  *Apply sterile gloves* Organizing items facilitates a smooth process.  *Place supplies into the urine collection tray*
13.Lubricate tip of catheter. For males lubricate approximately 20 cm; for females lubricate approximately 5 to 10 cm. Note: manufacturers no longer recommend to test the catheter balloon before insertion. In fact doing so may stretch the catheter and cause urethral trauma.	Lubrication minimizes urethral trauma and discomfort during procedure.  *Lubricate the tip of the catheter*

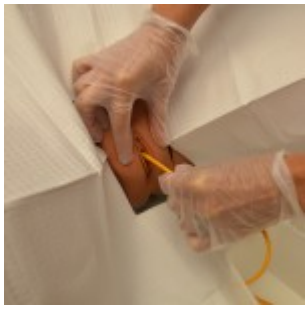
14. Drape patient with drape found in catheterization kit one under the buttocks and one on top of and exposing the perineum or penis. Ensure that any sterile supplies only touch the middle of the sterile drape (not the edges), and that sterile gloves do not touch non-sterile surfaces.	The outer 2.5 cm is considered non-sterile on a sterile drape.  *Cover patient with sterile drape* **note – some nurses drape before applying sterile gloves, others drape after applying sterile gloves. the principle to remember is sterile to sterile.
15. Place sterile tray with catheter between patient's legs.	Sterile tray will collect urine once catheter tip is inserted into bladder.
16. Clean perineal area as follows. *Female patient*: Separate labia with fingers of non-dominant hand (now contaminated and no longer sterile). Using sterile technique and dominant hand, clean labia and urethral meatus from clitoris to anus, and from outside labia to inner labial folds and urethral meatus is the last swipe of the swab. If using prepackaged swabs, use a new swab for each cleansing stroke. If using cotton swabs and sterile forceps it is still one wipe one way discard *Male patient*: Gently grasp penis at shaft and hold it at right angle to the body throughout procedure with non-dominant hand (now contaminated and no longer sterile). Using sterile technique and dominant hand, clean urethral meatus in a circular motion working outward from meatus. If using prepackaged swabs, use a new swab for each cleansing stroke. If using cotton swabs and sterile forcepts it is till one wipe one way discard.	This reduces the transmission of microorganisms.  *Cleanse perineal area*
17. Pick up catheter with sterile dominant hand 7.5 to 10 cm below the tip of the catheter.	Holding catheter closer to the tip will help to control and manipulate catheter during insertion.

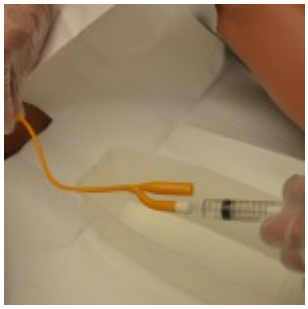
<table>
<tr><td>18. Insert catheter as follows.

Female patient:

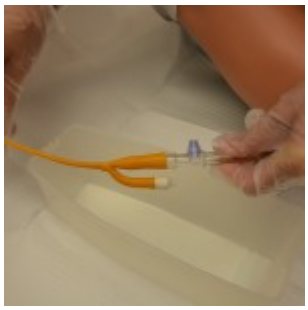
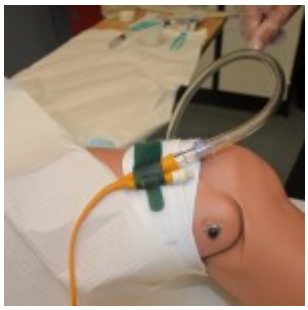
• Ask patient to bear down gently (as if to void or cough) to help expose urethral meatus.
• Advance catheter 5 to 7.5 cm until urine flows from catheter, then advance an additional 5 cm.

Male patient:

• Hold penis perpendicular to body and pull up slightly on shaft.
• Ask patient to take a deep breath and slowly insert catheter through urethral meatus.
• Advance catheter 17 to 22.5 cm or until urine flows from catheter then advance it to the bifurcation.</td><td>This process helps visualize urethral meatus and relax external urinary sphincter.
 
Insert catheter gently</td></tr>
<tr><td colspan="2">Note: If urine does not appear in a female patient, the catheter may be in the patient's vagina. Leave catheter in vagina as a landmark, and insert another sterile catheter.</td></tr>
<tr><td colspan="2">Note: If catheter does not advance in a male patient, do not use force. Ask patient to take deep breaths while holding steady pressure with the tip of the catheter. Sometimes the catheter will pass via the prostate. If catheter still does not advance, reposition the penis toward the abdomen while holding steady pressure with the tip of the catheter. If the catheter still does not advance, stop procedure and inform physician. Patient may have an enlarged prostate or urethral obstruction and may require a coudé tip catheter or the expertise of someone else.</td></tr>
<tr><td>19. Place catheter in sterile tray and collect urine specimen if required.</td><td>Urine specimen may be required for analysis. Collect as per agency policy.</td></tr>
<tr><td>20. While holding the catheter in place, slowly inflate balloon for indwelling catheters according to catheter size, using prefilled syringe. Observe the patient's facial expression during inflating noting any evidence of discomfort. If discomfort, STOP and deflate the balloon. The catheter balloon may be in the urethra.

Likewise, if every indication suggests the balloon is in the bladder, keep gentle pressure on the syringe plunger with thumb, gently pull back on the catheter to confirm the balloon is inflated and the catheter will remain insitu.</td><td>The size of balloon is marked on the catheter port.
 
Slowly inflate balloon

Inflating a balloon in a urethra can cause severe trauma.</td></tr>
<tr><td colspan="2">Note: If patient experiences pain on balloon inflation, deflate balloon, allow urine to drain, advance catheter, and reinflate balloon.</td></tr>
<tr><td>21. After balloon is inflated, pull gently on catheter until resistance is felt, and then advance the catheter again.</td><td>Moving catheter back into bladder will avoid placing pressure on bladder neck.</td></tr>
</table>

22. Connect urinary bag to catheter using principles of asepsis.	Keep urinary bag below level of patient's bladder.  *Connect urinary bag to catheter using sterile technique*
23. Secure catheter to patient's leg using securement device at tubing just above catheter bifurcation. *Female patient*: Secure catheter to inner thigh, allowing enough slack to prevent tension. *Male patient*: Secure catheter to upper thigh (with penis directed downward). Some patients require catheters to be secured to the abdomen (with penis directed toward chest). Always allow enough slack to prevent tension on the urinary meatus. Ensure foreskin is not left retracted.	Securing catheter reduces risk of CAUTI (catheter acquired urinary tract infection), urethral erosion, and accidental catheter removal.  *Secure catheter to patient's leg* For male patients, leaving the foreskin retracted can cause pain and edema.
24. Dispose of supplies following agency policy.	This reduces the transmission of microorganisms.
25. Remove gloves and perform hand hygiene.	This reduces the transmission of microorganisms.
26. Document procedure according to agency policy, including patient tolerance of procedure, any unexpected outcomes, and urine output.	Timely and accurate documentation promotes patient safety. Sample documentation: *date / time: Unable to void. Bladder scanned for 750 ml. Suprapubic abdomen firm and uncomfortable. #16 – 10cc Foley inserted without difficulty. Clear yellow returns. Attached to urine drainage bag. Tolerated without discomfort.* ––IPee RN.
Data source: BCCNP, 2019; BCIT, 2015c; Perry et al., 2018	

Watch the videos *Urinary Catheterization (Male)* AND *Urinary Catheterization (Female)* developed by Renée Anderson and Wendy McKenzie of Thompson Rivers University, 2018.

Removing a Urinary Catheter

Removing an indwelling Foley catheter is within the RN's scope of practice. As such the RN can choose to remove an indwelling catheter within their independent scope of practice if agency policy is supportive and the RN is competent to do so (BCCNP, 2018). Even with an order to remove an indwelling catheter, it remains the responsibility of the healthcare provider to evaluate if the indwelling catheter is necessary for the patient's recovery.

A urinary catheter should be removed as soon as possible when it is no longer needed. For post-operative patients who require an indwelling catheter, the catheter should be removed preferably within 24 hours. The following are appropriate uses of an indwelling catheter (Gould et al., 2009):

- Improved comfort for end-of-life care
- Assisting in the healing process of an open sacral or perineal pressure ulcer
- Patients requiring prolonged immobilization (unstable thoracic or lumbar fractures, multiple traumatic injuries)
- Select surgical procedures (prolonged procedures, urological surgeries, etc.)
- Intra-operative monitoring of urinary output
- Patients receiving large-volume infusions or diuretic intra-operatively

When a urinary catheter is removed, the healthcare provider must assess if normal bladder function has returned. The healthcare provider should report any hematuria, inability or difficulty voiding, or any new incontinence after catheter removal. Prior to removing a urinary catheter, the patient requires education on the process of removal, and on expected and unexpected outcomes (e.g., a mild burning sensation with the first void) (VCH Professional Practice, 2014). The healthcare provider should instruct patients to:

- Increase or maintain fluid intake (unless contraindicated).
- Void when able and within six to eight hours after removal of the catheter.
- Inform the healthcare provider when he or she has voided, and measure the amount, colour, and any abnormal findings; ensure first void (urine output) is measured as per agency policy.
- Report any burning, pain, discomfort, or small amount of urine volume.
- Report an inability to void, bladder tenderness, or distension.

- Report any signs of a CAUTI.

Review the steps in Checklist 83 on how to remove an indwelling catheter.

Checklist 83: Removing an Indwelling Catheter

Disclaimer: Always review and follow your agency policy regarding this specific skill.

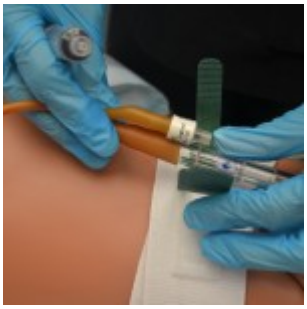
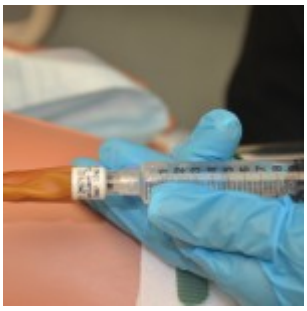
Safety considerations:

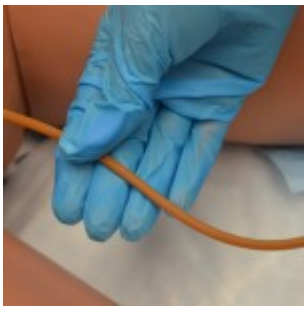
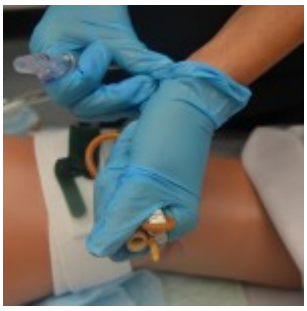
- Some agencies allow nurses to remove catheters within their independent scope of practice (ie. without an order). Check your agency guidelines.
- Perform hand hygiene.
- Check room for additional precautions.
- Introduce yourself to patient.
- Confirm patient ID using two patient identifiers (e.g., name and date of birth).
- Explain process to patient; offer analgesia, bathroom, etc.
- Listen and attend to patient cues.
- Ensure patient's privacy and dignity.
- Complete QPA including safety.
- Complete necessary focused assessments.
- Recognize the personal nature of this procedure and provide culturally sensitive care.

Steps	*Additional Information*

1. Verify prescriber's orders, perform hand hygiene, and gather supplies.	Supplies include non-sterile gloves, sterile syringe (verify size of balloon on Foley catheter), waterproof pad, garbage bag, cleaning supplies for perineal care, and urine collection device (hat or urinal).
2. Identify patient using two identifiers. Create privacy, and explain procedure for catheter removal.	This ensures you have the correct patient and follows agency policy on proper patient identification.
3. Educate patient on catheter removal and care post catheter removal.	Patient must be informed of what to expect after catheter is removed, and how to measure urine output, etc. Expect to void approximately 150 ml with each void initially.

4. Perform hand hygiene and set up supplies.	 *Perform hand hygiene* Raise bed to working height. Organize supplies. Position patient supine for easy access. Place waterproof pad under buttocks and garbage bag close to perineum.
5. Apply non-sterile gloves.	This reduces the transfer of microorganisms.  *Apply non-sterile gloves*

6. Remove catheter securement/anchor device (often requires alcohol). Perform catheter care with warm water and soap, or according to agency protocol.	Removing catheter securement device provides easy access to catheter for cleaning and removing.  *Remove catheter securement device* Pericare reduces microorganisms and risk of UTI.
7. Insert syringe in balloon port and drain fluid from balloon. Verify balloon size on catheter to ensure all fluid is removed from balloon. Note: some catheter manufacturers advise to attach a syringe and the balloon will automatically deflate.	A partially deflated balloon will cause trauma to the urethra wall and pain during removal.  *Insert syringe in balloon port and drain fluid from balloon*

8. Ask the patient to take a deep breath, and pull catheter out slowly and smoothly. Catheter should slide out easily.	 *Pull catheter out slowly and smoothly* Taking a deep breath is a distraction to help facilitate the process of removal. If resistance is felt, stop removal and reattempt to remove the fluid from the balloon. Attempt removal again. If unable to remove the catheter, stop and notify prescriber.
9. Wrap used catheter in waterproof pad or gloves or place in garbage bag. Unhook catheter tube from urinary bag. Measure, empty, and record contents of catheter bag. Remove gloves, perform hand hygiene, and apply new non-sterile gloves.	 *Wrap used catheter in waterproof pad or gloves* This prevents accidental spilling of urine from the catheter. Record drainage amount, colour, and consistency according to agency policy.
10. Discard equipment and supplies according to agency policy.	

11. Review post-catheter care, fluid intake, and expected and unexpected outcomes with patient.	Ensure patient has access to toilet, commode, bedpan, or urinal. Place call bell within reach. Ensure first void (urine output) is measured as per agency policy. Encourage patient to maintain or increase fluid intake to maintain normal urine output (unless contraindicated).
12. Lower bed to safe position, remove gloves, and perform hand hygiene.	Lowering the bed helps prevent falls. Hand hygiene prevents the transmission of microorganisms from patient to healthcare provider.  *Hand hygiene with ABHR*

13. Document procedure according to agency policy.	Document time of catheter removal, condition of urethra, and any teaching related to post-catheter care and fluid intake. Sample documentation: *date / time: #16 – 7 cc Foley removed as ordered. Tolerated procedure. Aware to increase fluid intake to 2 litres / day. Aware to anticipate mild discomfort with first void. Aware of need for measurement of initial void. ———IMGlad* RN Document time, amount, and characteristics of first void after catheter removal. Sample documentation: *Date / time: Initial void post Foley removal 350 ml. Denies discomfort. Reports clear urine and feels she has emptied her bladder completely. ——GInhome* RN
Data sources: BCCNP, 2019; BCIT, 2015b; Perry et al., 2018; VCH Professional Practice, 2014	

Watch the video *Foley Catheter Removal* developed by Renée Anderson and Wendy McKenzie of Thompson Rivers University, 2018.

If a patient is unable to void after six to eight hours of removing a urinary catheter, or has the sensation of not emptying the bladder, or is experiencing small voiding amounts with increased frequency, a bladder scan may be performed. A bladder scan can assess if excessive urine is being retained. Notify the healthcare provider if patient is unable to void within six to eight hours of removal of a urinary catheter. If a patient is found to have retained urine in the bladder and is unable to void, an intermittent/straight catheterization should be performed (Perry et al., 2018).

Read the *To Scan or Not To Scan* journal article by Davis, Chrisman, and Walden (2012) for more information on bladder scanning.

Critical Thinking Exercises

1. Describe the cleaning techniques for cleansing both a female and a male patient prior to catheterization.
2. Your male patient complains of pain while you are inserting a urinary catheter. Describe your next steps.

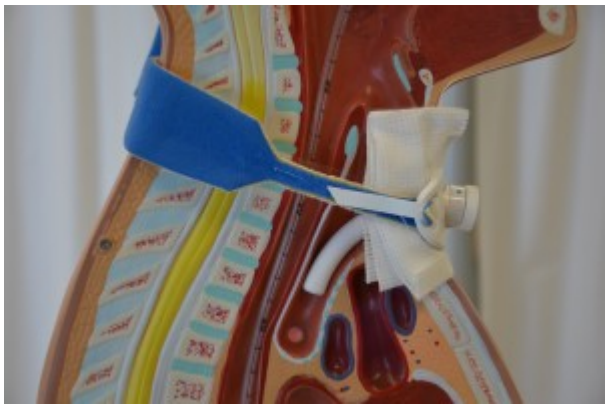
10.5 Tracheostomies

Tracheostomy Tubes

Tracheostomy tubes (TTs) are artificial airways that can be permanent or temporary depending on the patient's condition. They are placed through a hole in the neck and into the trachea to overcome tracheal obstruction caused by head and neck trauma including surgery or tumour. Other reasons for tracheostomy tubes include the need for prolonged mechanical ventilation and/or when the client is unable to maintain a patent airway because of conditions like neuromuscular disease or spinal cord injury (BTS, 2014; Perry et al., 2018; RCH, n.d.).

Nursing care of clients with tracheostomy tubes varies depending on how well established the tracheotomy is. The British Thoracic Society prioritizes humidification, ensuring the cleanliness and patency of the inner tube, secure fixation of the tube, and attention to cuff pressure as necessary for preventing TT related complications (BTS, 2014).

If the trach is temporary, decannulation (or removal) should be done as soon as possible to reduce the risk of complications. Decannulation should only be done by competent persons and is only done following thorough assessment of the upper airway.



Cross-section view of a tracheostomy (on a model) inserted in the trachea anterior to the esophagus

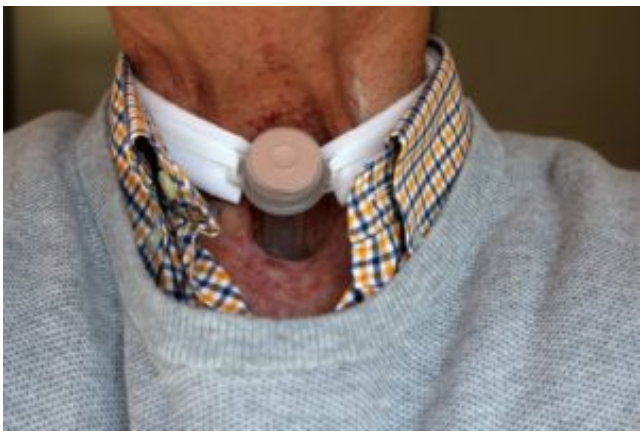


Figure 10.1 Person with TT in situ (capped)

Tracheostomy tubes can be soft plastic, hard plastic, or, at times, metal. All tracheostomy devices are made up of a number of pieces. Understanding the structure and function is key to providing

safe trach care. (See Figure 10.2 and Table 10.2.) TTs come in different sizes and may have a cuff and may be fenestrated. A cuffed tracheostomy produces a tight seal between the tube and the trachea. This seal prevents aspiration of oropharyngeal secretions and air leakages between the tube and the trachea. Tracheostomies are firmly tied and secured around the patient's neck. The ties prevent accidental decannulation of the trachea (in other words, accidental trach removal). New tracheostomies require attention to principles of asepsis for stoma (wound) care. Tracheostomies that are well established require clean technique for stoma care.

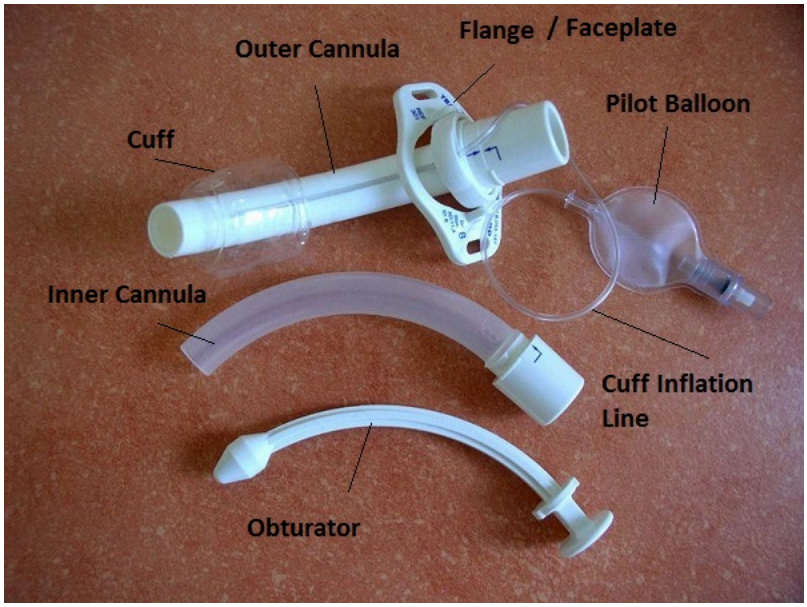


Figure 10.2 Parts of a tracheostomy tube

Table 10.2 Parts of a Tracheostomy Tube

Outer cannula	Sits in the trachea
Inner cannula	Fits inside the outer cannula. It is a safety feature and can be removed and replaced if obstructed. Whenever possible, TT that include an inner cannula should be used.
Flange / face plate	Rests against the patient's neck. Prevents the TT from migrating into the trachea.
Obturator	Sits inside the TT and is used when the TT is situated. It is replaced with an inner cannula.
Cuff	When inflated, provides protection from aspiration. Prevents the escape of air between the tube and tracheal wall. Cuff pressures that are too high can damage the tracheal mucosa. Follow your agency guidelines for monitoring cuff pressure. A note about uncuffed TTs: they allow patients some control with clearing their own airway, but they present increased risk of aspiration. Uncuffed TTs allow some patients to speak when the tube is in place.
Pilot balloon / cuff inflation line	Controls the inflation, deflation of the cuff.

