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Nursing Procedures

EIGHTH EDITION

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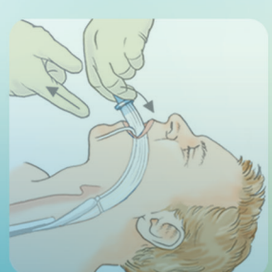

Wolters Kluwer

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9 8 7 6 5 4 3 2 1

Printed in China

Library of Congress Cataloging-in-Publication Data

Names: Wolters Kluwer (Firm), publisher.
Title: Lippincott nursing procedures.
Description: Eighth edition. | Philadelphia : Wolters Kluwer, [2019] |
Includes bibliographical references and index.
Identifiers: LCCN 2018035632 | ISBN 9781469815299 (paperback)
Subjects: LCSH: Nursing. | Evidence-based nursing. | BISAC: MEDICAL / Nursing /
Fundamentals & Skills. | MEDICAL / Nursing / Assessment & Diagnosis. |
MEDICAL / Nursing / General.
Classification: LCC RT41 .L57 2019 | DDC 610.73–dc23 LC record available at
https://lccn.loc.gov/2018035632

shop.lww.com

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How to use this book

As a nurse, you're expected to know how to perform or assist with literally hundreds of procedures. From the most basic patient care, to complex treatments, to assisting with the most intricate surgical procedures, you need to be able to carry out nursing procedures with skill and confidence. But mastering so many procedures is a tall order.

Newly updated with the latest evidence-based research, this eighth edition of *Lippincott Nursing Procedures* provides step-by-step guidance on the most commonly performed nursing procedures you need to know, making it the ideal resource for providing the professional, hands-on care your patients deserve.

The A to Zs of organization

With over 400 procedures covered in detail, the current edition of *Lippincott Nursing Procedures* presents this wealth of information in the most efficient way possible. Many procedures books use such categories as fundamental procedures, body systems, and other types of procedures (such as psychiatric care) to organize the material. But with the proliferation in the number and types of procedures you need to understand, such an organization can become difficult to manage.

To address this, *Lippincott Nursing Procedures* organizes all procedures into an A-to-Z listing, making the book fast and easy to use. When you need to find a particular procedure quickly, you can simply look it up by name. No need to scan through the table of contents. No time lost turning to the index, looking for the name of the procedure you want, and then finding the right page in the book.

Once you've found the entry for a particular procedure in the alphabetical listing, you'll find that each entry uses the same clear, straightforward structure. An introductory section appears first. After that, most or all of the following sections appear, depending on the particular procedure:

- The *Equipment* section lists all the equipment you'll need, including all the variations in equipment that might be needed. For instance, in the "endotracheal intubation" entry, you'll see a general equipment list, which is followed by separate lists of the additional equipment you'll need for direct visualization intubation and blind nasotracheal intubation.
- As the name implies, the *Preparation of equipment* section guides you through preparing the equipment for the procedure.
- In the *Implementation* section—the heart of each entry—you'll find the step-by-step guide to performing the particular procedure.
- *Special considerations* alerts you to factors to keep in mind that can affect the procedure.
- *Patient teaching* covers procedure-related and home care information you need to teach to the patient and family.
- *Complications* details procedure-related complications to watch for.
- The *Documentation* section helps you keep track of everything you need to document related to the procedure.
- The expanded *References* section includes numbered citations keyed to the main text of each entry. These numbered citations serve as the clinical evidence that underpins the information and step-by-step procedures presented in the entry. (There'll be more on this in the next section of this "how to" guide.)

The continued use of the A-to-Z organization in the eighth edition and the clear structure of each entry make this book a powerful tool for finding and understanding the procedures you need to know.

Evidently speaking…

Lippincott Nursing Procedures strengthens its evidence-based approach to nursing care with an expanded numbered *References* section that appears in each entry. As mentioned earlier, the numbered citations are keyed to information that appears throughout each procedure.

As you read through an entry and come across a bullet describing a particular step in a procedure, you'll notice one or more red superscript numbers following the bullet. These numbers are citations for studies listed in the *References* section; the studies supply clinical evidence or detail "best practices" related to that bulleted step in the procedure. This is what is meant by *evidence-based practice*: a particular practice—say, performing hand hygiene—is supported by the clinical evidence. This evidence-based approach means the procedures you'll read about in *Lippincott Nursing Procedures* are best-practice procedures that rely on solid, authoritative evidence.