Data source: BTS, 2014

Figure 10.3 shows a cuffed TT in situ (in place). Note the flow of air only occurs in and out of the TT. People with these kinds of TTs cannot talk because no air is allowed to pass the larynx. Figure 10.4 shows an uncuffed TT in situ. The flow of air occurs in and out of the TT and through the natural airway. People with these kinds of TTs can talk by covering the trach tube opening to force all expired air through the larynx.

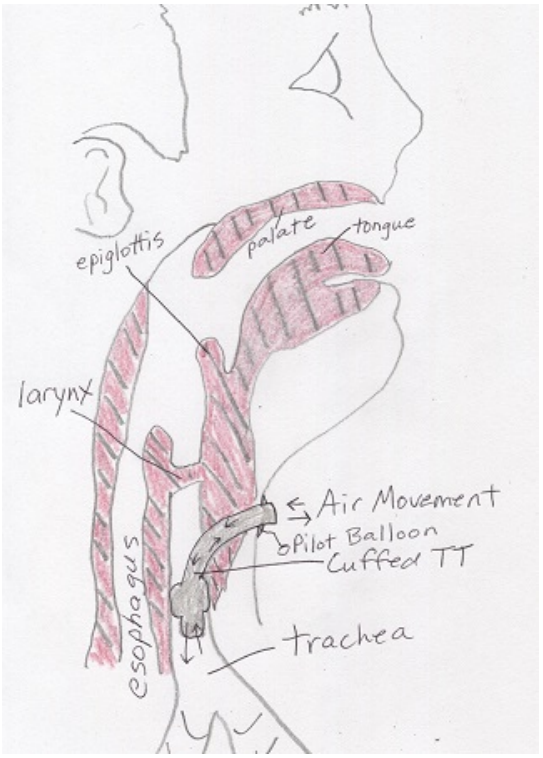


Figure 10.3 Cuffed TT

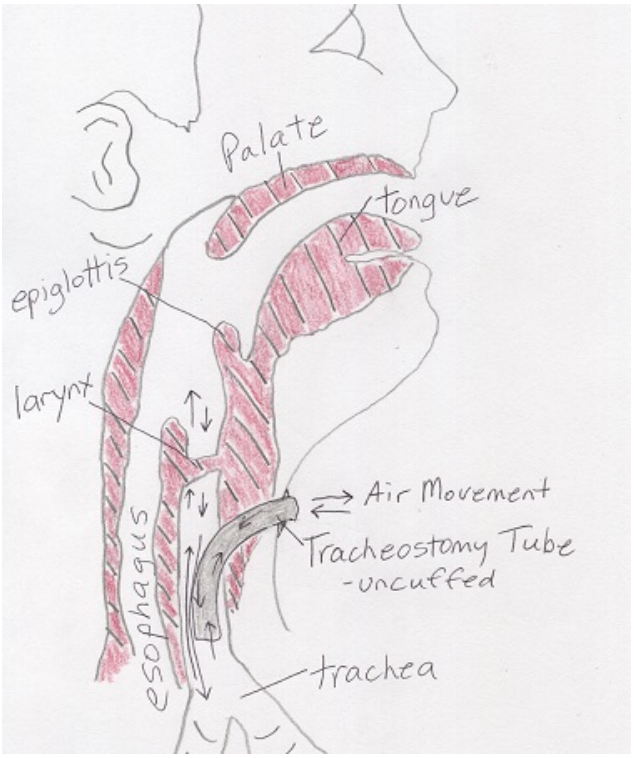


Figure 10.4 Uncuffed TT

Watch the video *Tracheostomy Tubes – inflated versus deflated Cuff* by Heather Noyes and Wendy McKenzie Thompson Rivers University (2019)

Fenestrated TTs have a number of holes in the outer cannula to allow air to flow from the lungs over the vocal cords. They can be used in conjunction with an uncuffed TT often when weaning the patient from the TT. They are only to be used with patients who can swallow without risk of aspiration (St. George's University Hospital, n.d.).

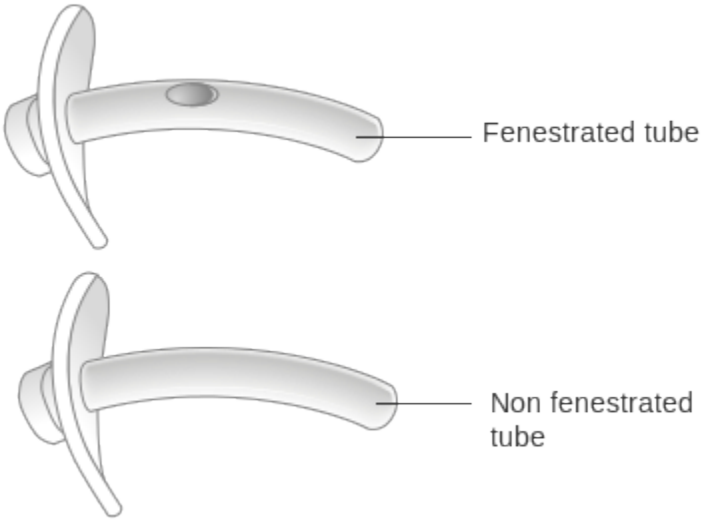


Figure 10.5 Fenestrated versus non-fenestrated tube

Other considerations for persons with TTs:

- Patients often need to lie at a 30-degree, or greater, angle to facilitate breathing and lung expansion.
- All persons with a tracheostomy must have suction equipment and emergency supplies at the bedside. Emergency equipment is usually in a clear bag on an IV pole attached to the patient's bed.
- People with tracheostomies cannot eat or drink (and often have difficulty swallowing) when the cuff is inflated. These people are NPO because of risk of aspiration.
- People with cuffed tracheostomies cannot talk because air cannot bypasses the larynx. As such, finding alternative forms of communication is paramount. For some, a permanent tracheostomy has led them to acquire a speaking valve (BTS, 2014). Others may use fenestrated TTs to help them communicate through speech (The Ohio State University Wexner Medical Center, 2012). (See Figure 10.5.)
- People with a tracheostomy must always have the tracheostomy tied securely around the neck using ties, according to agency policy. This prevents the tube from accidentally falling out.
- Patients with a tracheostomy produce more secretions than usual and may not be able to clear secretions from the tracheostomy with coughing. If secretions in the tracheostomy impair air entry and cause respiratory distress, the patient should be suctioned immediately.
- Persons who breathe through a tracheostomy bypass the upper airway where moisture is added to the breath. As such, dry air can dry out airways and cause possible tube blockage from tenacious sputum. Some patients with tracheostomies, particularly in the immediate

post op period, require humidity (RCH, n.d.). Humidification may also help to prevent ulceration of the tracheal mucosa, sputum retention, atelectasis, impaired gas exchange, and secondary infection (BTS, 2014).

- To optimize respiratory function and oxygenation, care should include physio, mobilization, hydration, suction, and medications as appropriate (BTS, 2014).
- New tracheostomies require attention to principles of asepsis for stoma (wound) care. Tracheostomies that are well established require clean technique for stoma care.

Potential Complications Associated with Tracheostomies

Early potential complications post tracheotomy may include hemorrhage, pneumothorax, subcutaneous emphysema, cuff leak, tube dislodgement, and respiratory/cardiovascular arrest. Complications occurring later, after the tracheostomy is established, may include airway obstruction, fistulae, infection, aspiration, and tracheal damage/erosion. Table 10.3 outlines potential complications, prevention strategies and interventions if the complication does occur.

Table 10.3 Potential Complications Associated with Tracheostomies, Prevention and Interventions

Complication	*Prevention*	*Interventions*
Hemorrhage	• Assess stoma for bleeding (excessive suctioning may also result in blood-streaked secretions). • Report neck swelling. • Report vigorous pulsation around the trachea.	• Inflate cuff. • Suction. • Notify physician immediately if you suspect bleeding. • CODE BLUE if pulsating frank blood. • Monitor vital signs. • Apply pressure to bleed if possible.
Stomal / pulmonary infection	• Perform dressing changes and tracheostomy care every 8 hours, and as needed. • Use sterile technique for tracheostomy suctioning (open method) prn. • Use clean technique for tracheostomy care. • Use humidified oxygen or air. • Perform respiratory assessment. • Have patient do deep breathing and coughing (DB&C) exercises every 2 to 4 hours, and as needed. • Maintain hydration. • Take vital signs often (as per patient condition or agency guidelines).	Wounds are often kept moist by secretions and/or humidity. Moisture impairs healing. Closed (in line) suction technique does not require sterile gloves. Humidity and hydration help to liquefy secretions for easier expectoration. Report potential signs of infection: • Redness • Sweeping • Purulent drainage • Fever • Abnormal breath sounds • Increased secretions • Decreased oxygen sats Routine instillation of NS to promote expectoration is not considered best practice.

Tube occlusion	• Keep inner cannula of dual tracheostomy tube in situ. • Check patency of single-lumen tracheostomy tube regularly. • Clean inner cannula every 8 hours at a minimum, and as needed. • Maintain humidification and hydration • Do DB&C exercises every 2 to 4 hours, and as needed. • Suction as needed.	The inner cannula is a safety feature, and can be removed if occlusion occurs. Whenever possible use double lumen tubes for this reason. If tube occludes: • Place patient supine to expose neck and check for tube dislodgement. • Try ventilation using ambu-bag, but do not force air entry. • If unable to ventilate, try suction • Remove inner cannula if suction catheter still does not pass; check patency and replace with new inner cannula. • If still unable to ventilate, deflate cuff or cuffed tube and notify physician and/or respiratory therapist. • If patient is still unable to ventilate, call CODE BLUE and cut tie tapes, remove tracheostomy tube, insert dilators, and hold stoma open with tracheal dilators until trained health care professional is able to reinsert a tracheostomy tube.
Aspiration	• All persons with a tracheostomy require a swallow assessment (usually requires a physician order) prior to oral feeding. • No swallow assessment or feeding occurs when cuff is inflated. • Consult speech and language therapist. • Patient should be placed in a semi- to high-upright sitting position. • Ensure cuff is inflated and check cuff pressure once per shift and as needed. • Always suction above cuff prior to cuff deflation.	High Fowler's positioning promotes lung expansion. During swallow assessment, helps to reduce risk of aspiration if the patient begins to choke. Report any signs of aspiration: • Excessive coughing and gagging (particularly with eating and drinking) • Increased or changed secretions • Presence of food in secretions • Drop in O_2 sats If patient vomits: • Inflate cuff, if present. • Suction immediately. • Raise head of bed; sit patient upright.

Accidental decannulation	• Tracheostomy ties must be secure. • Secure new ties *before* removing old ties. • Assess patient for restlessness/ confusion.	If partial decannulation occurs (air movement is felt from tube): • Deflate cuff if inflated. • Remove inner cannula and insert obturator. • Gently reinsert tube while holding obturator in place. • Remove obturator and replace inner cannula. • Check correct placement. ◦ Feel for air movement from tube. ◦ Check patient's O_2 sats. ◦ Ensure patient's breathing returns to baseline. • Ensure tie tapes are secure and cuff is inflated, if ordered. If complete decanulation occurs, call for trained health care professional to reinsert tracheostomy tube. In the meantime: • Maintain tracheal airway and ventilation with bag tracheostomy mask as best as possible. • Protect airway from foreign-body aspiration. • If stoma is less than 7 days old, use tracheal dilators to maintain stoma potency if necessary. • If patient is not ventilating adequately, close stoma and ventilate with bag and face mask with 100% O_2 until CODE team arrives. If patient has known upper-airway obstruction, or a laryngectomy, ventilate via stoma with a tracheostomy or pediatric mask.
Note: Do not hyper-extend neck if patient has a known or suspected neck injury.		
Data sources: BCIT, 2015b; BTS 2014; Vancouver Coastal Health, 2012a		

Emergency equipment should be available at the bedside and should accompany the patient off the unit. Check the agency policy to confirm contents. A basic kit should include:

1. Suction equipment (portable unit if necessary).

2. Oxygen equipment with humidification.
3. An emergency bag containing (see Figure 10.6):

    - Two replacement tracheostomy tubes (one of the same size, and one a smaller size than the current tube)
    - Obturator and spare inner cannula
    - 10 ml syringe
    - Tracheal dilators
    - Sterile gloves
    - Water-soluble lubricant
    - Scissors
    - Cotton tip applicators
    - Trach ties
    - Sterile gauze
    - Resuscitation bag and mask (appropriate size for patient)

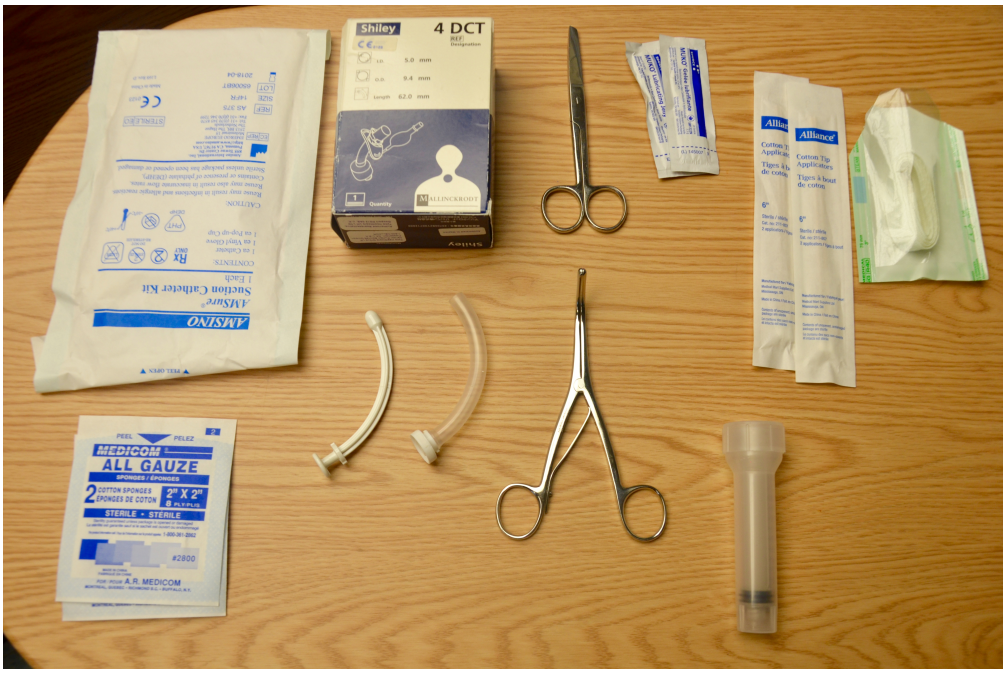


Figure 10.6 Emergency equipment for persons with a tracheostomy. Clockwise from top left: sterile gloves, spare tracheostomy tube, scissors, lubricant, cotton-tip applicators, ties, 10 ml syringe, tracheal dilators, inner cannula, obturator, sterile gauze

Tracheostomy Care

Tracheostomy care is performed routinely and as required. Tracheostomy care is essential to avoid potential complications such as obstruction and infection. In addition to suctioning, tracheostomy care includes: changing, cleaning and replacing the inner cannula; changing the site dressing; and replacing the tracheostomy ties.
If possible, these three tasks of tracheostomy care should be performed at the same time to minimize handling of the tracheal device. Collect all supplies at once and complete the procedure in the order listed above. However, there may be times when each task may be performed separately. Ongoing assessment is essential when caring for a patient with a tracheostomy. Checklists 84-87 provide guidelines to do these things.

Additional care includes performing more frequent respiratory assessments and checking patency of tracheostomy tube to assess if suction is required (every two hours, and as needed) according to agency policy; keeping patient well hydrated (helps keep secretions thin); encouraging deep breathing and coughing (as required); reporting potential problems such as swelling, elevated temperature, change in sputum production, and decreasing or increasing O_2 requirements.

> Watch the video *Replacing and Cleaning an Inner Tracheal Cannula* by Heather Noyes and Wendy McKenzie Thompson Rivers University (2019)

Tracheal Suctioning

The purpose of suctioning is to maintain a patent airway, to remove secretions from the trachea and bronchi, and to stimulate the cough reflex (Vancouver Coastal Health, 2006). Patients with tracheostomies often have more secretions than normal and will require suctioning to remove secretions from the airway to prevent airway obstruction. People with a tracheostomy should be assessed frequently to determine if suctioning is required. In hospital, sterile suction equipment is used each time tracheal suctioning is performed unless you are using an in line suction catheter which can be used for several suction procedures (Perry et al., 2018). In the home environment, it is common and accepted practice to use “clean” rather than sterile technique during suctioning. The basis of this being that home microorganisms are a part of the person’s normal flora and less likely to make them sick (Lewarski, 2005).

Tracheal suctioning is indicated with noisy (moist) respirations, decreased O_2 sats, anxiousness, restlessness, increased respirations or work of breathing, change in skin colour, or wheezing or gurgling sounds. These are signs and symptoms of respiratory distress, and the patient should be suctioned immediately. Checklist 84 outlines the steps for tracheal suctioning.

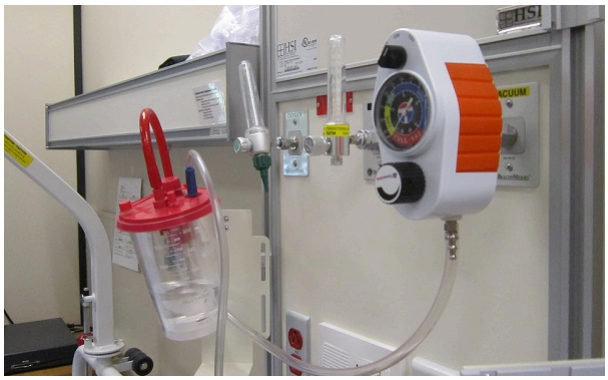
Checklist 84: Tracheal Suctioning—Open Method

Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Perform hand hygiene.
- Complete QPA including safety.
- Suctioning can cause increased intracranial pressure in patients with head injury. The nurse can reduce this risk by hyperoxygenating the patient before suctioning and/or limiting the number of times a suction catheter is inserted into the trachea. Pre-hyperoxygenate patient if required, and as per agency policy.
- Apply principles of asepsis for tracheal suctioning in acute care. Clean technique may be used in home settings.
- Perform point of care risk assessment for PPE. Donne face shield, gown, gloves (sterile or clean depending on setting).

Steps	*Additional Information*
1. Assess need for suctioning including respiratory assessment, signs of hypoxia, excess secretions, or alterations in oxygen levels.	Perform baseline respiratory assessment including SpO_2. Determine if the patient is on any medications that increase risk of bleeding.
2. Explain the procedure in a calm, reassuring manner explaining the benefits are to remove secretions and to make breathing easier. Position the patient in semi to high Fowler's unless contraindicated. Drape chest with towel or disposable pad.	Procedure can cause patient anxiety. This is part of the consent procedure. Positioning promotes lung expansion and promotes secretion clearance.

3. Perform hand hygiene. Gather equipment.	Equipment should include suction canister, regulator, suction tubing, sterile suction catheter, water soluble lubricant, PPE (face shield, sterile gloves, gown), sterile saline or water, and pulse oximeter. Preparing equipment ahead of time promotes safety, organization, and timeliness.
4. Administer oxygen if needed. This includes hyper-oxygenating if necessary.	Hyper-oxygenating might be necessary if the patient is hypoxic or at risk of hypoxia during procedure.
5. Turn the suction device on, and set the vacuum regulator to the appropriate negative pressure. Set suction levels to medium / moderate. Attach the suction catheter to the tubing whilst remaining in the sterile package. Open the sterile water / saline.	 *Portable suction unit*  *Figure 10.7 Wall suction unit* Suction setting: • Adult 80 to 100mmHg • Children 60 to 80 mmHg • Not to exceed 150 mmHg Excessive negative pressure damages mucosa and induces greater possibility for hypoxia.

6. Perform hand hygiene and perform point of care risk assessment. Donne PPE.	At minimum, PPE should include face shield and gloves (gown is highly recommended). This prevents transmission of microorganisms to healthcare provider. Sterile gloves in acute care environments. Clean gloves in home environments.
7. Sterile procedure: Apply sterile gloves With the non-dominant hand, pick up the packaged connecting tubing. That hand is now contaminated. Expose the suction catheter enough to allow the dominant hand (sterile) to grab the sterile catheter. Wrap the sterile catheter around the dominant hand. Suction a small amount of sterile NS / water.	 *Apply sterile glove to each hand or apply non-sterile glove to non-dominant hand and sterile glove to dominant hand* You can also apply a non-sterile glove to the non-dominant hand and a sterile glove to the dominant hand. There is more than one way to remove the catheter from the packaging. The principle of sterile to sterile must apply to the tip of the suction catheter.  *Suction is initiated by covering the hole on the suctioning tube with your thumb* Suctioning sterile NS / water ensures properly functioning equipment.

8. Insert suction catheter into tracheostomy until resistance is felt, then pull back about 1 cm. Do *not* apply suction when inserting suction catheter.	 *Insert suction catheter into tracheostomy until resistance is felt, then pull back about 1 cm* Resistance is felt at the level of the patient's carina.
9. Apply intermittent suction as the catheter is withdrawn. This means occluding and releasing the catheter vent with the non-dominant thumb. Some sources suggest twist the catheter back and forth as the catheter is withdrawn. Always encourage the patient to cough.	Do not apply suction for longer than 15 seconds. Suction removes oxygen and increases the risk of hypoxia as oxygen is sucked out. The need to rotate the catheter is questioned in the literature because present day suction catheters have multiple eyes / holes. Encourage coughing to promote secretion clearance. Routine installation of normal saline into the trachea to loosen and mobilize secretions is not best practice. If a sterile sputum sample is required, follow agency policy for specific directions related to type of equipment in the agency.
10. Replace oxygen delivery device and encourage deep breaths.	Promotes oxygenation.

11. Clear secretions from suction catheter by suctioning sterile normal saline or water from sterile container.	 *Clear secretions from suction catheter by suctioning sterile normal saline or water from sterile container* Clears tubing of secretions to maintain patency.
12. Assess need to repeat the procedure. Reassess respiratory status and O_2 saturation for improvements.	Allow periods of rest between suction. The length of time between suctioning depends on patient tolerance. Patient may be suctioned up to three times with the same suction catheter. Do not pass (insert) suction catheter more than three times. Declining SpO_2 suggests the patient is not tolerating the procedure. Consult the prescriber and/or respiratory therapist. Call for help if any abnormal signs and symptoms appear, or if respiratory status does not improve.
13. Discard suction catheter, sterile saline / water, and sterile gloves. Turn off suction. Remove gloves. Perform hand hygiene. Ensure supplies are readily available at the bedside for next suction procedure.	Open suctioning method requires new suction catheter after each round of suctioning. Reuse may introduce microorganisms into the patient's respiratory tract increasing risk of infection.  *One way to dispose of the suction catheter is to pull your glove over top of the catheter.* Additional suction supplies are essential in case of an emergency or respiratory distress.

14. Return patient to a safe and comfortable position and ensure that call bell is within patient's reach.	This promotes patient safety.
15. Document procedure according to agency policy.	Documentation may include the suction procedure; patient reaction; amount, thickness, and color of secretions; if normal saline was instilled; and if sputum samples were sent to the lab. Documentation provides accurate details of response to suctioning and clear communication among the health care team. Sample narrative documentation: *date / time: Audibly moist respirations. Thick yellow tinged secretions observed at trach site. T 37.5 HR 98 RR 24 BP 146/79. SpO_2 90% on 40% humidified oxygen @ 10L/ min. Trach suctioned with #14 suction catheter for moderate think yellow secrrtions. Cough reflex apparent. Following procedure RR 20/min. SpO_2 98%. O_2 reestablished as noted above. —— L,Owox RN*
Data sources: BCIT, 2015c; Halm & Krisko-Hagel, 2008; Perry et al., 2018; Vancouver Coastal Health, 2006	

A closed method of tracheal suctioning involves a multi-use suction catheter enclosed in a plastic sleeve and attached to the patient's airway (tracheal tube). In comparison to the open suction method, the closed method presents less risk of hypoxia and cardiovascular complications. To initiate closed suctioning, consult a respiratory therapist.

Watch the video *Tracheal Suctioning – Closed in line Method* developed by Heather Noyes and Wendy McKenzie of Thompson Rivers University, 2018.

Replacing and Cleaning an Inner Tracheal Cannula

The primary purpose of the inner cannula is to prevent tracheostomy tube obstruction. Many sources of obstruction can be prevented if the inner cannula is regularly cleaned and replaced. The inner cannula can be cleansed with half-strength hydrogen peroxide or sterile normal saline. Always check the manufacturer's recommendations for tube cleaning. Some inner cannulas are designed to be disposable, while others are reusable for a number of days. Inner tube cleaning

should be done as often as two or three times per day, depending on the type of equipment, the amount and thickness of secretions, and the patient's ability to cough up the secretions.

Changing the inner cannula may encourage the patient to cough, bringing mucous out of the tracheostomy. For this reason, the inner cannula should be replaced prior to changing the tracheostomy dressing to prevent secretions from soiling the new dressing. If the inner cannula is disposable, no cleaning is required. Checklist 85 describes how to clean and replace an inner tracheal cannula.

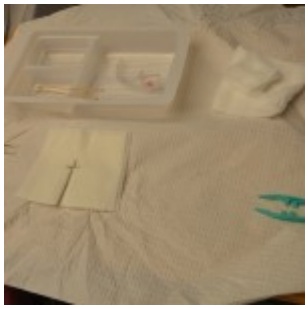
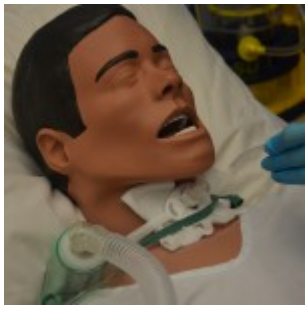
Checklist 85: Replacing and Cleaning an Inner Tracheal Cannula

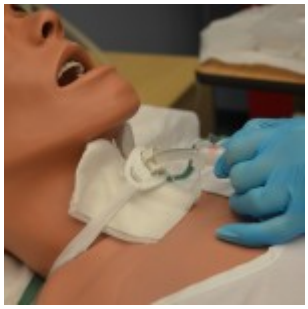
Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Reassess your patient's tolerance for tracheostomy care and watch for signs of respiratory distress.
- Pre-hyperoxygenate patient if required and according to agency policy.
- If removing oxygen while performing tracheostomy care, remember to replace it often to reoxygenate the patient.
- Disposable inner cannulae should be inspected / cleaned every 8 hours, or as needed.
- Disposable inner cannulae should be inspected every 8 hours (during tracheostomy care), and replaced every 24 hours and as needed.

Steps	*Additional Information*
1. Perform hand hygiene, collect supplies, and verify whether inner cannula needs to be cleaned as per policy.	Supplies include cotton-tip applicator, sterile pipe cleaner, sterile dressing tray, NS, non-sterile gloves, waterproof pad, and PPE.
2. Perform hand hygiene, ID patient using two identifiers, explain procedure to patient, and create privacy if required. Ensure patient has a method to communicate with you during the procedure.	Hand hygiene reduces the transmission of microorganisms. People with tracheostomies require a method to communicate with the healthcare provider.
3. Apply gloves and PPE , and cover chest with waterproof pad.	This prevents contact with secretions and prevents gown from becoming soiled. Use sterile technique in acute care, clean technique in home environments.

4. Set up sterile tray field; add cleaning solution and supplies.	Organization ensures the process is efficient and fast for the patient.  *Set up sterile tray and add cleaning solution and supplies*
5. Remove oxygen mask to clean dressing, but replace frequently as required by patient.	 *Remove oxygen mask to clean dressing* Replace the tracheal oxygen mask frequently to prevent hypoxia.

6. Remove inner cannula by stabilizing neck plate / flange and gently grasping the outer white area. Rotate inner cannula counter-clockwise to unlock it. Pull cannula out in a downward motion. Some inner cannulae will “click” on, some twist on/off. Do not touch the inner cannula; only handle the white outer area unless you are wearing sterile gloves. Replace the client’s oxygen while cleaning the inner cannula to prevent the client from desaturating or drying out secretions	Review policy for cleaning frequency and cleaning solution.  *Remove inner cannula by stabilizing neck plate / flange and gently grasping the outer white area*
7. Soak inner cannula in saline, if necessary, use a sterile pipe cleaner or cotton tipped applicators with gauze to remove exudate from the inner lumen. Rinse well.	Soaking the cannula helps loosen the secretions.  *Use a sterile pipe cleaner to remove exudate from the inner cannula*
8. Reinsert inner cannula by stabilizing neck plate, holding the white part with the end upright, and twisting into the shape of the tracheostomy.	This prevents trauma to the tracheal stoma.

9. Ensure the inner cannula has “clicked” into place. Use sterile gauze to clean the outer cannula surfaces	 *Ensure that inner cannula is “clicked” securely into place*
10. Discard used equipment. Remove gloves. Perform hand hygiene. Ensure the patient is in a safe and comfortable position.	Hand hygiene reduces the transmission of microorganisms.
Data sources: BCIT, 2015c; Morris, Whitmer, & McIntosh, 2013; Perry et al., 2018; Vancouver Coastal Health, 2012b	

Watch the video *Replacing and Cleaning an Inner Tracheal Cannula* by Heather Noyes and Wendy McKenzie Thompson Rivers University (2019)

Cleaning Stoma and Changing the Tracheosotomy Site Dressing

The stoma should be cleaned and the dressing changed every 6 to 12 hours or as needed, and the peristomal skin should be inspected for skin breakdown, redness, irritation, ulceration, pain, infection, or dried secretions. Patients with copious amounts of secretions often require frequent dressing changes to prevent maceration of the tissue and skin breakdown. Cotton-tip applicators can be used to get under the tracheostomy device, where cleaning can be done using a semi-circular motion, inward to outward. Always use aseptic technique. Checklist 86 provides a safe method to clean the tracheal stoma and replace the sterile dressing.

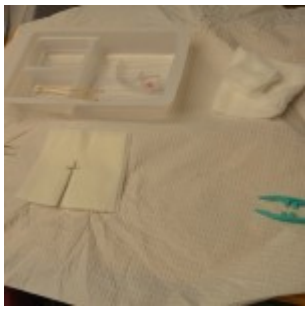
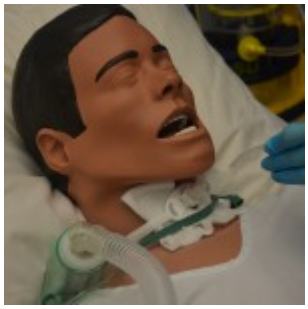
Checklist 86: Cleaning Stoma and Changing a Sterile Dressing

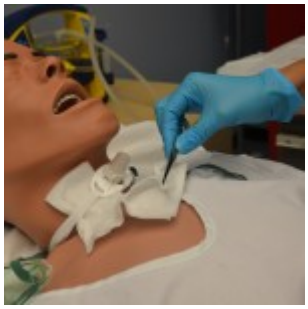
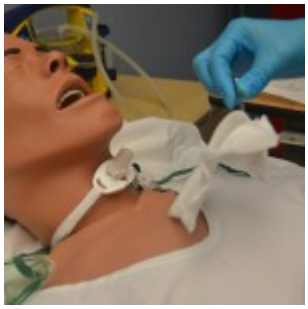
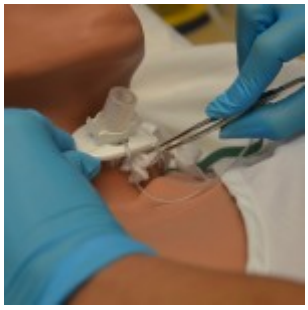
Disclaimer: Always review and follow your agency policy regarding this specific skill.

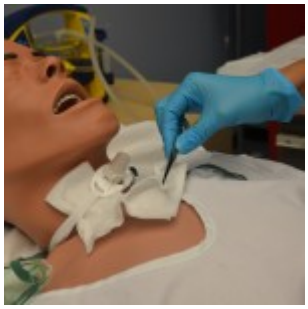
Safety considerations:

- Reassess your patient's tolerance for tracheostomy care and watch for signs of respiratory distress.
- Pre-hyperoxygenate patient if required and according to agency policy.
- If removing oxygen while preforming tracheostomy care, remember to replace it often to reoxygenate the patient.

Steps	*Additional Information*
1. Perform hand hygiene, verify physician orders for tracheostomy care, and collect supplies.	Supplies include sterile dressing kit, pre-cut 4 × 4 gauze, normal saline, cotton-tip applicators, non-sterile gloves, and garbage bag. Pre-cut gauze is less likely to have loose fibers that could potentially enter wound and delay healing.
2. Perform hand hygiene, ID patient using two identifiers, explain procedure to patient, and create privacy if required. Ensure patient has a method to communicate with you during the procedure.	This reduces the transmission of microorganisms. Patients with trachs always require a method to communicate with the healthcare provider.
3. Apply non-sterile gloves and cover chest with waterproof pad.	This prevents gown from becoming soiled.

4. Sanitize your working surface. Organize all supplies and set up sterile tray field; add cleaning solution to sterile tray.	Use agency approved cleaning solutions to wipe table tops. Organization ensures the process of cleaning is efficient.  *Set up sterile tray and add cleaning solution and supplies*
5. Remove oxygen mask to access the dressing but replace frequently as required by patient.	This prevents hypoxia.  *Remove oxygen mask to clean dressing*

6. Using forceps, remove the soiled dressing around the tube and discard in garbage bag.	All soiled dressings should be removed, as they may excoriate the surrounding peristomal skin.  *Use forceps to remove the soiled dressing*
7. Assess the stoma site for bleeding, appearance of stoma edges, and peristomal skin for evidence of infection or redness (assess for increase in pain, odour, or abscess formation).	Assessment is important to identify and prevent further complications.  *Assess stoma site*
8. Clean the stoma site (including under faceplate) with a gauze or cotton-tip applicator soaked in normal saline. Clean in circular motion from the stoma outwards. Be careful not to disturb the tracheostomy tube. Dry area.	Cleaning around the stoma removes any debris or exudate from the stoma. A tracheal stoma should be cleaned with normal saline. 

9. Assess the site to determine if skin protection (ie. barrier film)is required.	Consult wound care specialist if needed. Skin protectant is sometimes necessary to prevent further skin breakdown.
10. Apply new manufactured pre-cut tracheostomy dressing to tube using sterile forceps.	Use non-fraying material as a dressing round the stoma. Avoid cutting gauze for tracheostomy care. The small fibres from the cut gauze may become loose and accidentally travel into the inner cannula.  *Apply new manufactured pre-cut tracheostomy dressing to tube using sterile forceps*
Data sources: BCIT, 2015c; Morris et al., 2013; Perry et al., 2018; Vancouver Coastal Health, 2012	

Watch the video *Changing a Trachestomy Site Dressing*by Heather Noyes and Wendy McKenzie Thompson Rivers University (2019)

Tracheal ties will become dirty and require replacing. Ties should be replaced as required, according to agency policy. Ideally, one person should hold the tracheostomy tube in place while the tracheostomy ties are replaced by another person. Alternatively, secure the new tracheostomy ties prior to removing the old tracheostomy ties to avoid accidental dislodgement of the tracheostomy tube if the patient coughs or the tracheostomy is accidentally bumped out. Once the new tracheostomy ties are on, only one finger should fit between the tracheostomy ties and the neck.

Replacing Tracheostomy Ties (Velcro)

Checklist 87 lists the steps for replacing tracheostomy ties.

Checklist 87: Replacing Tracheostomy Ties (Velcro)

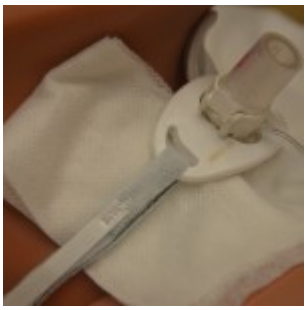
Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

- Reassess your patient's tolerance for tracheostomy care and watch for signs of respiratory distress.
- Pre-hyperoxygenate patient if required and according to agency policy
- If removing oxygen while preforming tracheostomy care, remember to replace it often to reoxygenate the patient.

Steps	*Additional Information*
1. Perform hand hygiene, collect supplies. Assess need for PPE	Hand hygiene reduces the transmission of microorganisms. Supplies include twill or Velcro ties, a second person to secure the tracheostomy when old ties are removed, scissors if using twill tape ties.
2. Have an additional health care provider assist with the tracheal tie change as required.	An additional helper is there to secure the trachestomy tube and prevent accidental dislodgement.

3. ID patient using two identifiers, explain procedure to patient, and create privacy if required. Ensure patient has a method to communicate with you during the procedure.	Persons with a tracheostomy require a method to communicate with the health care provider.
4. Apply non-sterile gloves.	This reduces the transmission of microorganisms. 

5. To secure the tracheostomy tube with velcro ties: • If patient is at risk of tracheostomy dislodgement due to confusion or agitation, replace velcro with ribbon tapes. • If possible, one health care worker can keep the tracheostomy tube in place by holding the flange with gloved hands, while the other can replace the tapes. • Thread the narrow velcro tab through the slit in the flange of the tracheostomy tube and fold it back to adhere to the main tube holder; repeat on other side. Overlap the shorter length of collar with the longer length of collar and secure with the wider velcro tab. Trim any excess length of collar to fit the size of the patient's neck. • Check how secure the collar feels. Ensure you can fit two fingers between the collar and the patient.	Tracheostomy ties are used to promote patient comfort and keep the tracheostomy secured and in situ. An assistant can hold the trach tube in place to reduce risk of potential dislodgement of the tube if the patient coughs.  *Velcro ties* The tape should be tight enough to keep the tracheostomy tube securely in place but loose enough to allow the little finger to fit between the tapes and the neck.
6. Clean the work area. Discard garbage appropriately. Perform hand hygiene. Leave the patient in a comfortable position.	Hand hygiene reduces the transmission of microorganisms.
Data sources: BCIT, 2015c; Morris et al., 2013; Perry et al., 2018	

Watch the video *Replacing Tracheostomy Ties* by Heather Noyes and Wendy McKenzie Thompson Rivers University (2019)

Critical Thinking Exercises

1. When suctioning your patient who has a tracheostomy, you notice thick, tenacious secretions. What interventions should be implemented?
2. What methods of communication can you use for your patient with a tracheostomy tube who is unable to speak?
3. Answer yes or no in relation to whether or not each of the following situations presents a concern:

a) If a person has a cuffed tracheostomy in place requires manual ventilation, such as with a bag and mask via the nose, will this deliver oxygen to the patient?

b) A suction catheter cannot pass through a tracheostomy.

c) A patient with an tracheostomy tube that has an inflated cuff is able to talk.

d) Decannulation occurred 4 days ago. The occlusive dressing has fallen off. The wound is now closed.

Attributions

Figure 10.1. Untitled by pixabay.com is used under an open Pexels license.

Figure 10.2. Tracheostomy Tube by Klaus D. Peter is used under a CC BY 2.0 DE license.

Figure 10.3 & 10.4. These are modified reproductions of "Diagram of an inserted endotracheal tube" by PhilippN in the Public Domain / A derivative from the original work.

Figure 10.5. Diagram Showing a Fenestrated and a Non Fenestrated Tracheostomy Tube by Cancer Research UK is used under a CC BY-SA 4.0 international license.

Figure 10.6 Emergency equipment is from BCIT

Figure 10.7 WAll suction unit by author is

10.6 Chest Tube Drainage Systems

A **chest tube**, also known as a thoracic catheter, is a sterile tube with a number of drainage holes inserted into the pleural space (see Figure 10.8). The pleural space is the space between the parietal and visceral pleura, and is also known as the pleural cavity (see Figures 10.9). A patient may require a chest drainage system any time the negative pressure in the pleural cavity is disrupted and causes respiratory distress. Negative pressure is disrupted when air, or fluid and air, enters the pleural space and separates the visceral pleura from the parietal pleura, preventing the lung from fully expanding and collapsing. Small amounts of fluid or air accumulating in the pleural space are often absorbed by the body without a chest tube.

Figure 10.10 demonstrates a pneumothorax. A large amount of fluid or air cannot be absorbed by the body and will require a drainage system in order to optimize oxygenation (Bauman & Handley, 2011; Perry et al., 2018). Another type of chest tube called a Heimlich valve is discussed later in this chapter.