As you look at the numbered references in each entry, you may notice that many of them are followed by a level number. This level number appears in parentheses after the reference as the word "Level" followed by a Roman numeral that ranges from I to VII. These level numbers give you an indication of the strength of the particular reference, with Level I being the strongest and Level VII the weakest.

Here's how the rating system for this hierarchy of evidence works:

- *Level I:* Evidence comes from a systematic review or meta-analysis of all relevant randomized, controlled trials.
- *Level II:* Evidence comes from at least one well-designed randomized, controlled trial.
- *Level III:* Evidence comes from well-designed, controlled trials without randomization.
- *Level IV:* Evidence comes from well-designed case-control and cohort studies.
- *Level V:* Evidence comes from systematic reviews of descriptive and qualitative studies.
- *Level VI:* Evidence comes from a single descriptive or qualitative study.
- *Level VII:* Evidence comes from the opinion of authorities, reports of expert committees, or both.

In this book, the majority of cited references followed by a level are rated "Level I." These Level I references provide the strongest level of evidence to support a particular practice. You can use these levels to gauge the strength of supporting evidence for any particular practice or procedure.

Another important way *Lippincott Nursing Procedures* provides a more evidence-based approach is by offering rationales for many procedure steps. These rationales are set off from the main text in italics. For instance, you may see a bullet like this: "Explain the procedure to the patient and family (if appropriate) according to their individual communication and learning needs *to increase their understanding, allay their fears, and enhance cooperation.*" The second part of that bullet—the italicized portion—is the rationale, or reason, for performing the first part. The practice of answering the patient's questions is supported by the clinical evidence of the patient's decreased anxiety and increased cooperation.

Just the highlights, please

Lippincott Nursing Procedures, Eighth Edition, also benefits from other features that make it easy to use. Throughout, you'll find highlighting that greatly enhances the main text.

Some examples:

- As mentioned earlier, footnotes appear in red for easier spotting.
- Colored letter tabs at the top of each page make finding a particular entry quick and easy.
- Full-color photos and diagrams highlight the main text, illustrating many of the step-by-step procedures in the *Implementation* section of each entry.
- Special alerts—with colorful, eye-catching logos—appear in many entries:

NURSING ALERT lets you know about potentially dangerous actions or clinically significant findings related to a procedure.

PEDIATRIC ALERT warns you of particular precautions to take concerning infants, young children, and adolescents.

ELDER ALERT cautions you about the special needs of this growing population.

HOSPITAL-ACQUIRED CONDITION ALERT warns you about conditions that the Centers for Medicare and Medicaid Services has identified as conditions that can occur as the result of hospitalization. Following various best practices can reasonably help to prevent such conditions; when these conditions do occur, they have payment implications for health care facilities.

- Short, boxed-off items appear throughout the book. These short pieces run the gamut, from explaining procedures in more detail, to highlighting equipment, to offering tips for clearer documentation, to name just a few. Several are set off with their own eye-catching icons and are enhanced with illustrations or full-color photos:

EQUIPMENT profiles an essential piece of equipment needed to help diagnose or treat the patient.

TROUBLESHOOTING helps you to quickly identify problems and complications, isolate their probable cause, and guide you with step-by-step interventions.

PATIENT TEACHING provides helpful tips, reminders, and follow-up instructions to share with patients being discharged following their procedure.

Your go-to guide

Now that you know what the eighth edition of *Lippincott Nursing Procedures* has to offer—and have learned how to use it quickly and adeptly—you're ready to take on the task of performing a variety of nursing procedures. Whether you're a nursing student, a recent graduate, or an experienced practitioner, you're ready to provide all your patients with expert nursing care, with your go-to guide at your fingertips.

ABDOMINAL PARACENTESIS, ASSISTING

As a bedside procedure, abdominal paracentesis involves the aspiration of fluid from the peritoneal space through a needle, trocar, or angiocatheter[1] inserted in the abdominal wall. Used to diagnose and treat massive ascites resistant to other therapies, the procedure helps to determine the cause of ascites while relieving the resulting pressure.

Abdominal paracentesis may also precede other procedures, including radiography, peritoneal dialysis, and surgery; detect intra-abdominal bleeding after a traumatic injury; and be used to obtain a peritoneal fluid specimen for laboratory analysis. The procedure must be performed cautiously in pregnant patients as well as in patients with bleeding tendencies, severely distended bowel, or infection at the intended insertion site.

Equipment

Stethoscope ■ blood pressure monitor ■ pulse oximeter ■ thermometer ■ scale ■ tape measure ■ sterile gloves ■ mask ■ gloves ■ gown ■ goggles ■ fluid-impermeable pads ■ four laboratory tubes ■ drainage bag ■ laboratory biohazard transport bag ■ laboratory request forms ■ antiseptic cleaning solution (povidone-iodine, chlorhexidine) ■ local anesthetic (multidose vial of 1% or 2% lidocaine with epinephrine) ■ sterile 4″ × 4″ (10-cm × 10-cm) gauze pads ■ tape ■ sterile paracentesis tray ■ sterile drapes ■ marking pen ■ 5-mL syringe with 21G or 25G needle ■ disinfectant pad ■ Optional: alcohol sponge, 50-mL syringe, suture materials, IV albumin, IV insertion kit, indwelling urinary catheter insertion equipment.

If a preassembled tray isn't available, gather the following sterile supplies: trocar with stylet, 16G to 20G needle, or angiocatheter; 25G or 27G 1½″ (3.8 cm) needle; 20G or 22G spinal needle; scalpel; #11 knife blade; three-way stopcock.

Preparation of equipment

Check the expiration date on each sterile package, inspect each for tears, and replace as necessary.

Implementation

- Verify the practitioner's order.
- Gather the necessary equipment.
- Confirm the practitioner has obtained written informed consent and that the consent is in the patient's medical record.[2,3,4,5]
- Check the patient's history for hypersensitivity to latex or to the local anesthetic.
- Conduct a preprocedure verification to make sure that all relevant documentation, related information, and equipment are available and correctly identified to the patient's identifiers.[6,7]
- Verify that laboratory and imaging studies have been completed as ordered and that the results are in the patient's medical record. Notify the practitioner of any unexpected results.[6]
- Perform hand hygiene and put on gloves.[8,9,10,11,12,13]
- Confirm the patient's identity using at least two patient identifiers.[14]
- Provide privacy.[15,16,17,18]
- Reinforce the practitioner's explanation of the procedure according to the individual communication and learning needs *to increase understanding, allay fears, and enhance cooperation.*[19] Reassure the patient that the he or she should feel no pain but may feel a stinging sensation from the local anesthetic injection and pressure from the needle, trocar, or angiocatheter insertion. The patient may also sense pressure when the practitioner aspirates abdominal fluid.
- Instruct the patient to void before the procedure. Alternatively, insert an indwelling urinary catheter, if ordered, *to minimize the risk of accidental bladder injury from insertion of the needle, trocar, or angiocatheter.*[1]
- Obtain the patient's weight.
- Raise the patient's bed to waist level when performing patient care *to prevent back strain.*[20]
- Perform hand hygiene.[8,9,10,11,12,13]
- Obtain the patient's vital signs, oxygen saturation level, weight, and abdominal girth *to serve as a baseline for comparison during and after the procedure.*[1] Use the tape measure to measure the patient's abdominal girth at the umbilical level. Use a felt-tipped marker to indicate the abdominal area measured.
- Perform a comprehensive pain assess using techniques appropriate for the patient's age, condition, and ability to understand *to serve as a baseline for comparison during and after the procedure.*[1,21]
- Make sure the patient has a patent IV catheter in place, if ordered; insert a new IC catheter, if necessary *to provide access for administration of IV fluid and sedation, as needed.*
- Position the patient in the supine position or on the side *to allow the fluid to pool in dependent areas.*[1]
- Expose the patient's abdomen from diaphragm to pubis. Keep the rest of the patient covered *to avoid chilling.*
- Make the patient as comfortable as possible and place a fluid-impermeable pad under him or her *for protection from drainage.*
- Remind the patient to stay as still as possible during the procedure *to prevent injury from the needle, trocar, or angiocatheter.*
- Perform hand hygiene.[8,9,10,11,12,13]
- Open the paracentesis tray using sterile technique *to ensure a sterile field.*
- Put on a gown, a mask, goggles, and gloves *to comply with standard precautions.*[22,23,24]
- Label all medications, medication containers, and other solutions on and off the sterile field.[25,26]
- Assist the practitioner during preparation of then patient's abdomen with antiseptic cleaning solution, draping the insertion site with sterile drapes, and administering the local anesthetic.
- Conduct a time-out immediately before starting the procedure *to perform a final assessment that the correct patient, site, positioning, and procedure are identified and, as applicable, that all relevant information and necessary equipment are available.*[27]
- Using the scalpel, the practitioner may make a small incision before inserting the needle, trocar, or angiocatheter (usually 1″ to 2″ [2.5 to 5 cm] below the umbilicus). Listen for a popping sound, *which signifies that the needle, trocar, or angiocatheter has pierced the peritoneum.*
- Assist the practitioner with collecting specimens in the proper containers. If the practitioner orders substantial drainage, aseptically connect the three-way stopcock and tubing to the needle, trocar, or angiocatheter. Run the other end of the tubing to the drainage bag. Alternatively, aspirate the fluid with a three-way stopcock and 50-mL syringe.
- Label the specimen tubes in the presence of the patient *to prevent mislabeling,*[14] and send them to the laboratory in a laboratory biohazard transport bag[24] with the appropriate laboratory request forms. If the patient is receiving antibiotics, note this information on the request form for consideration during the fluid analysis.
- Gently turn the patient from side to side *to enhance drainage*, if necessary.[1]
- As the fluid drains, monitor the patient's vital signs and oxygen saturation level frequently. Observe the patient closely for vertigo, faintness, diaphoresis, pallor, heightened anxiety, tachycardia, dyspnea, and hypotension, especially if more than 5 L of peritoneal fluid was aspirated at one time. In rare cases, *this loss may induce a fluid shift and hypovolemic shock.*[28] Immediately report signs of shock to the practitioner.
- Administer IV albumin, as ordered, *to prevent hypovolemia and a decline in renal function.*[21,28,29,30,31,32]
- When the procedure ends and the practitioner removes the needle, trocar, or angiocatheter, apply pressure to the wound using sterile 4″ × 4″ (10-cm × 10-cm) gauze pads. If there is still wound leakage after 5 minutes, the practitioner may suture the incision.[1] Alternatively, if permitted in your facility, remove the paracentesis catheter, as directed: *some facilities permit a specially trained nurse to remove the catheter.*
- Remove and discard your gloves,[22,24] perform hand hygiene,[8,9,10,11,12,13] and put on sterile gloves.[22,24]
- When drainage becomes minimal, remove and discard the pressure dressing, apply dry sterile gauze pads, and tape them to the site.