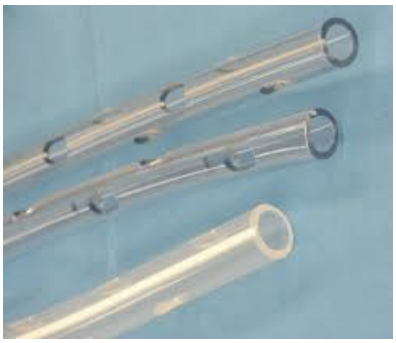


Figure 10.8 Chest tube samples; note the various holes

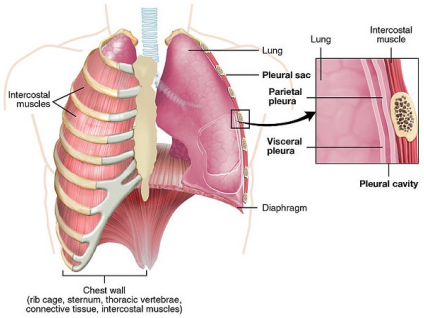


Figure 10.9 Chest wall structure; note the lung's pleura

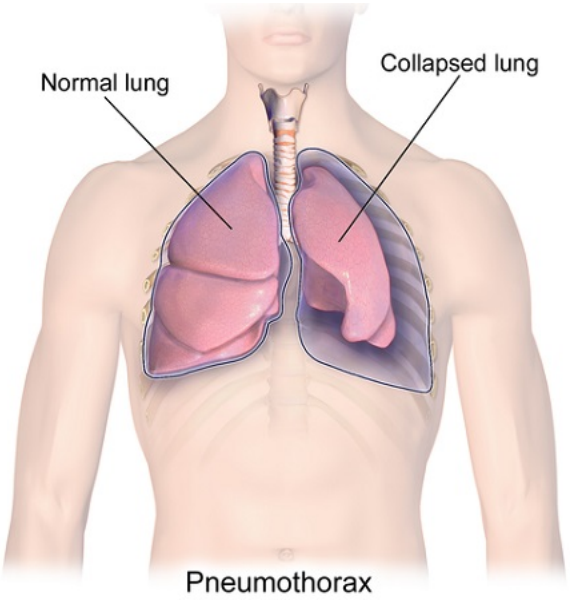


Figure 10.10 Pneumothorax

The location of the chest tube depends on what is being drained from the pleural cavity. If air is in the pleural space, the chest tube will be inserted above the second intercostal space at the mid-clavical line. If there is fluid in the pleural space, the chest tube is inserted at the fourth

to fifth intercostal space, at the mid-axillary line. A chest tube may also be inserted to drain the pericardial sac after open heart surgery. These tubes are placed directly under the sternum and are referred to as mediastinal chest tubes (Perry et al., 2018).

Some conditions that may require a chest tube drainage system include (Bauman & Handley, 2011; Perry et al., 2018):

- Pleural effusion
- Pneumothorax
- Hemothorax
- Spontaneous pneumothorax
- Tension pneumothorax
- Traumatic pneumothorax (stab or gunshot wound)
- Cardiac tamponade (accumulation of blood surrounding the heart after open heart surgery or chest surgery)

Chest Tube Drainage Systems

A chest tube is connected to a closed chest drainage system, which allows for air or fluid to be drained and prevents air or fluid from entering the pleural space. Because the pleural cavity normally has negative pressure, which allows for lung inflation and deflation, any tube connected to it must be sealed so that air or liquid cannot enter the space where the tube is inserted (Bauman & Handley, 2011; Rajan, 2013). In a chest drainage system, a water seal provides that protection. Chest tube drainage systems are sterile and disposable and consist of either two or three compartments (see Figure 10.11). The traditional chest drainage system typically has three chambers (Bauman & Handley, 2011; Rajan, 2013). Figure 10.12 illustrates how a chest drainage system works. Note how the three chambers are connected and the path that air (pneumothorax) or blood (hemothorax) would take if the chest tube were attached to such a system.

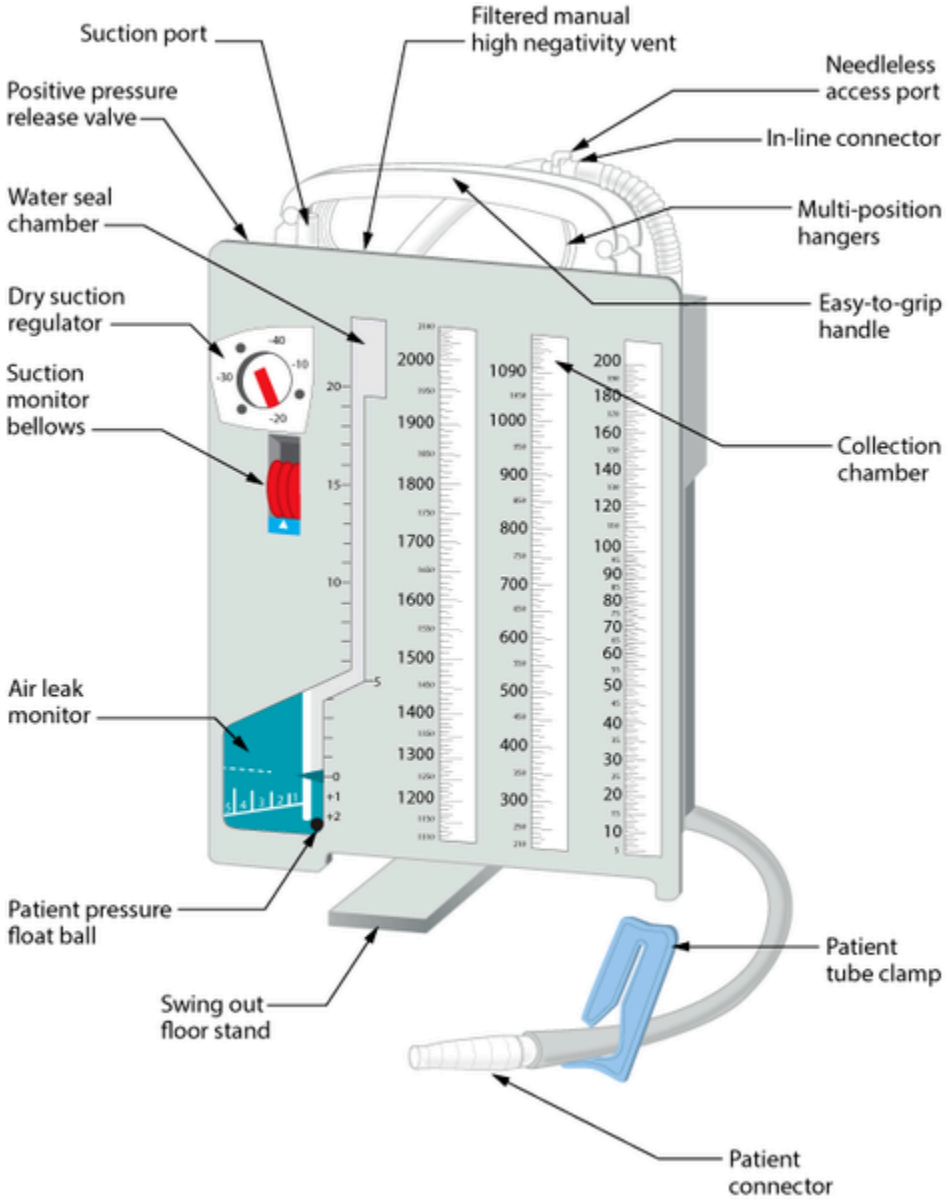


Figure 10.11 Chest tube drainage system with labels

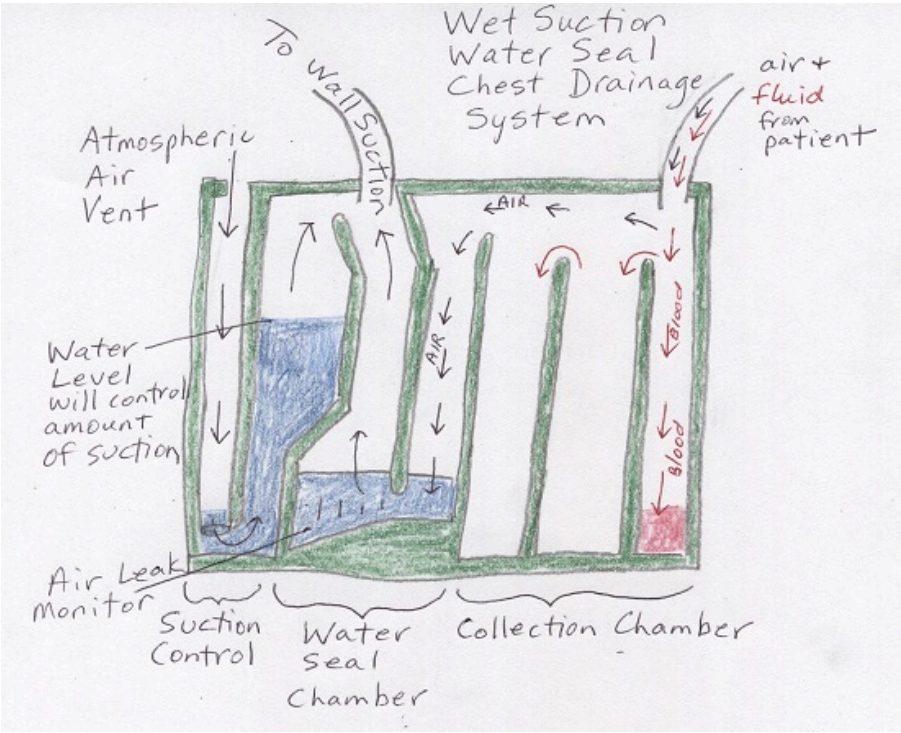


Figure 10.12 Under water seal drainage system

Always review what type of system is used in your agency, and follow the agency's and the manufacturer's directions for setup, monitoring, and use. An explanation of the different chambers in is order:

1. Collection chamber: The chest tube connects directly to the collection chamber, which collects drainage from the pleural cavity. The chamber is calibrated to measure the drainage. The outer surface of the chamber has a "write-on" surface to document the date, time, and amount of fluid. This chamber is typically on the far right side of the system (Teleflex Medical Incorporated, 2009).
2. Water-seal chamber: This chamber has a one-way valve that allows air to exit the pleural cavity during exhalation but does not allow it to re-enter during inhalation due to the pressure in the chamber. The water-seal chamber must be filled with sterile water and maintained at the 2 cm mark to ensure proper operation, and should be checked regularly. Fill with additional sterile water as required. The water in the water-seal chamber may rise with inhalation and fall with exhalation (this is called ***tidaling***), which demonstrates that the chest tube is patent. Tidaling can also be seen in the drainage tube that connects the patient to the chest drainage unit. Note the differences between dry suction systems and wet suction systems in terms of what bubbling means (see Table 10.4). Some chest drainage systems have a feature that allows for measurement of air leaks—the higher the number, the

greater the air leak. The water-seal chamber can also monitor intrathoracic pressure (Teleflex Medical Incorporated, 2009). Some systems have dry seal technology that serves the same purpose (Teleflex, 2018).

3. Suction control chamber: Chest drainage systems can function either via wet or dry suction. Not all patients require suction. If suction is ordered, knowing the type of drainage system you have and how it works will allow you to ensure it is working correctly (Teleflex Medical Incorporated, 2009).

In addition to the three chambers, the drainage system has many safety features to ensure that high negative pressures can be monitored and relieved quickly. To review these safety features and additional information regarding the chambers of a closed chest tube drainage system, visit the Teleflex Medical Incorporated website.

Sometimes the prescriber will order a chest tube attached to suction to facilitate rapid drainage. In this case, the amount of suction should be prescribed. Chest drainage systems designs include dry suction systems and wet suction systems. Table 10.4 outlines the key differences between dry and wet suction units.

Table 10.4 The Differences Between a Dry Suction Chest Drainage System and a Wet Suction Chest Drainage System

Dry Suction Chest Drainage System	*Wet Suction Chest Drainage System*
• Newer technology. • Negative pressures are controlled by the unit's design (a system that includes a float ball, vents and controlled release system. • One way valves reduce risk of fluid migration from one chamber to the next if the unit is tipped over. • Water is only used to fill the water seal chamber therefore set up is quick. • A silent system (bubbling isn't the norm like the wet suction system). In this type of system, bubbling indicates a leak. • Light weight allows for easier transport than a heavy unit. • The control dial on the chest drainage unit controls the amount of suction. • Capable of higher levels of suction as compared to the wet suction system. • Some dry suction units have an air-leak monitor feature. • Suction is regulated by the suction dial on the unit and not the suction source (ie. wall or portable suction machine). • Equipped with a negative pressure release valve to release pressure caused by vigorous coughing, chest tube stripping (not recommended), decreasing or disconnecting suction. • If suction is discontinued, the suction port on the chest drainage system must remain unobstructed and open to air to allow air to exit and minimize the risk of development of a tension pneumothorax	• Older technology. • Water level controls the negative pressure transmitted to the chest. As the water level evaporates, the negative pressure lowers. As such water levels must be checked and topped up frequently. • The weight of the fluid makes transport more challenging. • Takes time to set up. Also has a water seal chamber. • These units are noisy because of the bubbling in the water seal chamber. Bubbling is expected • If using suction, increasing the suction at the regulator increases air flow through the system but has minimal effect on the amount of suction imposed on the chest cavity. Excessive suction at the regulator causes the system to be noisier (more bubbling) and quickens evaporation of the water in the water seal chamber. • Some wet suction systems have an air leak monitoring feature. • equipped with a negative pressure release valve to release pressure caused by vigorous coughing, chest tube stripping (not recommended), decreasing or disconnecting suction.

Sources: Atrium, 2009; Teleflex, 2018; Zisis et al., 2015

Table 10.5 provides a list of potential complications and interventions related to chest tube drainage systems.

Table 10.5 Complications and Interventions Related to Chest Tube Drainage Systems

Complications	*Interventions*
Potential pneumothorax/ respiratory distress	This is the primary concern for a patient with a chest tube drainage system. • Signs and symptoms include decreased SpO_2, increased work of breathing (WOB), diminished breath sounds, decreased chest movement, complaints of chest pain, tachycardia or bradycardia, hypotension. • Notify health care provider. • Request urgent chest x-ray. • Ensure drain system is intact with no leaks or blockages such as kinks or clamps. • Apply oxygen and take a set of vital signs.
Air leak	An air leak may occur from the chest tube insertion site or the drainage system. Immediately: • check connections and ensure they are secure. • assess insertion site. This may include removing the dressing to observe the insertion site. You can test the drainage system itself for a leak by • Using a booted (or padded) clamp, begin at the dressing and clamp the drainage tubing momentarily. • Look at the water-seal/air leak meter chamber. Keep moving the clamp down the drainage tubing toward the chest drainage system, placing it at 20 to 30 cm intervals. Each time you clamp, check the water-seal/air leak meter chamber. • When you place the clamp between the source of the air leak and the water-seal/air leak meter chamber, the bubbling will stop. If bubbling stops the first time you clamp, the air leak must be at the chest tube insertion site or the lung.
Accidental chest tube removal or chest tube falls out	A chest tube falling out is an emergency. Immediately apply pressure to chest tube insertion site and apply sterile gauze or place a sterile petroleum gauze and dry dressing over insertion site and ensure tight seal. Apply dressing when patient exhales. If patient goes into respiratory distress, call a code. Notify primary health care provider to reinsert new chest tube drainage system.

Accidental disconnection of the drainage system	A chest tube drainage system disconnecting from the chest tube inside the patient is an emergency. Momentarily but immediately clamp the tube and place the end of chest tube in sterile water or NS. The two ends will need to be swabbed with alcohol and reconnected. Have an emergency "accidental chest tube removal kit" at the bedside which includes: clamp, petroleum impregnated dressing, two sterile 4 × 4's; container of sterile normal saline or sterile water, occlusion dressing, alcohol swabs.
Bleeding at the insertion site	Bleeding may occur after insertion of the chest tube. Apply pressure to site and monitor.
Subcutaneous emphysema	Subcutaneous emphysema is painless tracking of air underneath the subcutaneous tissue. It may be seen in the chest wall, down limbs, around drain sites, or around the head or neck. When the skin is palpated, it feels similar to having tissue paper trapped beneath the skin. Subcutaneous emphysema is not life threatening but requires monitoring in the event it worsens. In the event of worsening symptoms suggesting subcutaneous emphysema, report to primary health care provider.
Drainage suddenly stops and respiratory distress increases	The chest tube may be clogged by a blood clot or by fluid in a dependent loop. Assess the drainage system and the patient, and notify primary health care provider if required.
Sudden increase in bright red drainage	This may indicate an active bleed. Monitor amount of drainage and vital signs, and notify the primary health care provider.
The drainage unit has tipped over	Situate the unit upright. Immediately check the fluid level in the water seal for correct volume. Replace lost fluid and likewise withdraw any excess fluid. If all of the chambers are contaminated with blood, consider replacing the entire unit. Use the swing out floor stand that is a part of the drainage unit. Consider securing the unit to an IV pole.
Data source: BCIT, 2015c; Perry et al., 2018; Teleflex Medical Incorporated, 2009	

Checklist 88 reviews the care and management of a person with a closed chest tube drainage system

Checklist 88: Care and Management of a Closed Chest Tube Drainage System

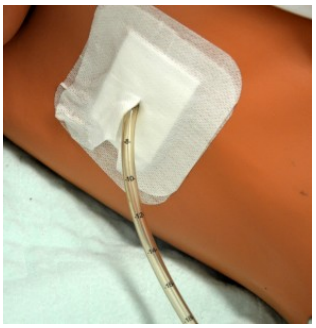
Disclaimer: Always review and follow your agency policy regarding this specific skill.

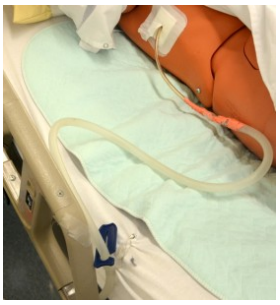
Safety considerations:

- A chest tube may be inserted at the bedside, in procedure room, or in the surgical suite. Health care providers often assist physicians in the insertion and removal of a closed chest tube drainage system.
- After initial insertion of a chest tube drainage system, assess the patient at minimum every 15for at least an hour. Once the patient is stable, and depending on the condition of the patient and the amount of drainage, monitoring may be less frequent. Always follow hospital policy for frequency of monitoring a patient with a chest tube.
- Prior to managing a patient with a chest tube, review reason for the chest tube, the location of the chest tube, normal volume of drainage, characteristics of the drainage, date of last dressing change, and any previously recorded air leaks measurements.
- Safety/emergency equipment must always be at the patient's bedside and with the patient at all times during transportation to other departments. Safety equipment should include:
  - Two guarded clamps
  - Sterile water
  - Vaseline gauze (Jelonet)
  - 4 × 4 sterile dressing
  - occlusive dressing or Waterproof tape
  - small container of sterile water or saline
  - alcohol swabs
- *Never* clamp a chest tube without a prescriber's order or valid reason. The tube must remain unobscured and unclamped to drain air or fluid from the pleural space. There are a few exceptions where a chest tube may be clamped; see special considerations below.
- Chest tube drainage systems are replaced only when the collection chamber is full or the system is contaminated.

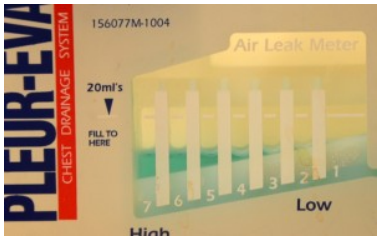
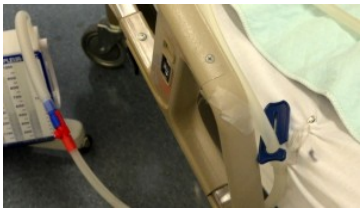
Steps	*Additional Information*
1. Perform hand hygiene. Identify patient using two identifiers and explain assessment process to patient. Create privacy to assess the patient and drainage system.	Hand hygiene reduces the transmission of microorganisms. Proper identification provides patient safety measures for safe care.

2. Complete respiratory assessment, ensure patient has minimal pain, and measure vital signs. Place patient in semi-Fowler's position for easier breathing.	Patient should be in a semi-Fowler's position, have minimal pain, have *no* respiratory distress, and have *no* evidence of an air leak around the insertion site, and *no* drainage from the insertion site or chest tube equipment. Frequent assessment of the respiratory status is important if the patient's condition is stable, resolving, or worsening, and ensures that the chest tube is functioning correctly. Assessment should be at minimum every 15 minutes for the first hour immediately following chest tube insertion/ Continue until patient is stable. Increase monitoring if patient's condition worsens. Chest tubes are painful, as the parietal pleura is very sensitive. Ensure patient has adequate pain relief, especially prior to re-positioning, sitting, or ambulation.
3. Ensure the chest drainage unit is below the level of the insertion site, upright, and secured to prevent it from being accidentally knocked over.	 *Chest tube lower than insertion site* The drainage system must remain upright for the water-seal chamber to function correctly. The chest drainage system must be lower than the chest to facilitate drainage and prevent back flow.