NURSING ALERT **If the patient has fragile skin, use dressings and tape specifically formulated for fragile skin *to prevent skin stripping during removal.*[33]**

- Help the patient assume a comfortable position.

- Monitor the patient's vital signs and oxygen saturation level, and check the dressing for drainage as determined by the patient's condition and at an interval determined by your facility *because no evidence-based research is available to indicate best practice for the frequency of vital sign assessment after a procedure*.[34] Make sure that alarm limits are set properly for the patient's current conditions and that alarms are turned on, functioning properly, and audible to staff.[35,36,37,38]
- Check the dressing for drainage. Be sure to note drainage color, amount, and character.
- Perform a comprehensive pain assessment using techniques appropriate for the patient's age, condition, and ability to understand.[21] Administer pain medication as needed and ordered, following safe medication administration practice.[30,31,32,39]
- Return the bed to the lowest position *to prevent falls and maintain patient safety.*[40]
- Dispose of used supplies in the appropriate receptacles.[24]
- Remove and discard your gloves and personal protective equipment.[22,24]
- Perform hand hygiene.[8,9,10,11,12,13]
- Clean and disinfect your stethoscope using a disinfectant pad.[41,42]
- Perform hand hygiene.[8,9,10,11,12,13]
- Document the procedure.[43,44,45,46]

Special considerations

- Throughout this procedure, help the patient remain still *to prevent accidental perforation of abdominal organs*.
- If the patient shows signs of hypovolemic shock, reduce the vertical distance between the needle, trocar, or angiocatheter and the drainage collection container *to slow the drainage rate*. If necessary, stop the drainage.
- If peritoneal fluid doesn't flow easily, try repositioning the patient *to facilitate drainage*.
- After the procedure, observe for peritoneal fluid leakage. If this develops, notify the practitioner.
- Obtain the patient's weight (using the same scale) and abdominal girth daily. Compare these values with the baseline figures *to detect recurrent ascites*.
- Ultrasound may be used to assist in locating the fluid and inserting the needle, trocar, or angiocatheter. Ultrasound-guided paracentesis has been shown to result in fewer adverse events than paracentesis performed without ultrasound guidance.[1,47]
- Monitor for respiratory changes during the procedure. Ascites may place pressure on the diaphragm, leading to respiratory distress. Removal of ascitic fluid should help relieve this pressure and distress.[1,29]
- The Joint Commission has issued a sentinel event alert concerning medical device alarm safety *because alarm-related events have been associated with permanent loss of function or death*. Among major contributing factors were improper alarm settings, alarm settings inappropriately turned off, and alarm signals not audible to staff. Make sure that alarm limits are set properly and that alarms are turned on, functioning properly, and audible to staff. Follow facility guidelines for preventing alarm fatigue.[35]