4. Assess chest tube insertion site to ensure sterile dressing is dry and intact and that the chest tube is secured to reduce risk of it being pulled out. Check insertion site for subcutaneous emphysema.	Dressing should remain dry and intact; no drainage holes should be visible in the chest tube. Dressing is generally changed 24 hours post-insertion, then every 48 hours. Chest tubes are generally sutured in place. There should be no fluid leaking from around the site or sounds of air leaks from insertion site.  *Chest tube insertion site*

5. Assess the drainage system to ensure the system is intact and to prevent accidental tube removal or disruption of the drainage system. Ensure tubing is not kinked or bent under the patient or in the bed rails, or compressed by the bed.	Know what kind of chest drainage system this is. If suction is ordered, ensure the unit is functioning (wet suction units bubble; dry suction units only bubble if there is an air leak). If there is no suction, note any evidence of air leak. Note: when suction is on, air leaks are not demonstrated on the suction unit. Assess amount and character of the drainage and note if there is any significant changes. Kinked or bent tubing could interfere with the drainage of the pleural fluid. Dependent loops may collect fluid and impede drainage. The long tube may be coiled and secured to a draw sheet with a safety pin (allowing enough tubing so that the patient can move in bed comfortably) to prevent dependent loops.  *Tubing free from kinks and dependent loops*

6. Ensure prescribed suction is set at the correct level.	Dry suction systems: the amount of suction is determined by the suction control dial. Check that the “float” or ‘bellow’ appears completely in the viewing window. Wet suction systems: the amount of suction is controlled by the water level. Ensure that the water level is correct and bubbling is evident.  *Suction pressure set at – 20 cm. Note the float does not appear in the window. As such suction is not working.*
7. If suction is *not* ordered, ensure the suction port is left open to air.	 *Suction port on the top of a chest tube drainage system must remain open when suction is not in use. At this point this port functions as a vent*
8. Check the water-seal chamber to ensure water level is to the dotted line (2 cm) at least once every shift. Add water as necessary.	Adequate water in the water-seal chamber prevents excess suction being placed on the delicate tissue. Water levels should be checked each shift as the water may evaporate.
9. Assess the water-seal chamber and/or the drainage tubing for tidaling (water moving up and down) with respirations.	Gentle bubbling is normal as the lungs expand in wet suction systems. Any bubbles in a dry suction system suggest an air leak. Tidaling is not evident when the chest drainage unit is attached to suction.

10. Assess air leak meter according to the chest drainage unit's feature. On every shift, document the level of air leak and if the air leak occurs at rest or with coughing.	Bubbling in the air leak meter indicates an air leak (or suction is on in a wet suction unit). If bubbling is NOT expected, measure and monitor. If an air leak is suspected, look for the source of the leak: • Checking and tightening all connections. • Testing the tube for leaks (see special considerations below). If leak is in the tubing, replace the unit. • If the leak may be at the insertion site, remove the chest tube dressing and inspect. Has the chest tube been pulled out beyond the chest wall? If you cannot see or hear any obvious leaks at the site, the leak is likely from the lung. • Check patient history. Would you expect a patient air leak? Notify the prescriber of any new, increased, or unexpected air leaks that are not corrected by the above actions. To document the air leak, note the numbered column through which the bubbling occurs. If bubbling is present at the 3rd marker, document "air leak level 3."  *Air leak meter on chest drainage system*
11. Check that the clamp is open.	The chest tube should *not* be clamped unless for specific reasons. See special considerations below.  *Blue clamp is open*

12. Measure date and time, and the amount of drainage, and mark on the outside of the chamber at the end of each shift and prn. Record amount and characteristics of the drainage on the fluid balance sheet and patient chart.	Drainage that is red and free-flowing indicates a hemorrhage. A large amount of drainage, or drainage that changes in colour, should be recorded and reported to the primary health care provider. Drainage that suddenly decreases may indicate a blood clot or obstruction in the chest tube drainage system.  *Drainage in collection chamber*
13. Promote oxygenation by encouraging frequent position changes, mobilization, and deep-breathing and coughing exercises.	All of these strategies promote lung expansion and promote fluid drainage.
14. The following should be documented and assessed according to agency policy: • Breath sounds • Patient comfort level or pain level • Appearance of insertion site and/or dressing • Presence of air leaks • Fluctuation (tidalling) in water-seal chamber • Amount of suction • Amount of drainage and type • Presence of subcutaneous emphysema	Proper documentation is required to manage a chest tube drainage system to ensure it is functioning effectively. Sample documentation: *date / time: Chest tube rt. lateral lower chest in situ → underwater seal chest tube drainage system. Resps easy. Chest auscultated ↓ air entry RLL. No adventitious sounds. Denies sputum. Continues to DB&C hourly. +2 air leak noted intermittently. No subcutaneous emphysema noted. Dressing dry and intact. ——BRth RN*
Data sources: Bauman & Handley, 2011; BCIT, 2015c; Durai, Hoque, & Davies, 2010; Rajan, 2013; Teleflex Medical Incorporated, 2009	

Special considerations:

- Do not strip or milk the chest tube: In practice, stripping is used to describe compressing the

chest tube with the thumb or forefinger and, with the other hand, using a pulling motion down the remainder of the tube away from the insertion site. *Milking* refers to techniques such as squeezing, kneading, or twisting the tube to create bursts of suction to move clots. Any aggressive manipulation (compressing the tube to dislodge blood clots) can generate extreme pressures in the chest tube. There is no evidence showing the benefit of stripping or milking a chest tube (Bauman & Handley, 2011; Durai et al., 2010; Halm, 2007).

- The *only* exceptions to clamping a chest tube are: 1) if the drainage system is being changed; 2) if assessing the system for an air leak; 3) if the chest tube becomes disconnected from the chest drainage system—the chest tube should not be clamped for more than a few minutes (Salmon, Lynch, & Muck, 2013); or 4) if the condition of the patient is resolved and the chest tube is ready for removal (as per prescriber's orders).

Watch the video *Chest Tubes – Care and Maintenance* by Kirstin McLaughlin and Wendy McKenzie, Thompson Rivers University (2019)

Watch the video *Dry Suction Chest drainage system* developed by Kirstin McLaughlin and Wendy McKenzie, TRU School of Nursing (2019).

Heimlich Valve

A Heimlich valve (see Figures 10.13 and 10.14) is a small, specially designed flutter valve that is portable and mobile, allowing the patient to ambulate with ease. It attaches to the chest tube at one end and a drainage bag at the other. The valve can be worn under clothing. The valve functions in any position, never needs to be clamped, and can be hooked up to suction if required (Gogakos et al., 2015). Figure 10.15 illustrates how air entering the valve from the patient opens the sleeve to allow air to escape the patient's pleural space. The sleeve collapses preventing the back flow of air back into the patient.

Figure 10.13 Heimlich valve

Figure 10.14 Blue end connects to chest tube; other end may be left open to air or attach to a small drainage bag

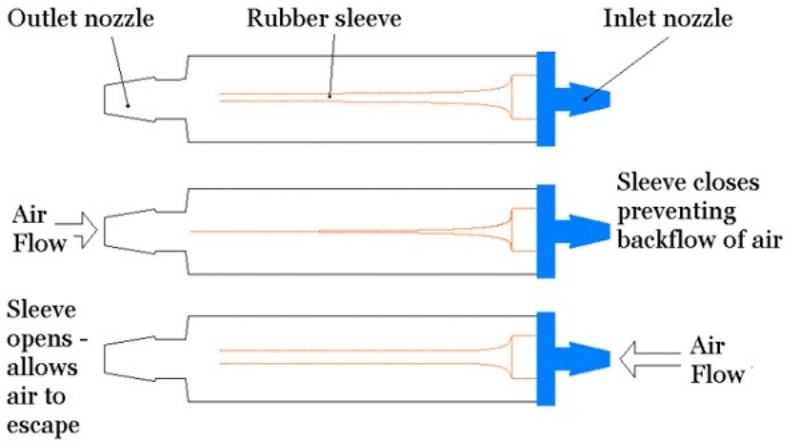


Figure 10.15 Heimlich valve. Demonstration of how they work.

Critical Thinking Exercises

1. What should you do if your patient's chest tube becomes disconnected from the chest tube drainage system?
2. When a patient has a chest tube, what emergency supplies must be at the patient's bedside at all times?

Attributions

Figure 10.8. Chest tube drainage holes in a variety of chest tubes by Bentplate84 is used under a CC BY-SA 3.0 license.

Figure 10.9. Parietal and Visceral Pleurae of the Lungs from OpenStax College, Anatomy & Physiology. Used under a CC BY 3.0 license. Download for free at http://cnx.org/contents/14fb4ad7-39a1-4eee-ab6e-3ef2482e3e22@6.27.

Figure 10.10. Pneumothorax by Blausen.com staff is used under a CC BY 3.0 license.

Figure 10.11.Chest tube drainage system from BCIT is used under a CC BY-SA 4.0 international license.

Figure 10.12. Adapted from GrepMed, n.d.; Chung, n.d.; Salmon, Lynch & Muck, 2013, by author.

Figure 10.13 & 10.14 Heimlich Valve from BCIT is used under a CC BY-SA 4.0 international license.

Figure 10.15. Line diagram of Heimlich Valve (Flutter Valve) including mechanism for one-way airflow by Orinoco-w is used under a CC BY-SA 3.0 license.

10.7 Summary

When patients have tubes and attachments to aid in their recovery, health care providers are required to understand the type, purpose, precautions, complications, and interventions to ensure treatment is effective and to prevent patient harm. Each tube and attachment is unique, and the function of the tube, care of the patient, and safety precautions must be understood. This chapter reviewed many common types of tubes and attachments found in the acute and community setting, and reviewed the care and maintenance of nasogastric tubes, indwelling catheters, ostomies, urostomies, chest tube drainage systems, and tracheostomies.

Key Takeaways

- Specific guidelines and procedures must be followed when working with tubes and attachments to prevent complications from the device.
- Patients with tubes and attachments are more at risk for infection. Take care to maintain sterility of all tubes and ensure device insertion sites stay dry and intact, and all connection points stay intact.
- Be aware of potential complications of each tube and attachment, and prevention strategies. Regularly assess the patient and the device for complications.
- If unfamiliar with a specific device, review all policies and procedures prior to using the device to prevent harm to the patient.
- Know the purpose, type, and special precautions for all tubes and devices that are used in your agency. Complete all training as required.

References

Atrium. (2009). A *personal guide to managing dry suction water seal chest drainage*. Retrieved from https://co.grand.co.us/DocumentCenter/View/677/Oasis-Dry-Suction-Water-Seal-Chest-Drain-Managing-Dry-Suction-Chest-Drainage?bidId.

Bauman, M., & Handley, C. (2011). *Chest tube care: The more you know, the easier it gets*. Retrieved from http://www.americannursetoday.com/assets/0/434/436/440/8172/8174/8176/8256/1d298438-82c6-439d-8b2e-77ffaf165fca.pdf.

Bourgault, A. et al., (2014). Factors influencing critical care nurse adoption of the AACN practice alert on verification of feeding tube placement. American Journal of Critical Care, 23, 2. DOI: 10.4037/ajcc2014558

British Columbia College of Nursing Professionals [BCCNP]. (2018). *Scope of practice for Registered Nurses*. Retrieved from https://www.bccnp.ca/Standards/RN_NP/StandardResources/RN_ScopeofPractice.pdf.

British Columbia Institute of Technology (BCIT). (2015a). Patient care for sonography. In, *NURS 1186*. Vancouver, BC: BCIT.

British Columbia Institute of Technology (BCIT). (2015b). Clinical techniques. In, *NURS 3020*. Vancouver, BC: BCIT.

British Columbia Institute of Technology (BCIT). (2015c). NURS 3020: Clinical techniques. Vancouver: BCIT.

British Thoracic Society [BTS]. (2014). Standards for the care of adult patients with a temporary Tracheostomy; Standards and Guidelines. Intensive Care Society Standards. Retrieved from https://www.evidence.nhs.uk/search?q=Standards+for+the+care+of+adult+patients+with+a+temporary+tracheostomy.

Centers for Disease Control and Prevention. (2015). *Healthcare associated infections*. Retrieved from http://www.cdc.gov/HAI/ca_uti/uti.html.

Chung, D. (nd). Chest drain FAQ. Retrieved http://www.medicine-on-line.com/html/skills/s0001en.htm

Davis, C., Chrisman, J., & Walden, P. (2012). To scan or not to scan? Detecting urinary retention. *Nursing Made Incredibly Easy!*, 10(4), 53-54. doi: 10.1097/01.NME.0000415016.88696.9d.

Durai, R., Hoque, H., & Davies, T. W. (2010). *Managing a chest tube and drainage system*. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/20152201.

Gogakos, A., Barbetakis, N., Lazaridis, G., Papaiwannou, A., Karavergou, A., Lampaki, S., . . . Zarogoulidis, P. (2015). *Heimlich valve and pneumothorax*. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4381465/.

Gould, C. V., Umscheid, C. A., Agarwal, R. K., Kuntz, G., Pegues, D. A., & Healthcare Infection Control Practice Advisory Committee. (2009). *Guidelines for prevention of catheter associated urinary tract infections 2009*. Retrieved from Center for Disease Control website: www.cdc.gov/hicpac/pdf/CAUTI/CAUTIguideline2009final.pdf.

GrepMed (nd). How a chest tube drainage system works. Retrieved https://www.grepmed.com/images/3385/wallsuction-schematic-pleurevac-chesttube-waterseal-chambers-drainage

Halm, M. A. (2007). *To strip or not to strip? Physiological effects of chest tube manipulation*. Retrieved from http://ajcc.aacnjournals.org/content/16/6/609.full.

Halm, M. A., & Krisko-Hagel, K. (2008). Instilling normal saline with suctioning: Beneficial technique or potentially harmful sacred cow? *American Journal of Critical Care*, 17(5), 469-472.

Lewarski, J. (2005). Long-term care of the patient with a tracheostomy. *Respiratory Care*, 50(4), 534-537. Retrieved from http://rc.rcjournal.com/content/respcare/50/4/534.full.pdf.

Lilley, L., Rainforth Collins, S., Snyder, J., & Swart, B. (2016). *Pharmacology for Canadian health care practice* (3rd Canadian ed.). Toronto, ON: Elsevier.

Morris, L. L., Whitmer, A., & McIntosh, E. (2013). *Tracheostomy care and complications in the intensive care unit*. Retrieved from http://ccn.aacnjournals.org/content/33/5/18.

The Ohio State University, Wexner Medical Center. (2012). *Fenestrated tracheostomy tube*. Retrieved from https://patienteducation.osumc.edu/documents/fenestr.pdf.

Perry, A. G., Potter, P. A., & Ostendorf, W. R. (2018). *Clinical nursing skills and techniques* (9th ed.). St. Louis, MO: Elsevier-Mosby.

Rajan, C. S. (2013). *Tube thoracostomy management*. Retrieved from http://emedicine.medscape.com/article/1503275-overview#a7.

The Royal Children's Hospital Melbourne [RCH]. (n.d.). *Tracheostomy guidelines*. Retrieved from https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Tracheostomy_Management_Guidelines/#Related%20Documents.

Salmon, N., Lynch, S., & Muck, K. (2013). *Chest tube management*. Retrieved from http://ajcc.aacnjournals.org/content/16/6/609.full.

Simons, S. & Abdallah, L. (2014). Bedside assessment of enteral tube placement: aligning practice with evidence. American Journal of Nursing,112(2). doi: 10.1097/01.NAJ.0000411178.07179.68.

Stewart, M. L. (2014). Interruptions in enteral nutrition delivery in critically ill patients and recommendations for clinical practice. *Critical Care Nurse*, 34(4), 14-22. https://doi.org/10.4037/ccn2014243.

St. George's University Hospital. (n.d.). *Tracheostomy tubes*. Retrieved from https://www.stgeorges.nhs.uk/gps-and-clinicians/clinical-resources/tracheostomy-guidelines/tracheostomy-tubes/.

Teleflex. (2018). *Chest drainage*. Retrieved from https://www.teleflex.com/usa/product-areas/surgical/cardiovascular/chest-drainage/index.

Teleflex Medical Incorporated. (2009). *Chest drainage systems*. Retrieved from http://www.teleflex.com/en/usa/ucd/chest_drainage_systems.php.

Vancouver Coastal Health. (2006). *Tracheostomy and endotracheal tubes – suctioning*. Vancouver, BC: Vancouver Coastal Health.

Vancouver Coastal Health. (2012a). *Tracheostomy: Care and management of a patient with a tracheostoma*. Vancouver, BC: Vancouver Coastal Health.

Vancouver Coastal Health. (2012b). *Tracheostomy tubes: Dressing changes and inner cannula cleaning*. Vancouver, BC: Vancouver Coastal Health.

VCH Professional Practice. (2014). *Indwelling urinary catheter: Procedure for insertion and removal (adult)*. Vancouver, BC: Vancouver Coastal Health.

Zisis, C., Tsirgogianni, K., Lazaridis, G., Lampaki, S., Baka, S., Mpoukovinas, I., . . . Zarogoulidis, P. (2015). Chest drainage systems in use. *Annals of Translational Medicine*, 3(3). https://dx.doi.org/10.3978%2Fj.issn.2305-5839.2015.02.09.

CHAPTER 11: OSTOMY CARE

11.1 Introduction

An **ostomy** is a surgically created opening from the urinary tract or intestines, where effluent (urine, fecal matter, or mucous) is rerouted to the outside of the body using an artificially created opening called a **stoma**. A stoma typically protrudes above the skin, is pink to red in colour, moist, and circular shaped, with no nerve sensations. Ostomy surgeries are performed when part of the bowel or urinary system is diseased and therefore removed in order to assist with elimination needs.

This chapter reviews different kinds of ostomies including continent ostomies; physical and emotional considerations for persons with an ostomy; and the mechanics of flange changes and care of the appliance.

Learning Outcomes

- Differentiate colostomy, ileostomy and urostomy.
- Discuss physical and emotional considerations that may impact ability to care for one's ostomy.
- Discuss care and maintenance of ostomy appliances in relation to:
    - what to expect in terms of drainage.
    - flange application and pouch drainage.
    - peristomal skin care and maintenance.

11.2 Ostomy Care

An ostomy is named according to the part of intestine used to construct it. A **colostomy** is the creation of a stoma from part of the colon (large bowel), where the intestine is brought through the abdominal wall and attached to the skin, diverting normal intestinal fecal matter through the stoma instead of the anus. An **ileostomy** is created from the ileum (small bowel), which is brought through the abdominal wall and used to create a stoma. A **urostomy** or **ileal conduit** is a stoma created using a piece of the intestine to divert urine to the outside of the body. The ureters are sewn to a piece of the intestine that is made into a small conduit. The conduit emerges from the abdominal wall as a stoma.

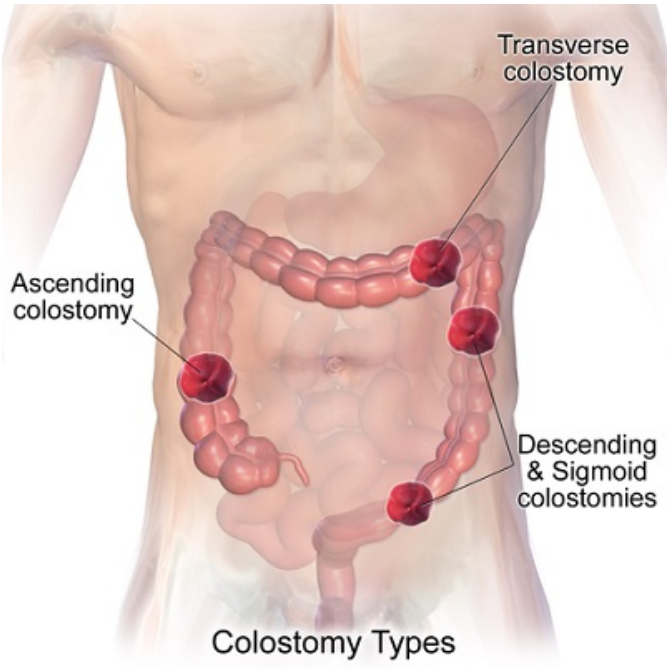


Figure 10.16 Types of ostomies (fecal related)

These surgeries are performed on patients with diseases such as cancer of the bowel or bladder, inflammatory bowel diseases (such as colitis or Crohn's), or perforation of the colon. Emergencies that may require an ostomy include diverticulitis, bowel rupture, trauma, necrotic bowel, or radiation complications. An ostomy may be permanent or temporary, depending on the reason for the surgery. Other types of ostomies are called jejunostomy, double-barrel ostomy, and loop ostomy (Perry et al., 2018).

Pouching Systems (Ostomy Appliances)

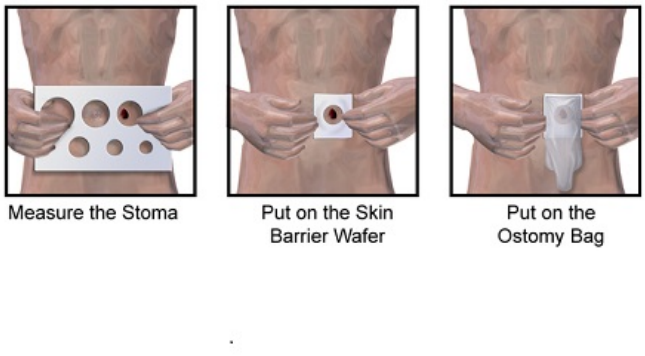


Figure 10.17 Application of ostomy appliance

Individuals with colostomies, ileostomies, or urostomies have no control over the activity of their ostomy. Persons with ostomies must wear a pouching system. The pouching system must be completely sealed to prevent leaking of the effluent and to protect the surrounding peristomal skin. The disposable pouching systems can be either a one-piece or a two-piece system consisting of a pouch (plastic bag) and a flange (skin barrier) that sit against the patient's skin. Most flanges are flat. Sometimes a stoma that is flat or retracted can be protruded with the use of a convex flange making it easier to direct the drainage into the pouch. The pouch has an open end to allow effluent to be drained, and is closed according to the manufacturer's design—usually a plastic clip or Velcro strip. Urostomy pouches have a spout type of drainage hole to allow urine to be drained.

Different manufacturers make different types of pouching systems each designed to meet the needs of the client. Step 2 in Checklist 89 shows ostomy supplies including a flange, an ostomy bag, and a one-piece system (Perry et al., 2018; United Ostomy Association of America, 2017). The flange is cut to fit around the stoma in a way that avoids pressure or irritation on the stoma while covering the peristomal skin or a moldable flange can be used to achieve the same result (see Figure 10.18).

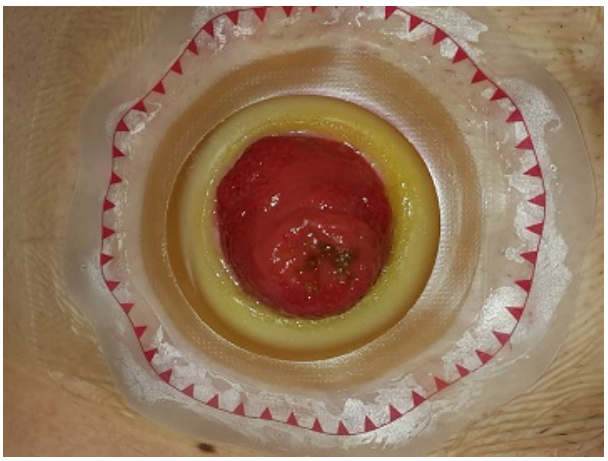


Figure 10.18 Moldable flange. Note the turtle-necking of the wafer.

Ostomy pouching systems are chosen based on type of stoma (ileostomy, colostomy, urostomy), stoma characteristics (flat, raised, recessed), stoma location, patient abilities (to cut a flange and to operate the opening / closing of the pouch), skin folds, and patient preference. Pouching systems generally last from four to seven days. Ileosotmies and urostomies generally require more frequent flange changes due to the weight of the effluent and the impact of the weight on the flange's ability to remain adhered to the patient. The pouch must be changed if it is leaking, if there is excessive skin

exposure between the stoma and the edge of the flange (particularly for ileostomies because this stool contains enzymes that break down skin), or if the patient complains of itching or burning under the flange. Patients with established ostomies can swim and participate in most activities of daily life. In terms of showering, pouching systems can remain on or off and will depend on the patient's preference and activity of the ostomy. All patients are expected to participate in all aspects of their ostomy care; if they cannot, a caregiver may be involved in the teaching (Perry et al., 2018).

Continent Ostomies

Depending on the patient, a surgical procedure may be performed to create an internal pouch to collect feces or urine, which eliminates the need for an external pouch. A **continent ileostomy** is made from part of the ileum and is flushed a number of times each day to clean out the effluent (Koch pouch) (Oxford Radcliff Hospitals, 2013). An **ileoanal ostomy** is a pouch created above the anal sphincter and is also created from a portion of the ileum (Birmingham Bowel Clinic, 2011). Two types of internal urinary diversions may be created from part of the intestine. The first is an orthotopic neobladder, where a bladder is created and placed in the body at a normal bladder position; over time, with continence training, the patient can learn to void normally. The second type is a **continent urinary reservoir**, where a pouch is created from part of the intestine, and a catheter is inserted a number of times during the day to remove the urine (Perry et al., 2018; United Ostomy Association of America, 2017).

Physical and Emotional Assessment and Care

Patients may have co-morbidities that affect their ability to manage their ostomy care. Conditions such as arthritis, vision changes, Parkinson's disease, or post-stroke complications may hinder a patient's coordination and fine motor skills needed for ostomy management. In addition, the emotional burden of coping with an ostomy may be devastating for some people and may affect their self-esteem, body image, quality of life, and ability to be intimate. It is common for a person with an ostomy to struggle with body image and altered body function. The nurse's attitude and non-verbal responses around ostomy care can help to normalize the situation and play a significant role in helping the patient adjust to new patterns of elimination. An important element of nursing care includes care both inside and outside the acute care setting. This includes ensuring the patient has the appropriate referrals to a wound / ostomy nurse and a social worker and information about support groups, possibly including online support groups (Perry et al., 2018).

Checklist 89 reviews the steps to changing an ostomy appliance (flange and pouch).

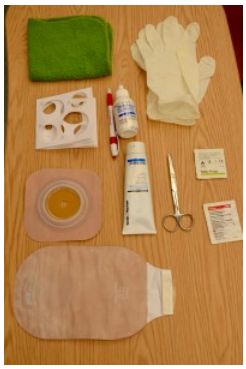
Checklist 89: Changing an Ostomy Appliance (Flange and Pouch)

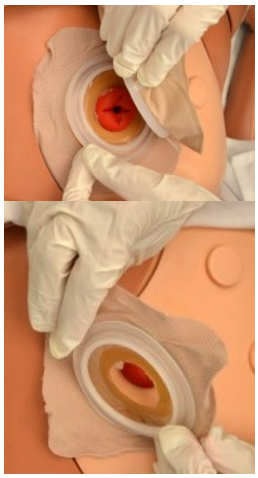
Disclaimer: Always review and follow your agency policy regarding this specific skill.

Safety considerations:

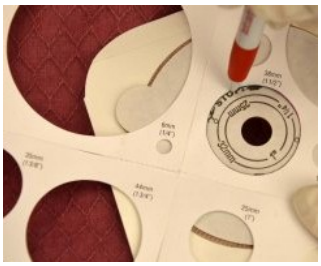
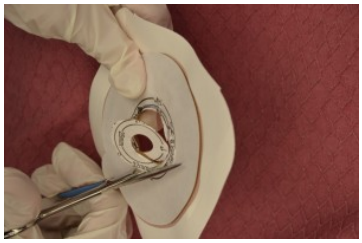
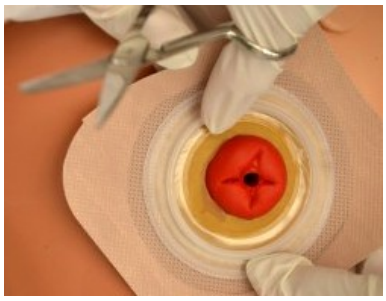
- Pouching system should be changed every 4 to 7 days, depending on the patient and type of pouch.
- If available, a wound care specialist or enterostomal therapist (ET) should be involved with care, preferably pre- and post-op.
- Consult the wound care specialist / ET if there is skin breakdown, if there are challenges with flange adhesion, or if there are other concerns related to the pouching system.
- Patients should participate in the care of their ostomy, and health care providers should promote patient and family involvement.
- Encourage the patient to empty the pouch when it is one-third to one-half full of urine, flatus, or feces as they become heavy and have increased risk of spillage.
- Ostomy product choices may be limited in acute care settings. Other choices are available in community retail settings. Encourage the patient / family to explore other options.
- Follow all post-operative assessments for new ostomies according to agency policy.
- Observe the center of the flange for evidence of leaking. Waste on the peristomal skin can cause skin breakdown. Leaking flanges must be changed immediately
- Medications and diet may need adjusting for persons with new ileostomies or colostomies.
- An ostomy belt may be used to help hold the ostomy pouch in place.
- Factors that affect the pouching system include sweating, high heat, moist or oily skin, and physical exercise.
- Always treat minor skin irritations immediately. Skin that is sore, wet, or red is difficult to seal with a flange.
- Change ileostomy appliances PRIOR to eating to decrease the likelihood that a bowel movement will occur during appliance change.
- Consider financial considerations of ostomy cost. Consult social services as necessary.
- Discuss community supports and follow up nursing care following the hospitalization.

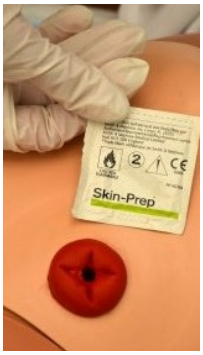
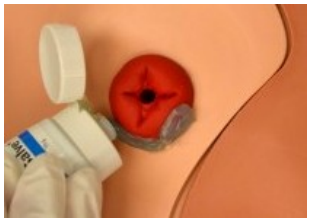
Steps	*Additional Information*
1. Perform hand hygiene.	This prevents the spread of microorganisms.

2. Gather supplies.	Supplies include flange, ostomy bag and clip, scissors, stoma measuring guide, waterproof pad, pen, adhesive remover for old flange, skin prep, stomahesive paste or powder, warm wet cloth(s) and dry cloth, non-sterile gloves,  *Ostomy supplies*
3. Identify the patient and review the procedure. Encourage the patient to participate as much as possible, or observe and assist patient as they complete the procedure.	Proper identification complies with agency policy. Encouraging patients to participate helps them adjust to having an ostomy.
4. Create privacy. Place waterproof pad under pouch.	Attention to psychosocial needs is imperative. The pad prevents the spilling of effluent on patient and bed sheets.

5. Apply non sterile gloves. Remove ostomy bag. Remove flange by gently pulling it toward the stoma. Support the skin with your other hand. An adhesive remover may be used. If a rod is in situ, do not remove. Measure and empty contents. Place old pouching system in garbage bag.	 *Removing ostomy bag from flange-001* The pouch and flange can be removed separately or as one unit. Gentle removal helps prevent skin tears. An adhesive remover may be used to decrease skin and hair stripping. A rod may be used during the formation of a stoma. It can only be removed by a physician or wound care nurse. If a rod is in place, it can be slid from side to side to allow the pouch to be removed.

6. Clean stoma gently by wiping with warm water. Do not use soap.	Aggressive cleaning can cause bleeding. If removing stoma adhesive paste from skin, use a dry cloth first.  *Clean stoma and peristomal skin* Soaps often contain perfumes and oils, which can interfere with adhesion of the flange. Ivory soap (pure soap) is OK. It is normal for blood to appear on the cloth, this suggests healthy blood flow to the stoma. Mucous is normal. Immediately post op the blood and mucous must be wiped from the stoma regularly to allow proper assessment of stoma colour and integrity.
7. Assess stoma and peristomal skin.	A stoma should be pink to red in colour, preferrably raised above skin level, and moist. Stomas that are flat or convex can still be healthy but they can present challenges in terms of ostomy management and directing waste into the pouch.  *Assess stoma* Skin surrounding the stoma should be intact and free from wounds, rashes, or skin breakdown. Notify wound care nurse if you are concerned about the condition of the peristomal skin.

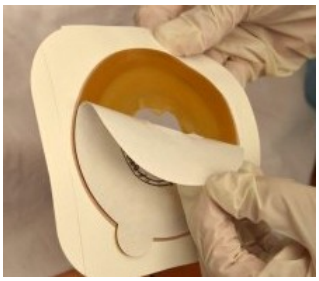
	The opening should match the stoma size. Ileostomies cannot have skin exposed between the stoma and edge of the flange. Ileostomy drainage contains enzymes that will break down intact skin causing excoriation.  *Trace template*
8. If the stoma is round, measure the stoma diameter using the pre-cut measuring guide (tracing template). Trace diameter of the measuring guide onto the flange, and cut on the outside of the pen marking. If the stoma is not round, create a template (the clear plastic cover of the flange packaging works well). Trace the shape of the stoma onto this plastic. Cut out the stoma shape. Trace onto the flange and cut on the outside of the pen marking. Some flange systems require the flange be "rolled" or "molded" from the center outward to fit the size of stoma. Assess the flange for proper fit to the stoma.	 *Once size is traced onto back of flange, cut out size to fit stoma*  *Assess flange for proper fit to stoma* Keep the measurement guide / template with patient ostomy supplies for future use. Stomas are edematous immediately post op. Anticipate stoma size will shrink over the 6 week post-op recovery. As such the template will have to be reassessed and adjusted accordingly.

9. Prepare skin. If adhesive remover was used to remove the flange, all residue must be removed. Apply accessory products as required or according to agency policy.	Residue from adhesive remover will interfere with adhesion of the new flange. Accessory products may include stomahesive paste, stomahesive powder, or products used to create a skin sealant to adhere the pouching system to skin to prevent leaking (skin prep, Eakin Seal). Wet skin will prevent the flange from adhering to the skin.  *Peristomal skin prep*  *Stomahesive paste* Paste can be applied directly to the skin or to the flange just prior to applying.

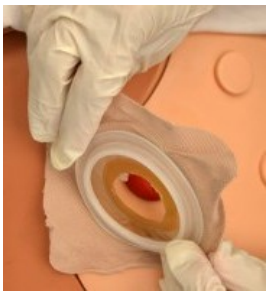
10. Remove inner backing on flange and apply flange over stoma. Leave the border tape on. Apply pressure. With the index finger press gently around the periphery of the stoma to create seal.

Then remove outer border backing and press gently to create seal.

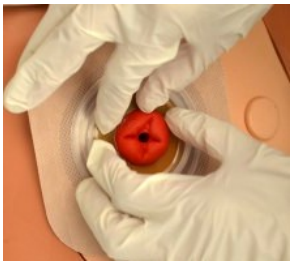
If rod is in situ, carefully move rod back and forth but do not pull up on rod.



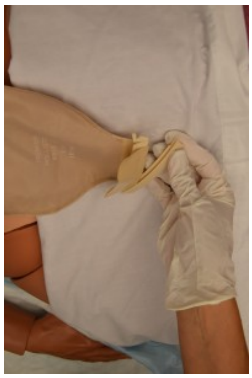
Remove backing from flange



Apply flange around stoma



With the index finger press gently around the periphery of the stoma to create a seal

11. Apply the ostomy bag. Close the end of the bag (clip, Velcro closure, plug). Likewise the ostomy bag can be attached to the flange prior to applying it to the body. Secure / close the bottom of the bag according to manufacturer's instructions.	 *Attach clip to bottom of bag*
12. Hold palm of hand over ostomy pouch for 2 minutes to assist with appliance adhering to skin.	Some flanges are heat activated and adhere better when warmth is applied.
13. Clean up supplies, and place patient in a comfortable position. Remove garbage from patient's room.	Removing garbage helps decrease odour.
14. Perform hand hygiene.	This minimizes the transmission of microorganisms.
15. Document procedure.	Follow agency policy for documentation. Document appearance of stoma and peristomal skin, products used, and patient's ability to tolerate procedure and assistance with procedure. Sample documentation: *date / time: flange change complete. Stoma red, moist, warm and raised. Peristomal skin intact. Patient involved with cutting flange to correct size. Discussed frequency of flange changes and showering with an ostomy. See ostomy flowsheet — I Cee RN*
Data source: BCIT, 2015; Berman & Snyder, 2016; Convatec, 2018; Perry et al., 2018; United Ostomy Association of America, 2017	

Special Considerations

- When patients are discharged from an acute care facility, ensure they have referrals to a community / home health nurse; that they are able to empty and change their pouch system independently or with assistance from a caregiver (this includes burping the system of excess flatus) (Ostomy Canada Society, n.d.); that they have spare supplies and know what supplies to get and where to get them (involve social services if finances are a barrier); that they know the signs and symptoms of complications and where to seek help; that they have had the necessary dietitian referral and information, particularly related to ileostomy dietary

considerations (Registered Nurses Association of Ontario, 2019); that they know about showering or bathing with an ostomy appliance; that they recognize peristomal skin irritation and know what to do.

Different manufacturers have patient teaching videos on the web. This is not an endorsement of any particular product but will help inform you and your practice around ostomy care: Convatec Ostomy Care Video Library and Hollister Ostomy Care Resources.

Urostomy Care

A urostomy is similar to a fecal ostomy, but it is an artificial opening for the urinary system and the passing of urine to the outside of the abdominal wall through an artificially created hole called a stoma. A urostomy is created for the following reasons:

- Bladder cancer
- Cystectomy
- Trauma or surgery
- Incontinence
- Painful bladder or overactive bladder
- Congenital abnormalities
- Conversion of continent urinary diversion to incontinent stoma
- Neurological conditions and diseases
- Spinal cord injury
- Chronic inflammation of bladder
- Interstitial cystitis
- Radiation damage
- Inability to manage a continent urinary diversion or a neobladder

A person with a urostomy has no voluntary control of urine, and a pouching system must be used and emptied regularly. Many patients empty their urostomy bag every two to four hours, or as often as they regularly used the bathroom prior to their surgery. Urostomy pouches (see Figure 10.19) have a drain spot at the distal end, and the pouch should be emptied when one-third full. The pouch may also be attached to a large drainage bag for overnight drainage as an attempt to

minimize sleep disturbances associated with having to wake up to attend to a full pouch. People with a urostomy are more at risk for urinary tract infections (UTIs) and should be taught about the signs and symptoms of such infections (Perry et al., 2018).

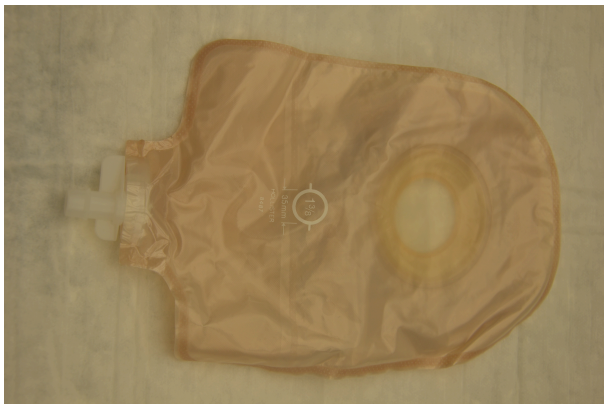


Figure 10.19 Urostomy pouch. note the different opening (left side of photo)

Changing a urostomy appliance (flange and pouch) is for the most part the same as changing an ileostomy or colostomy appliance. A few considerations specific to a urostomy are outlined in Table 10.6.

Table 10.6 How Changing a Urostomy Pouch Is Different than a Colostomy / Ileostomy

Consideration	*Explanation*
Urine flows continually from a urostomy making it a little more challenging to ensure a good seal with the flange.	Because the kidneys continually produce urine, a urostomy continually drips urine. Wet peristomal skin interferes with flange adhesion. Solution: Place a sterile gauze on top of the stoma to absorb urine during cleansing of peristomal skin and flange preparation. Remove it immediately before application of the new flange before urine can wet the peristomal skin.
Ureteral Stents that go from the ureter(s) through the stoma opening are placed post-operatively to prevent stricture at the ureter / stoma anastamosis site. When ureteral stents are present, sterile technique must be used when changing a urostomy appliance. Always follow agency policy. The stents are usually removed in the hospital by the surgeon or at the first physician visit. When present, the stents present an extra consideration when changing the flange.	Ureteral stents facilitate urine drainage from the kidney and the increase the risk for urinary tract infection. Following principles of asepsis, place the stents on a sterile drape during flange change. This reduces risk of introducing microorganisms into the urinary tract. Care must be taken to avoid accidental removal of the stents during removal of the old appliance and application of the new. Feed the stents into the drainage bag through the hole in the flange.
Like ileostomies, the weight of the effluent impacts the flanges ability to remain adhered to the skin	Change urostomy flanges every 5 days.
Urine character from a urostomy / ileal conduit is normally cloudy and can be foul smelling.	Because urine passes through a piece of bowel, the character of the urine will be cloudy from mucous and likely foul smelling from the bacteria that lives in the ileal conduit.
Without a bladder, signs and symptoms of urinary tract infection might be different than anticipated	Cloudy, foul smelling urine is no longer a potential symptom of urinary tract infection. Without a bladder, urgency and frequency are no longer possible. Assess for fever, changes to urine character (changes from the new norm), flank pain. Encourage hydration by drinking at least 2 litres of fluid per day (unless contraindicated).