Complications

Removing large amounts of fluid may cause hypotension, oliguria, and hyponatremia, although this is rare. Ascitic fluid may form again, drawing fluid from extracellular tissue throughout the body. Other possible procedural complications include perforation of abdominal organs, including of the bowel or bladder by the needle, trocar, or angiocatheter; wound infection; internal bleeding; and peritonitis.[28,29]

Documentation

Record the date and time of the procedure, puncture site location, and whether the wound was sutured. Document the amount, color, viscosity, and odor of aspirated fluid in your notes as well as in the fluid intake and output record. Record the patient's vital signs, oxygen saturation, weight, and abdominal girth measurements before and after the procedure. Also note the patient's tolerance of the procedure, his or her vital signs, and any signs or symptoms of complications during the procedure. Note the number of specimens sent to the laboratory. Document any patient teaching provided and the patient's understanding.

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ADMISSION

Admission to a nursing unit prepares a patient for his or her stay in a health care facility. Whether the admission is scheduled or follows emergency treatment, effective admission procedures should include certain steps to accomplish important goals. These steps include verifying the patient's identity using at least two patient identifiers,[1] assessing the clinical status, making the patient as comfortable as possible, introducing the patient to roommates (if possible) and staff, orienting the patient to the environment and routine, and providing supplies and special equipment needed for daily care.

The Joint Commission and DNV GL-Healthcare require that each patient undergo an admission assessment by a registered nurse within 24 hours after inpatient admission.[2,3,4] The *Healthcare Facilities Accreditation Program* requires that an initial assessment be performed by a registered nurse within the timeframe established by the individual facility.[5] During this assessment, the nurse should prioritize the patient's needs, always remaining aware of the patient's levels of fatigue and comfort, and should maintain the patient's privacy while obtaining the health history. According to the American Hospital Association's Patient Care Partnership (which replaced the Patient's Bill of Rights), the patient has the right to expect that examinations, consultations, and treatment will be conducted in a manner that protects the patient's privacy.[6]

Admission routines that are efficient and show appropriate concern for the patient can ease the patient's anxiety and promote cooperation and receptivity to treatment. Conversely, admission routines that the patient perceives as careless or excessively impersonal can heighten anxiety, reduce cooperation, impair the patient's response to treatment, and perhaps aggravate symptoms.

Equipment

Patient gown ■ blankets ■ bath towel ■ washcloth ■ personal property form ■ valuables envelope ■ admission form ■ nursing assessment form ■ vital signs monitoring equipment ■ stethoscope ■ thermometer ■ hospital-grade disinfectant pad ■ patient scale ■ identification band ■ validated screening questionnaire for unhealthy alcohol use ■ standard fall risk assessment tool ■ standardized suicide screening tool ■ Optional: gloves; personal care items (emesis basin, bedpan, urinal, bath basin); emergency equipment (code cart with cardiac medications, defibrillator, handheld resuscitation bag with mask, intubation equipment); oxygen delivery system; suction equipment; equipment for obtaining blood or urine specimens; patient care reminders; friction-reducing device or lateral transfer board (for a patient who weighs less than 200 lb [91 kg]), ceiling lift with supine sling, mechanical transfer device, or air-assisted device (for a patient who weighs more than 200 lb [91 kg]);[7] advance directive information; alert bracelets.

Preparation of equipment

Position the bed as the patient's condition requires. If the patient is ambulatory, place the bed in the low position; if the patient's arriving on a stretcher, place the bed in the high position. Fold down the top linens. Prepare emergency or special equipment, such as oxygen or suction, as needed.

Implementation

- Adjust the lights, temperature, and ventilation in the room.
- Quickly review the admission form and the practitioner's orders. Note the reason for admission, restrictions on activity and diet, and any orders for diagnostic tests requiring specimen collection.

Managing emergency admissions

After emergency department (ED) treatment, the patient is transported to the nursing unit. The patient arrives on the nursing unit with a temporary identification bracelet, the practitioner's orders, and a record of treatment. Provide privacy.[17,18,19,20] Read this record and receive hand-off communication from the person who was responsible for the patient's care in the ED. Ask questions, as necessary, *to avoid miscommunications that can cause patient care errors during transitions of care*.[21,22] Expect to receive the patient's weight in kilograms during the hand-off *to prevent medication errors*.[23] Trace each tubing and catheter from the patient to its point of origin as part of the hand-off process; use a standard line reconciliation process using high-reliability practices.[24,25]