Needing to frequently empty a urostomy pouch can interfere with sleep.	Use a nighttime drainage bag attached to the pouch. When using a large urine drainage bag, the anti-reflux valve incorporated into the bag should prevent backup of urine into the urostomy pouch.
Data sources: BCIT, 2015; Perry et al., 2018; United Ostomy Association of America, 2017	

Attributions

Figure 10.16 Blausen.com staff (2014). "Medical gallery of Blausen Medical 2014". WikiJournal of Medicine 1 (2) is used under a Creative Commons Attribution 3.0 Unported license.

Figure 10.17 A medical illustration depicting how to put an ostomy bag on by Bruce Blaus is used under a Creative Commons Attribution-Share Alike 4.0 International license.

Figure 10.18 Ileostomy patient wearing a two-piece ostomy wafer [cropped from original photo] by Eric Polsinelli (VeganOstomy) is used under the CC BY 4.0 license.

Figure 10.19 Urostomy pouch from BCIT is used under a CC BY-SA 4.0 international license.

Critical Thinking Exercises

1. What dietary or medication changes might be considered for a patient who has a new ileostomy and no longer has a small bowel?
2. A patient with a new colostomy refuses to look at his stoma or participate in changing the pouching system. What are some suggestions to help your patient adjust to the stoma?

11.3 Summary

Having an ostomy whether it be a colostomy, ileostomy, or urostomy can be a life changing event. Nursing care includes attention to the physical care and recovery after surgery plus ongoing attention to emotional and psychological elements of holistic care. This chapter reviewed the nature of different types of ostomies and the care and maintenance involved in caring for these types of drainage systems.

Key Takeaways

- Know the type of ostomy and the nature of the drainage to be expected.
- Teaching the client about ostomy self care is a significant part of nursing care of clients with these devices.
- Care of clients with ostomies requires an holistic approach.
- Ostomy care is a specialized skill. This chapter provided a brief introduction only. Mastery takes years.

Suggested Online Resources

Ostomy Canada Society This is a resource for individuals and their families living with ostomies. The website contains up-to-date information on a variety of ostomy related topics.

References

Berman, A. J., & Snyder S. (2016). *Skills in clinical nursing* (8th ed.). New Jersey: Pearson.

Birmingham Bowel Clinic. (2011). *Ileo-anal pouch procedure*. Retrieved from http://www.birminghambowelclinic.co.uk/ileo-anal-pouch-procedure/.

British Columbia Institute of Technology (BCIT). (2015b). Clinical techniques. In, NURS 2020. Vancouver, BC: BCIT.

Convatech. (2018). *Ostomy care video library*. Retrieved from https://www.convatec.com/videos/ostomy-videos/.

Ostomy Canada Society. (n.d.). *Passing gas with an ostomy*. Retrieved from http://stolencolon.com/passing-gas-farting-ostomy/.

Oxford Radcliff Hospitals. (2013). *Koch pouch operation information for patients*. Retrieved from https://www.ouh.nhs.uk/patient-guide/leaflets/files/101101kochpouch.pdf.

Perry, A. G., Potter, P. A., & Ostendorf, W. R. (2018). *Clinical nursing skills and techniques* (9th ed.). St. Louis, MO: Elsevier-Mosby.

RNAO (2019). Best Practice Guideline: Supporting Adults who live with or anticipate an ostomy. Second Edition. https://rnao.ca/sites/rnao-ca/files/bpg/OSTOMY_FINAL_WEB_Updated_July_5.pdf

United Ostomy Association of America. (2017). *Ileostomy guide*. Retrieved from http://www.ostomy.org/uploaded/files/ostomy_info/IleostomyGuide.pdf?direct=1.

Appendix 1: Glossary

Glossary

- **2 x 2**: Small, commonly used gauze pad measuring 2 inches by 2 inches, or approximately 5 cm x 5 cm.
- **4 x 4**: Medium size, commonly used gauze pad measuring 4 inches by 4 inches, or approximately 10 cm x 10 cm.
- **Absorption atelectasis**: A form of lung collapse that occurs when high concentrations of oxygen displace nitrogen in the alveoli and, as a result, reduce alveolar volume.
- **Additional precautions**: Practices in addition to routine practices for certain pathogens or clinical presentations. These precautions are based on the type of transmission, such as contact, droplet, or airborne.
- **Adverse reaction (**also known as **adverse event**): An undesirable effect of any health product such as prescription and non-prescription pharmaceuticals, vaccines, serums, and blood-derived products, cells, tissues, and organs; disinfectants; and radiopharmaceuticals. An adverse reaction may occur under normal use and conditions of the product.
- **Air embolism**: The presence of air in the vascular system that occurs when air is introduced into the venous system and travels to the right ventricle and/or pulmonary circulation.
- **Airborne precautions**: Precautions used in addition to routine practices for patients with known or suspected illness that is transmitted by the airborne route.
- **Alcohol-based hand rub (ABHR)**: A liquid, foam, or gel formation of an alcohol-based solution used to reduce the number of microorganisms on the hands when the hands are not visibly soiled. A form of hand hygiene.
- **Ambulation**: Moving from one place to another.
- **Ampule**: A glass container that holds a single dose of medication in liquid form in 1 ml to 10 ml sizes.
- **Antibiotic-resistant organisms (ARO)**: Microorganisms that have developed resistance to the action of various antibiotic agents. Common AROs are MRSA and VRE.
- **Arterial blood gas (ABG)**: Analysis of an arterial blood sample to evaluate the adequacy of ventilation, oxygen delivery to the tissues, and acid-base balance status.
- **Asepsis**: The absence of infectious material (microorganisms) or infection.
- **Aspiration**: The action of pulling back on the plunger of a syringe for 5 to 10 seconds prior to injecting medication.
- **Assistive device**: An object or piece of equipment designed to help a patient with activities of daily living, such as a walker, cane, gait belt, or mechanical lifts.
- **Base of support**: The space between the feet that bears the weight of the body, and the centre of gravity that falls within the base of support.
- **Blood or body fluid (BBF) exposure**: A splash or puncture exposing you to another person's blood, urine, feces, vomit, or secretions.
- **Body alignment**: The optimal placement of the body parts, working with the pull of gravity to contribute to body balance. Without this balance, the risk of falls and injuries increases.
- **Body balance**: A state of equilibrium achieved by creating a wide **base of support**, the space between the

feet that bears the weight of the body, and the centre of gravity that falls within the base of support.

- **Body mechanics**: The coordinated effort of muscles, bones, and the nervous system to maintain balance, posture, and alignment during moving, transferring, and positioning patients.
- **British Columbia Patient Safety and Learning System (BCPSLS)**: A web-based tool used to report and learn about safety events, near misses, and hazards in health care settings.
- **C & S swab**: Swab for culture and sensitivity blood test to determine if a bacterial infection is present in the blood.
- **Capillary refill**: The process whereby blood returns to a portion of the capillary system after its blood supply has been interrupted briefly. For example, depress the nail edge to cause blanching and then release. Colour should return to the nail instantly or in less than three seconds. If it takes longer than three seconds, this suggests decreased peripheral perfusion and may indicate cardiovascular or respiratory dysfunction.
- **Catheter embolism**: Occurs when a small part of the cannula breaks off and flows into the vascular system.
- **Catheter-related blood stream infection (CR-BSI)**: An infection caused by microorganisms that are introduced into the blood through the puncture site, the hub of the needle, or contaminated IV tubing or IV solution, leading to bacteremia or sepsis.
- C**atheter-related thrombosis (CRT)**: The development of a blood clot related to long-term use of CVCs. Mostly occurs in the upper extremities and can lead to further complications such as pulmonary embolism, post thrombotic syndrome, and vascular compromise.
- **Central venous catheter (CVC)** (also known as **central line** or **central venous access device)**: An intravenous catheter that is inserted into a large vein in the central circulation system, where the tip of the catheter terminates in the superior vena cava (SVC).
- **Centre of gravity**: The point at which the mass of a body or object is centred when weight on all sides is equal.
- **Cerebral vascular accident (CVA)**: Also known as a stroke, a CVA is the interruption of blood flow to the brain (i.e., an ischemic stroke) or the rupture of a blood vessel (i.e., a hemorrhagic stroke) causing brain cells in the affected area to die. This event usually results in the loss of some brain function.
- **Chain of infection**: The transmission of microorganisms and subsequent infections is often referred to as the chain of infection. This infectious process can be thought of as a circular chain with six links that represent the specific circumstances needed for the infectious process to occur.
- **Chest tube**: A sterile tube with a number of drainage holes that is inserted into the pleural space. Also known as a thoracic catheter.
- **Chest tube drainage system**: A sterile, disposable system that consists of a compartment system that has a one-way valve, with one or multiple chambers, to remove air or fluid and prevent return of the air or fluid back into the patient.
- **Clean technique**: *See* medical asepsis.
- ***Clostridium difficile* infection (CDI)**: Infection caused by a bacterium that causes mild to severe intestinal problems and diarrhea. It is the most frequent cause of diarrhea in the hospital setting.
- **Clubbing**: A description of nails, usually presenting in the early stages as being straightened out to 180 degrees, with the nail base feeling spongy. Clubbing occurs with heart disease, emphysema, and chronic bronchitis.
- **Cohorting**: Placing patients with the same infections in the same room if a private room is not available.
- **Colloid solutions**: Solutions made up of large molecules that cannot pass through semi-permeable membranes and are used to expand intravascular volume by drawing fluid from extravascular space via

high osmotic pressure. Examples include albumin, dextrans, and hydroxyethyl starches.

- **Colostomy**: The creation of a stoma from part of the colon (large bowel), where the intestine is brought through the abdominal wall and attached to the skin, diverting normal intestinal fecal matter through the stoma instead of the anus.
- **Contact precautions**: Precautions used in addition to routine practice for patients who are known or suspected to be infected with microorganisms that can be transferred by the direct or indirect contact route.
- **Continent ileostomy**: Made from part of the ileum and is flushed a number of times each day to clean out the effluent.
- **Continent urinary reservoir**: Where a pouch is created from part of the intestine, and a catheter is inserted a number of times during the day to remove the urine.
- **Continuous intravenous infusion**: The infusion of a parenteral drug over several hours (continuous drip) to days. It involves adding medication to sterile IV solution (100-1,000 ml bag) and hanging the IV solution as a primary infusion.
- **Crystalloids solutions**: Solutions made up of solutes such as electrolytes or dextrose that are easily mixed and dissolvable in solution. Crystalloids contain small molecules that flow easily across semi-permeable membranes, which allows for transfer from the bloodstream into the cells and tissues.
- **CWMS**: An initialism used to remember "colour, warmth, movement, sensation of extremities."
- **Cyanosis**: A bluish, mottled discoloration that signifies decreased perfusion and indicates that the tissues are not being adequately oxygenated.
- **D50W**: Fifty-percent dextrose in water.
- **D5W**: Five-percent dextrose in water.
- **Dacron cuff**: An antimicrobial cuff surrounding a tunnelled CVC near the entry site, which is coated in antimicrobial solution to help prevent infection and holds the CVC in place.
- **Deep venous thrombosis (DVT)**: The formation of a blood clot within a deep vein, predominantly in the legs.
- **Droplet precautions**: Precautions used in addition to routine practices for patients who are known or suspected to be infected with microorganisms that are spread by large droplets.
- **Effluent**: The output from the stoma (urine, feces, or mucous).
- **Extension tubing**: Short, 20 cm, flexible sterile tube with a positive fluid displacement/positive pressure cap attached to the hub of the peripheral cannula.
- **Extravasation**: When vesicant solutions (medication) are administered and inadvertently leaked into surrounding tissue, causing damage to surrounding tissue.
- **Fowler's position**: The patient's head of bed is placed at a 45-degree angle. Hips may or may not be flexed. Common position to provide patient comfort and care.
- **Fraction of inspired oxygen (FiO_2)**: Fraction or percentage of oxygen being measured. Natural air includes 20.9% **oxygen**, which is equivalent to FiO2 of 0.21.
- **Gait belt or Transfer belt**: A two-inch-wide (5 mm) belt, with or without handles, that is placed around a patient's waist and fastened with Velcro. A transfer belt can be used with patients who are a one-person pivot transfer, a two-person pivot transfer, or a transfer with a slider board.
- **Gauge of a needle**: The diameter of the needle.
- **Gestational diabetes**: A form of diabetes that develops in women during pregnancy and disappears after delivery. Gestational diabetes affects about 4% of all pregnancies and increases the risk of developing Type 2 diabetes.
- **Hand hygiene**: A general term used to describe any action of hand cleaning. It refers to the removal of

soil and oil, and the killing or removal of transient microorganisms from the hands. Hand hygiene may be accomplished using an alcohol-based hand rub or soap and water. Surgical hand scrub is also a method of hand hygiene.

- **Hand hygiene with soap and water**: Hand hygiene using friction, soap, and water to remove microorganisms from hands.
- **Health care associated infection (HAI)**: An infection that develops as a result of contact with a pathogen in the health care setting or from a health care worker, that was not present at the time of admission. Also known as a nosocomial infection.
- **High alert medications**: Medications that are most likely to cause significant harm, even when used as intended. Mistakes may or may not be more common with high alert medications, but the harm to patients is more serious.
- **Hypertonic solution**: An IV solution that has a higher osmolality than plasma (serum), with an osmolality greater than 375 mOsm/L.
- **Hypotonic solution**: A solution that has an osmolality of less than 25 mOsm/L, a lower osmolality than intravascular space.
- **Hypoxemia**: A condition where arterial oxygen tension or partial pressure of oxygen (PaO_2) is below normal (<80 mmHg).
- **Hypoxia**: The reduction of oxygen supply at the tissue level, which is not measured directly by a laboratory value but by pulse oximetry and SpO_2.
- **Hypoxic drive**: A condition found in some patients with a chronically high level of $PaCO_2$, such as those with chronic obstructive pulmonary disease (COPD), where the stimulus and drive to breathe is caused by a decrease in PaO_2, not by an increase of CO_2.
- **Ileal conduit**: See *urostomy*.
- **Ileoanal ostomy**: A pouch created above the anal sphincter and is also created from a portion of the ileum.
- **Ileostomy**: Created from the ileum (small bowel), which is brought through the abdominal wall and used to create a stoma.
- **Implanted central venous catheter (ICVC)**: A CVC inserted into a vessel, body cavity, or organ and attached to a reservoir or "port" located under the skin. The device may be placed in the chest, abdomen, or inner aspect of the forearms. Also known as an implanted venous access device (IVAD), port a catheter, or port a cath.
- **Infection prevention and control (IPAC) practices**: Evidence-based procedures and practices that, when used consistently in a health care setting, can prevent and reduce disease transmission, eliminate sources of potential infections, and prevent the transfer of pathogens from one person to another.
- **Infiltration**: When non-vesicant solutions (IV solutions) are inadvertently administered into surrounding tissue.
- **Injection pens**: A new technology used by patients to self-inject insulin using a syringe, needle, and pre-filled cartridge of insulin.
- **Intradermal (ID) injection**: An injection that places the medication into the dermis, just under the epidermis.
- **Intramuscular (IM) injection**: An injection that places the medication into the body of a muscle.
- **Intravenous (IV) injection**: An injection that places the medication/solution into a vein through an existing IV line or a short venous access device (saline lock). Medications given by the intravenous route can be given as an IV bolus, as an intermittent (piggyback) medication, or in a large-volume continuous infusion.

- **Intravenous therapy**: Treatment that infuses intravenous solutions, medications, blood, or blood products directly into a vein.
- **Isotonic solution**: A solution in which the concentration of the dissolved particles is similar to that of plasma, with an osmolality of 250 to 375 mOsm/L.
- **Keloid formation**: A firm scar-like mass of tissue that occurs at the wound site. The scarring tends to extend past the wound and is darker in appearance.
- **Kussmaul respiration**: Deep, rapid, and laboured breathing that is characteristic of patients with acidosis (excess acidity of tissues).
- **Lateral position**: The patient lies on the side of the body with the top leg over the bottom leg. This position helps relieve pressure on the coccyx.
- **Latex allergy**: A reaction to latex products made from natural rubber in which people become allergic (or sensitive) to the proteins found in natural rubber.
- **Line of gravity**: The vertical line extending from the centre of gravity to the base of support, down the centre of the body. If the line of gravity moves outside the base of support, the amount of energy required to maintain equilibrium is increased.
- **Lumen**: A small, hollow channel within the CVC tube.
- **Mechanical lift**: A hydraulic lift, usually attached to a ceiling, used to move patients who cannot bear weight, who are unpredictable or unreliable, or who have a medical condition that does not allow them to stand or assist with moving.
- **Medical asepsis** (also known as **clean technique**): Includes procedures used for reducing the number of microorganisms and preventing their spread.
- **Medication incident**: Any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer.
- **Methicillin-resistant *Staphylococcus aureus* (MRSA)**: A strain of *Staphylococcus aureus* that is resistant to beta-lactam classes of antibiotics such as penicillin, cloxacillin, and cephalosporin.
- **Musculoskeletal injury (MSI)**: An injury or disorder of the muscles, tendons, ligaments, joints or nerves, blood vessels, or related soft tissue including a sprain, strain, or inflammation related to a work injury.
- **Nasogastric (NG) tube**: A flexible plastic tube inserted through the nostrils, down the nasopharynx, and into the stomach or the upper portion of the small intestine.
- **Needles**: Hollow cylindrical objects, made of stainless steel, with a sharp point used to inject medications into or draw fluids from the body. Needles are made up of the hub, shaft, and bevel.
- **No-Interruption Zone (NIZ)**: A place where health care providers can prepare medications without interruptions.
- **Nosocomial infection**: *See* health care associated infection (HAI).
- **Obturator**: A small plastic device used as a guide during tracheostomy tube insertion.
- **Oral suctioning**: The use of a rigid, plastic suction catheter, known as a yankauer, to remove pharyngeal secretions through the mouth.
- **Orthopneic or tripod position**: The patient sits at the side of the bed with head resting on an over-bed table on top of several pillows. This position is used for patients with breathing difficulties.
- **Orthostatic hypotension**: A form of low blood pressure that occurs when changing position from lying down to sitting, making the patient feel dizzy, faint, or lightheaded.
- **Ostomy:** A surgically created opening from the urinary tract or intestines, where effluent (fecal matter, urine, or mucous) is rerouted to the outside of the body using an artificially created opening called a **stoma**.
- **Oxygen therapy**: Treatment to provide oxygen according to target saturation rates (as per physician

orders or hospital protocol) in order to achieve normal or near normal oxygenation saturation levels for acute and chronically ill patients.

- **Oxygen toxicity**: A condition caused by excessive or inappropriate supplemental oxygen, which can lead to severe damage to the lungs — ranging from mild tracheobronchitis to diffuse alveolar damage — and other organ systems.
- **Parenteral medications**: Refers to the path by which the medication comes in contact with the body. Medications that enter the body by the parenteral route enter the tissue and circulatory system by injection.
- **$PaCO_2$**: The partial pressure of carbon dioxide in the arterial blood, which is measured by using a $PaCO_2$ analyzer.
- **Percutaneous central venous catheter**: A CVC inserted directly through the skin into the internal or external jugular, subclavian, or femoral vein. The tip of the catheter is located in the superior vena cava (SVC).
- **Peripheral IV (PIV)**: A short intravenous catheter inserted by percutaneous venipuncture into a peripheral vein.
- **Peripherally inserted central catheter (PICC)**: A central line inserted through the antecubital fossa or upper arm (basilic or cephalic vein) and threaded the full length until the tip reaches the superior vena cava (SVC).
- **Personal protective equipment (PPE)**: Clothing or equipment worn to protect against hazards.
- **Phlebitis**: The inflammation of the vein's inner lining, the tunica intima.
- **Pinch-off syndrome**: An internal pinching of a central line between the first rib and clavicle; can contribute to a mechanical occlusion of a CVC.
- **Port a catheter/port a cath**: *See* implanted central venous catheter (ICVC).
- **Primary infusion tubing/administration set**: A thin, flexible plastic sterile tubing used to infuse IV therapy.
- **Primary intention**: A type of wound healing where the wound edges are sutured or stapled closed, and the wound heals quickly with minimal tissue loss. Examples of wounds healing by primary intention are simple surgical wounds that heal without complications.
- **p.r.n.**: From the Latin *pro re nata* and means "as needed."
- **Prone position**: When the patient lies on the stomach with the head turned to the side.
- **Pulmonary edema** (also known as **circulatory overload** or **fluid overload**): A condition caused by excess fluid accumulation in the lungs, due to excessive fluid in the circulatory system.
- **Refeeding syndrome**: Caused by rapid refeeding after a period of under-nutrition, leads to metabolic and hormonal changes characterized by electrolyte shifts (decreased phosphate, magnesium, and potassium in serum levels), which may lead to widespread cellular dysfunction.
- **Routine practices**: A system of prevention and control practices recommended by the Public Agency of Canada to be used for all patients/residents/clients during all care to prevent and control all transmission of microorganisms in all health care settings.
- **Saline lock** (also known as **heparin lock**): A peripheral intravenous cannula with extension tubing attached to the hub, usually inserted in the arm or hand.
- **Secondary intention**: A type of wound healing where the wound is left open to heal by scar formation. Healing is slow, which places the patient at risk for infection, there is a loss of skin, and granulation tissue fills the area left open. Examples of wounds healing by secondary intention include severe lacerations or massive surgical interventions.
- **Secondary tubing administration set**: Flexible, sterile tubing used to hang a secondary IV medication,

which connects to an access port on the primary IV tubing.

- **Semi-Fowler's position**: The patient's head of bed is placed at a 30-degree angle. This position is used for patients who have cardiac or respiratory conditions, and for patients with a nasogastric tube.
- **Sims position**: Patient lies between supine and prone with legs flexed in front of the patient. Arms should be comfortably placed beside the patient, not underneath.
- **Slider board or Transfer board**: Board used to transfer immobile patients from one surface to another surface while the patient lies supine. The board allows health care providers to move immobile, bariatric, or complex patients in a safe manner.
- **Speed shock**: A systemic reaction caused by the rapid injection of a medication into the circulatory system, resulting in toxic levels of medication in the plasma.
- **Sterile asepsis**: *See* sterile technique.
- **Sterile field**: A sterile surface on which to place sterile equipment that is considered free from microorganisms.
- **Sterile gloves**: Gloves that are free from all microorganisms; required for contact with any invasive procedure and when contact with any sterile site, tissue, or body cavity is expected.
- **Sterile technique** (also known as **sterile asepsis**): A set of specific practices and procedures performed to make equipment and areas free from all microorganisms and to maintain that sterility.
- **Stoma:** See *ostomy*.
- **Subcutaneous (SC) injection**: An injection that places medication/solution into the loose connective tissues just under the dermis.
- **Supine position**: In this position, patients lie flat on their back. Additional supportive devices may be added for comfort.
- **Surgical asepsis**: The absence of all microorganisms within any type of invasive procedure.
- **Surgical hand scrub**: An antiseptic surgical scrub or antiseptic hand rub performed prior to donning surgical attire.
- **Surgical site infection (SSI)**: An infection that occurs after surgery in the area of surgery.
- **Syringe**: A sterile, single-use device with a Luer lock or non-Luer lock tip, which influences the name of the syringe. Syringes come in various sizes from 0.5 ml to 60 ml.
- **Tertiary intention**: A type of wound healing where the wound closing is intentionally delayed. On occasion, wounds are left open (covered by a sterile dressing) to allow an infection or inflammation to subside. Once the wound is closed with staples or sutures, the scarring is minimal.
- **Total parenteral nutrition (TPN)**: The infusion of nutrients, including amino acids, vitamins, electrolytes, dextrose, fat, and trace elements. It is most commonly administered through a central venous catheter.
- **Transfers**: Moving a patient from one flat surface to another, such as from a bed to a stretcher.
- **Transfusion medical services (TMS)**: Blood bank.
- **Trendelenburg position**: A position that places the head of the bed lower than the feet. Used in situations such as hypotension and medical emergencies. Helps promote venous return to major organs such as the head and heart.
- **Tunnelled central venous catheter**: A long-term CVC with a proximal end tunnelled subcutaneously from the insertion site and brought out through the skin at an exit site. It is a surgical procedure, where the catheter is tunnelled subcutaneously under the skin in the chest area before it enters the superior vena cava (SVC).
- **Type 1 diabetes**: A condition that usually develops in childhood or adolescence, and used to be called juvenile-onset diabetes. It occurs when the beta cells of the pancreas are destroyed by the immune system and no longer produce insulin, or produce very little insulin.

- **Type 2 diabetes**: A condition that used to be called non-insulin-dependent diabetes or adult-onset diabetes. With Type 2 diabetes, the body does not make enough insulin or does not respond well to the insulin it makes.
- **Urostomy** or **ileal conduit**: A stoma created using a piece of the intestine to divert urine to the outside of the body.
- **Vancomycin-resistant *Enterococci* (VRE)**: Strains of *Enterococcus faecium* or *Enterococcus faecalis* that are resistant to antibiotics. A type of ARO.
- **Vertigo**: A sensation of dizziness.
- **Vial**: A single- or multi-dose plastic container with a rubber seal top, covered by a metal or plastic cap.
- **Volume-controlled intermittent set**: A small device attached below the primary infusion to regulate the mini bag. The medication is added to a small amount of IV solution and administered through an IV line.
- **Workaround**: A process that bypasses a procedure, policy, or problem in a system. For example, nurses may "borrow" a medication from another patient while waiting for an order to be filled by the pharmacy.
- **Wound dehiscence**: A mechanical failure of wound healing; remains a problem and can be affected by multiple factors.
- **Z-Track method**: A method of administrating an intramuscular injection that prevents the tracking of the medication through the subcutaneous tissue and seals the medication in the muscle, minimizing irritation from the medication.

Appendix 2: Checklists - Summary and Links

Chapter 1

Checklist 1: Routine Practices

Checklist 2: Five Key Moments in Hand Hygiene

Checklist 3: Hand Hygiene with ABHR

Checklist 4: Hand Hygiene with Soap and Water

Checklist 5: Applying and Removing Non-Sterile Gloves

Checklist 6: Donning PPE

Checklist 7: Doffing PPE

Checklist 8: BBF Exposure

Checklist 9: Entering the OR

Checklist 10: Surgical Hand Scrub with Medicated Soap

Checklist 11: Donning Sterile Gloves

Checklist 12: Preparing a Sterile Field

Chapter 2

Checklist 13 Health History Checklist

Checklist 14: Pain Assessment

Checklist 15: Vital Signs

Checklist 16: Head and neck / Neurological assessment

Checklist 17 Chest / Respiratory Assessment

Checklist 18 Cardiovascular (CV) Assessment

Checklist 19 Abdominal / Gastrointestinal Assessment

Checklist 20 Genitourinary Assessment

Checklist 21 Musculoskeletal Assessment

Checklist 22 Integument Assessment

Checklist 23 Quick Priority Assessment

Chapter 3

Checklist 24 Risk Assessment for Safer Patient Handling

Checklist 25 Moving a patient from bed to stretcher

Checklist 26 Bed to Wheelchair Transfer – one person assist

Checklist 27 Moving a patient up in bed

Checklist 28 Positioning a Patient to the Side of the Bed

Checklist 29 Assisting a Patient to a Sitting Position

Checklist 30 Assisting to ambulate using a gait belt / transfer belt

Checklist 31 Ambulating with a walker

Checklist 32 Ambulating with crutches

Checklist 33 Ambulating with a cane

Checklist 34 Lowering a Patient to the Floor

Chapter 4

Checklist 35 Simple Dressing Change

Checklist 36 Wet to moist dressing changes

Checklist 37 Wound Irrigation and Packing

Checklist 38 Intermittent Suture Removal

Checklist 39 Staple Removal

Checklist 40 Emptying a Closed Wound Drainage System

Checklist 41 Drain Removal

Chapter 5

Checklist 42 Applying and Titrating Oxygen Therapy

Checklist 43 Oral Suctioning with Yankeur suction tip

Checklist 44: Oropharyngeal suctioning

Chapter 6

Checklist 45: Administering Medication by Mouth

Checklist 46: Administering Medication via a Gastric Tube

Checklist 47: Medication Administered Rectally

Checklist 48: Medication Administered Vaginally

Checklist 49: Instilling Eye (Ophthalmic) Medications

Checklist 50: Instilling Ear (Otic) Medications

Checklist 51: Instilling Nasal Medications

Checklist 52: Medication by Small-Volume Nebulizer

Checklist 53: Medication by Metered Dose Inhaler (MDI)

Checklist 54 Medication by Dry Powder Inhaler (DPI)

Checklist 55: Applying a Transdermal Patch

Checklist 56: Applying Topical Creams, Lotions, and Ointments

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Checklist 57: Administering an Intradermal (ID) Injection

Checklist 58: Subcutaneous Injections

Checklist 59: Administering a Z track Intramuscular Injection

Checklist 60: Administering medications IV Direct into a Locked / Capped IV

Checklist 61: Administering Medication IV Direct into an Infusing IV with Compatible Solution

Checklist 62 Administering IV Direct into an Infusing IV with Incompatible IV Solution

Checklist 63: Administering an Intermittent IV Medication by a Minibag (inital dose)

Checklist 64: Administering an Intermittent IV Medication by a Minibag using an Existing Secondary Line.

Chapter 8

Checklist 65: Assessing an IV System

Checklist 66: Priming IV Tubing

Checklist 67: Changing an IV

Checklist 68 Changing IV Tubing

Checklist 69: Flushing a PVAD – short Saline Lock

Checklist 70: Flushing a CVAD (PICC and Percutaneous Non hemodialysis)

Checklist 71: Removing a PVAD – short cannula / Peripheral Midline Catheter

Checklist 72: Removing a Percutaneous Non hemodialysis CVC/ PICC

Checklist 73: Changing an IV site dressing – no additional securement devices

Checklist 74: Changing an IV site dressing involving a securement device

Checklist 75 Pretransfusion Preparation

Checklist 76 Transfusion of Blood and Blood Products

Checklist 77: Managing a Blood or Blood Product Transfusion Reaction

Checklist 78: PN Administration

Chapter 9

Checklist 79: Blood Glucose Monitoring

Chapter 10

Checklist 80: Inserting a Nasogastric Tube – Adult

Checklist 81: Removal of an NG Tube

Checklist 82: Insertion of an Intermittent or Indwelling Urinary Catheter

Checklist 83: Removing an Indwelling Catheter

Checklist 84: Tracheal Suctioning – open method

Checklist 85: Replacing and Cleaning an Inner Tracheal Cannula

Checklist 86: Cleaning Stoma and Changing a Sterile Dressing

Checklist 87: Replacing Tracheostomy Ties (Velcro or Twill Tape)

Checklist 88: Care and management of a Closed Chest Tube Drainage System

Checklist 89: Changing an Ostomy Appliance (flange and pouch)

Appendix 3: Video titles and links

The following is a quick reference to all videos in this text.

Chapter	Video title	Link
1.4	*Donning and Doffing PPE*	https://barabus.tru.ca/nursing/donning_and_doffing.html
1.5	*Principles of Asepsis*	https://barabus.tru.ca/nursing/principles_of_asepsis.html
1.7	*Applying Sterile Gloves*	https://barabus.tru.ca/nursing/applying_sterile_gloves.html
1.7	*Simple Sterile Dressing Change*	https://barabus.tru.ca/nursing/simple_sterile_dressing_change.html
2.6	*Neurological Assessment (Basic)*	https://barabus.tru.ca/nursing/neurological_assessment.html
2.11	*Assessing Range of Motion and Strength*	https://barabus.tru.ca/nursing/assessing_ROM.html
3.7	*Assisting from Bed to Chair with a Gait Belt / Transfer Belt*	https://barabus.tru.ca/nursing/assisting_from_bed.html
3.8	*Sit to Stand Mechanical Assist*	https://barabus.tru.ca/nursing/sit_to_stand.html
3.8	*How to use a ceiling lift*	https://barabus.tru.ca/nursing/ceiling_lift.html
3.8	*How to Use a Hammock Sling*	https://barabus.tru.ca/nursing/hammock_sling.html
3.8	*How to Use a Hygiene Sling*	https://barabus.tru.ca/nursing/hygiene_sling.html
3.10	*How to Ambulate With or Without a Gait Belt or Transfer Belt*	https://barabus.tru.ca/nursing/ambulate_with_gait_belt.html
3.10	*How to Ambulate With Crutches*	https://barabus.tru.ca/nursing/ambulate_with_crutches.html
3.10	*How to ambulate with a cane*	https://barabus.tru.ca/nursing/ambulate_with_cane.html
3.11	*Assisted Fall*	https://barabus.tru.ca/nursing/assisted_fall.html
4.5	*Principles of Asepsis*	https://barabus.tru.ca/nursing/principles_of_asepsis.html
4.5	*Simple Sterile Dressing Change*	https://barabus.tru.ca/nursing/simple_sterile_dressing_change.html
4.6	*Wound Irrigation and Wound Packing*	https://barabus.tru.ca/nursing/wound_irrigation_packing.html
4.7	*Intermittent Suture Removal*	https://barabus.tru.ca/nursing/Inter_SutureRemoval.html
4.7	*Continuous / blanket suture removal*	https://barabus.tru.ca/nursing/Blanket_SutureRemoval.html

4.7	*Continuous / Blanket Suture Removal*	https://barabus.tru.ca/nursing/Blanket_SutureRemoval.html
4.8	*Staple Removal*	https://barabus.tru.ca/nursing/StapleRemoval.html
4.9	*JP Drain Removal*	https://barabus.tru.ca/nursing/jp_drain_removal.html
5.8	*Oral Suctioning*	https://barabus.tru.ca/nursing/Oral_Suctioning.html
5.9	*Oropharyngeal Suctioning*	https://barabus.tru.ca/nursing/Oropharyngeal_Suctioning.html
7.2	*Preparing Medications from a Vial*	https://barabus.tru.ca/nursing/Prepare_MedsVial.html
7.2	*Preparing a Medication from an Ampule*	https://barabus.tru.ca/nursing/Prepare_MedsAmpoule.html
7.2	*Reconstitution of Powdered IV Medication and administration via a minibag*	https://barabus.tru.ca/nursing/reconstitution_powdered_medication.html
7.4	*Administering a Subcutaneous Injection*	https://barabus.tru.ca/nursing/admin_subinjection.html
7.4	*Insertion of an Indwelling Subcutaneous Device aka 'subcutaneous butterfly'*	https://barabus.tru.ca/nursing/Insert_SubcutaneousButterfly.html
7.5	*Landmarking—Deltoid Administering an IM Injection— Using Z-track*	https://barabus.tru.ca/nursing/Deltoid_AdminIMInjection.html
7.5	*Landmarking—Ventrogluteal Administering an IM Injection—Using Z-track*	https://barabus.tru.ca/nursing/Ventrogluteal_AdminIMInjecton.html
7.5	*Landmarking— Vastus Lateralus Administering IM Injection—Using Z-track*	https://barabus.tru.ca/nursing/VastusLateralis_AdminIMInjection.html
7.6	*Administering Medications: Direct IV – Into a Locked IV (PVAD short)*	https://barabus.tru.ca/nursing/administering_med_locked_iv.html
7.6	*Administering Medications: Direct IV – Into an IV with an Infusion (PVAD short)*	https://barabus.tru.ca/nursing/administering_med_iv_infusion.html
7.7	*Reconstitution of Powdered IV Medication and administration via a minibag*	https://barabus.tru.ca/nursing/reconstitution_powdered_medication.html
8.7	*Priming IV Lines*	https://barabus.tru.ca/nursing/Prime_IVLines.html
8.7	*Changing IV Bags*	https://barabus.tru.ca/nursing/ChangingIVBag.html

8.7	*Converting an IV to a saline loc – extension present*	https://barabus.tru.ca/nursing/IVtoSaline_ExPreset.html
8.7	*Converting and IV to a saline loc – no extension present*	https://barabus.tru.ca/nursing/IVtoSaline_NoExPreset.html
8.8	*PVAD short flush (aka Saline Lock Flush)*	https://barabus.tru.ca/nursing/pvad_short_flush.html
8.8	*CVAD Care and Maintenance—Lumens with Valves*	https://barabus.tru.ca/nursing/cvad_with_valves.html
8.8	*CVAD Care and Maintenance—Lumens without Valves*	https://barabus.tru.ca/nursing/cvad_without_valves.html
8.9	*Blood draw through a CVAD*	https://barabus.tru.ca/nursing/blood_draw_cvad.html
8.10	*Removing a PVAD-Short Cannula*	https://barabus.tru.ca/nursing/removing_pvad.html
8.10	*PVAD-Short Dressing Change*	https://barabus.tru.ca/nursing/pvad_short_dressing_change.html
8.10	*PICC Dressing Change*	https://barabus.tru.ca/nursing/picc_dressing_change.html
10.3	*Nasogastric tube insertion*	https://barabus.tru.ca/nursing/nasogastric_tube_insertion.html
10.4	*Urinary Catheterization (Male)*	https://barabus.tru.ca/nursing/urinary_catherization_male.html
10.4	*Urinary Catheterization (Female)*	https://barabus.tru.ca/nursing/urinary_catherization_female.html
10.4	*Foley Catheter Removal*	https://barabus.tru.ca/nursing/foley_catheter_removal.html
10.5	*Tracheostomy Suctioning – Closed in line Method*	https://barabus.tru.ca/nursing/Closed_Tracheostomy.html
10.5	*Replacing and Cleaning an Inner Tracheal Cannula*	https://barabus.tru.ca/nursing/replacing_inner_tracheal_cannula.html
10.5	*Changing a Trachestomy Site Dressing*	https://barabus.tru.ca/nursing/changing_tracheostomy_site_dressing.html
10.5	*Changing Tracheostomy Ties*	https://barabus.tru.ca/nursing/changing_traceostomy_ties.html

10.5	*Trach Tubes – inflated versus deflated cuffs*	https://barabus.tru.ca/nursing/tracheostomy_tubes.html
10.6	*Chest tube care & maintenance*	https://barabus.tru.ca/nursing/Chest_tubes.html
10.6	*Dry suction chest drainage system*	https://barabus.tru.ca/nursing/dry_suction_chest_drainage.html

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About the Authors

Glynda Rees Doyle

Glynda Rees Doyle teaches at the British Columbia Institute of Technology (BCIT) in Vancouver, British Columbia. She completed her MSN at the University of British Columbia with a focus on education and health informatics, and her BSN at the University of Cape Town in South Africa. Glynda has many years of national and international clinical experience in critical care units in South Africa, the UK, and the USA. Her teaching background has focused on clinical education, problem-based learning, clinical techniques, and pharmacology.

Glynda is involved in several interprofessional research projects within BCIT and also in collaboration with other Canadian nursing schools, studying the impact of mobile devices laden with clinical resources, social networks, and e-portfolios on nursing students and their education. Her interests include the integration of health informatics in undergraduate education, and the impact of educational technologies on nursing students' clinical judgment and decision making at the point of care to improve patient safety and quality of care.

Glynda currently sits on the Research Ethics Board at BCIT, is a digital health peer leader for the Canadian Association of Schools of Nursing and Canada Health Infoway, the communications

director for the Canadian Nursing Informatics Association, and a member of the American Medical Informatics Association's Education and Nursing Informatics Working Groups.

Jodie Anita McCutcheon

Jodie McCutcheon teaches in the undergraduate BSN program at the British Columbia Institute of Technology (BCIT). She is currently the nursing lab coordinator for the BSN program. She completed her BSN at the University of Victoria and came to BCIT to teach with experience in medical, geriatric, and cardiac nursing, as well as leadership experience as a nurse educator and clinical coordinator at VGH. She completed her MSN at the University of British Columbia with a focus on clinical education and online learning.

Jodie chose to become an educator because she wanted to impact the future of nursing by preparing individuals to practise safely and effectively in a complex health care environment. Jodie has many years of teaching experience in problem-based learning, skill acquisition, and course development for the nursing program and allied health care programs at BCIT. Her interests include lab education and simulation as effective teaching strategies to promote learning. Jodie is involved in many Interprofessional Education (IPE) projects at BCIT. Her primary passion in nursing education is the promotion of patient safety and quality initiatives and teaching strategies in the School of Health Sciences at BCIT. She is the co-chair of the patient safety and quality committee in the BSN program and has brought various safety initiatives to BCIT, including

Change Day and Canadian Patient Safety Week. Jodie is a member of the BC Lab Educators committee, Western and Northern Region Canadian Association of Schools of Nursing, and the International Nursing Association for Clinical Simulation and Learning.

Renée Anderson

Renée Anderson teaches in the BScN program at Thompson Rivers University. She started nursing with an RN diploma and realized that more education would open more doors in the future. That led to the completion of an undergraduate degree from University of Victoria through UCC and then a Masters of Nursing through Athabasca University where she focused her studies on nursing and adult learning and development. Her nursing background has included mostly med -surg acute care with a year of pediatrics at the start of her nursing career. Her teaching interests include nursing practice, psychomotor skills, simulation, pharmacology. In the past she has cochaired the Teaching Practices Colloquium committee at TRU. Her committee work with the TRU School of Nursing includes cochair of the program evaluation and very active member of the curriculum committee. She wass the practice lead in the BScN program providing support to faculty in their development as practice educators for the past 4 years.