Tape the connections to prevent accidental disconnection of the tubing. If the patient has more than one connection to a port of entry into the body (e.g., if an IV catheter has more than one infusion infusing through it), label each tube near the insertion site. Label the infusion bag, ensuring that the label faces out so it can be read easily.[26] Route tubing and catheters having different purposes in a standardized approach—for example, keeping IV lines routed toward the head and enteric lines routed toward the feet to prevent dangerous misconnections.[25] If different access sites are used, label each tubing at the distal end (near the patient connection) and proximal end (near the source container) to distinguish the different tubing and prevent misconnections.[25] If the patient has an electronic infusion device or other patient equipment with alarms, make sure that alarm limits are set according to the patient's current condition and that alarms are turned on, functioning properly, and audible to staff.[27,28,29]

Obtain and record the patient's vital signs, and follow the practitioner's orders for treatment. If the patient is conscious and not in distress, explain any treatment orders. If family members accompany the patient, ask them to wait in the lounge while you assess the patient and begin treatment. Permit them to visit the patient after the patient is settled in the room. When the patient's condition allows, proceed with routine admission procedures.

- Gather and prepare the appropriate equipment.
- Perform hand hygiene.[8,9,10,11,12,13]
- Put on gloves, as needed, *to comply with standard precautions.*[14,15]
- Speaking slowly and clearly, greet the patient by the patient's proper name and introduce yourself and any other staff members present.[16]
- Confirm the patient's identity using at least two patient identifiers.[1] Apply an identification band, verifying that the identifiers are correct, including the patient's name and its spelling. Notify the admission office of any corrections.
- Escort the patient to his or her room and, if the patient isn't in great distress, introduce the patient to the roommate. Alternatively, if the patient is being admitted from the emergency department and is on a stretcher, summon the help of coworkers to transfer the patient from the stretcher to the bed using appropriate transfer device.[7] Keep in mind that, depending on the patient's condition, he or she may require immediate treatment; *treatment takes priority over routine admission procedures.* (See *Managing emergency admissions*.)
- Provide privacy.[17,18,19,20]
- Help the patient change into a hospital gown or pajamas from home if appropriate.[30]
- Itemize all valuables, clothing, and prostheses in the medical record on the personal property form if your facility uses such a form. Encourage the patient to store valuables or money in the safe or, preferably, to send them home along with any medications the patient may have brought.
- Orient the patient to the room. Show the patient how to use the equipment in the room, including the call system, bed controls, TV controls, telephone, and lights. Show an ambulatory patient where the bathroom and closets are located.
- Explain the routine at your health care facility. Mention when to expect meals, vital signs assessments, and medications. Review visiting hours and any restrictions.
- Obtain and record the patient's vital signs.
- Measure the patient's height and weight. If the patient can't stand, use a chair or bed scale and ask the patient his or her height. *Knowing the patient's height and weight is important for planning treatments and diet and for calculating medication and anesthetic dosages*. Record the patient's weight in kilograms and document it prominently in the patient's medical record *to help prevent medication errors*.[23,31]
- Collect blood and urine specimens, if ordered. Label specimens in the presence of the patient *to prevent mislabeling*, place them in a laboratory transport bag, and send them to the laboratory.[1]
- Notify the patient's practitioner of the patient's arrival. Report emergency or unexpected assessment findings.
- Obtain a complete patient history. Include all previous hospitalizations, illnesses, surgeries, and food and drug allergies.
- Screen the patient for tobacco and unhealthy alcohol use.[32] Use a validated screening tool.[32,33,34]
- Make sure that a complete list of the medications the patient was taking at home (including doses, routes, and frequency) is documented in the patient's medical record. Compare this list with the patient's current medications and reconcile and document any discrepancies (omissions, duplications, adjustments, deletions, or additions) in the patient's medical record *to reduce the risk of transition-related adverse drug events*.[35,36]
- Determine whether the patient has an advance directive and, if so, ask for a copy to place in the medical record. If the patient doesn't have one, provide information about advance directives to the patient.[37,38,39] (See the "Advance directives" procedure, page 9.)
- Review patient rights with the patient and family members.[6,19]
- Perform an admission assessment. Ask the patient to tell you the reason he or she came to the facility. Record the answers (in the patient's own words) as the chief complaint. Follow up with a physical assessment, emphasizing complaints. Record any marks, bruises, discolorations, and wounds on the nursing assessment form.
- Screen the patient for suicide ideation using a brief, standardized, evidence-based screening tool.[40] If at risk for suicide, address the patient's immediate safety needs, and collaborate with the multidisciplinary team to determine the most appropriate setting for treatment.[41]
- Perform a structured pressure injury risk assessment within 8 hours of admission.[42,43]

HOSPITAL-ACQUIRED CONDITION ALERT **Keep in mind thata stage 3 or 4 pressure injury is considered a hospital-acquired condition *because it can be reasonably prevented using best practices*. Make sure to follow pressure injury prevention practices (such as performing a structured pressure injury risk assessment, using skin moisturizers, providing adequate hydration and nutrition, and avoiding prolonged positional immobilization) *to reduce the risk of pressure injuries*.[43,44]**

- Determine the patient's risk of falling, using either a standardized risk assessment tool or one developed by your facility, and institute fall precautions.[43,45,46]

HOSPITAL-ACQUIRED CONDITION ALERT **Keep in mind that an injury from a fall is considered a hospital-acquired condition *because it can be reasonably prevented using best practices*. Make sure to follow fall prevention practices (such as determining the patient's risk of falling and instituting fall precautions) *to reduce the risk of falls*.[43,44,46]**

- Screen and assess the patient's pain using facility-defined criteria that are consistent with the patient's age, condition, and ability to understand.[47]
- If required by your facility, attach an alert bracelet to the patient's arm if the patient has a drug allergy, is at risk for falls, or has another condition that requires an alert bracelet; also place an alert in the patient's medical record.[48]
- Assess and address the patient's safety needs.
- After the assessment, inform the patient about any ordered tests and their scheduled times. Describe what the patient should expect for each test.
- Develop an interdisciplinary care plan and review it with the patient.[49,50]
- Before leaving the patient's room, make sure the patient is comfortable. Adjust the bed, and place the call light and other personal items within the patient's easy reach.
- Post patient care reminders (concerning such topics as allergies and special needs) at the patient's bedside, as needed, *to notify coworkers*. (See *Using patient care reminders*.)
- Remove and discard your gloves, if worn, and perform hand hygiene.[8,9,10,11,12,13]

- Clean and disinfect your stethoscope and other equipment, as needed, using a hospital-grade disinfectant pad.[51,52]
- Perform hand hygiene.[8,9,10,11,12,13]
- Document the procedure.[53,54,55,56]

Special considerations

- The Joint Commission issued a sentinel event alert to assist clinicians in all care settings to better identify and treat individuals with suicide ideation. The alert addresses methods for screening, assessing risk, and detecting suicide ideation, and for providing safety, treatment, discharge, and follow-up care for individuals at risk for suicide. It also includes suggestions for educating staff about suicide risk, keeping the health care environment safe for those at risk for suicide, and documenting care.[40]
- If you're caring for a patient who brought medications from home, take an inventory and record this information on the nursing assessment form.[36] Instruct the patient not to take any medications unless authorized by the practitioner. Send authorized medications to the pharmacy for identification and relabeling.[57] Send other medication home with a responsible family member, or store them in the designated area outside the patient's room until the patient is discharged. *Use of unauthorized medications may interfere with treatment or cause an overdose.*
- The Joint Commission issued a sentinel event alert concerning medical device alarm safety *because alarm-related events have been associated with permanent loss of function and death*. Among the major contributing factors were improper alarm settings, inappropriately turned off alarms, and alarm signals that were not audible to staff. Make sure alarm limits are appropriately set and that alarms are turned on, functioning properly, and audible to staff. Follow facility guidelines for preventing alarm fatigue.[58]
- Find out the patient's normal routine, and ask if adjustments should be made to the facility regimen; for instance, the patient may prefer to shower at night instead of in the morning. *By accommodating the patient with such adjustments whenever possible, you can ease the patient's anxiety and help him or her feel more in control of a potentially threatening situation.*
- Place the patient who requires airborne precautions in an infection isolation room *to reduce the risk of transmission.*[14,59]
- Teach the patient and family about the importance of proper hand hygiene in preventing the spread of infection.[8,11] Encourage them to speak up if a health care worker fails to perform hand hygiene before having contact with the patient or the patient's environment.
- Arrange for an interpreter, if necessary, *to ensure that the patient and family can communicate their concerns and understand information provided by the health care providers.*[60]

Documentation

After leaving the patient's room, document your assessment findings, including the patient's vital signs, height, weight, allergies, and drug and health history; a list of the patient's belongings and those sent home with family members; the results of your physical assessment; and a record of specimens collected for laboratory tests.

Using patient care reminders

Patient care reminders are specially designed cards or signs that are used to post important information about a patient. When placed at the head of the patient's bed or other location designated by your facility, these care reminders call attention to the patient's special needs and help ensure consistent care by communicating these needs to the hospital's staff, the patient's family, and other visitors. Examples of information that might be placed on a patient care reminder include:

- allergies
- aspiration risk
- dietary restrictions
- high risk of falls
- fluid restrictions
- specimen collection needs
- infection prevention or isolation procedures
- hearing impairments, including whether the patient is deaf or hearing impaired and in what ear
- foreign language spoken.

Patient care reminders can also include special instructions, such as:

- complete bed rest
- no blood pressure on right arm
- turn every hour
- nothing by mouth.

Although patient care reminders serve as useful tools, health care providers should be careful not to violate the patient's privacy by posting the patient's name, diagnosis, details about surgery, or other information the patient might find embarrassing.

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ADMIXTURE OF DRUGS IN A SYRINGE

Combining two drugs in one syringe avoids the discomfort of two injections. Usually, drugs can be mixed in a syringe in one of four ways: they may be combined from two multidose vials (e.g., regular and long-acting

insulin), from one multidose vial and one ampule, from two ampules, or from a cartridge-injection system combined with either a multidose vial or an ampule. Such combinations are contraindicated when the drugs aren't compatible and when combined doses exceed the amount of solution that can be absorbed from a single injection site.

The Association of Professionals in Infection Control and Epidemiology and the World Health Organization recommend using single-use or single-dose vials whenever possible. The risk of transmission posed by inappropriate handling of multidose vials has been clearly demonstrated and mandates a practice of one vial per one patient whenever possible.[1,2] Infection transmission risk is reduced when multidose vials are dedicated to a single patient.[2] The Infusion Nurses Society also recommends that nurses administer pharmacy-prepared or commercially available products whenever possible.[3]

Equipment

■ Medication record ■ prescribed medications ■ alcohol pads ■ syringe and needle ■ Optional: safety needle, 5-micron filter needle or straw,[3,4,5] needleless transfer device,[6] gauze pad, ampule breaker

The type and size of syringe and needle depend on the volume and viscosity of prescribed medications, the patient's body mass, and the injection site.

Implementation

■ Before preparing the injection, make sure the preparation area is free from clutter[2], and clean the preparation surface with an alcohol pad.[1,7]

■ Avoid distractions and interruptions when preparing medication *to prevent medication errors.*[8,9]

■ Verify the order on the patient's medication record by checking it against the practitioner's order.[10,11,12,13]

■ Reconcile the patient's medications when a new medication is ordered *to reduce the risk of medication errors, including omissions, duplications, dosing errors, and drug interactions.*[14,15]

■ Perform hand hygiene before assessing supplies and preparing medications *to prevent the transmission of* infection.[2]

■ Gather the medications and equipment.

■ Compare the medication labels with the order in the patient's medical record.[10,11,12,13]

■ Verify the compatibility of the drugs to be combined.

■ Check the patient's medical record for an allergy or a contraindication to the prescribed medications. If an allergy or a contraindication exists, don't administer the medications; notify the practitioner.[10,11,12,13]

■ Check the expiration date on each of the medications. If either of the medications is expired, return the expired medication to the pharmacy and obtain new medication.[10,11,12,13]

■ Visually inspect each solution for particles or discoloration or other loss of integrity; don't administer the medications if either has compromised integrity.[10,11,12,13]

■ Discuss any unresolved concerns about the medications with the patient's practitioner.[10,11,12,13]

■ Calculate the doses to be administered.

■ Have another nurse double-check your calculations if necessary.

NURSING ALERT **High-alert medications can cause significant patient harm when used in error. If either of the prescribed medications is considered a high-alert medication, have another nurse perform an independent double-check before administering the medications, if required by your facility,** ***to verify the patient's identity and make sure that the correct medications are drawn up in the prescribed concentrations, the indications for both medications correspond with the patient's diagnosis, the dosage calculations are correct and the dosing formula used to derive the final dose is correct, and the route of administration is safe and proper for the patient.***[16,17]

■ Perform hand hygiene.[1,18,19,20,21,22,23]

■ When preparing the medications, read the medication labels as you select the medications, as you draw each up, and after you have drawn each up *to verify the correct dose*.

Mixing drugs from a multidose vial and an ampule

■ Remove the medication vial's lid.

■ Disinfect the stopper with an alcohol pad.[2] Allow it to dry.[1,3]

■ Pull back the syringe plunger until the volume of air drawn into the syringe equals the volume to be withdrawn from the drug vial.

■ Insert the needle or transfer device with syringe into the top of the vial and inject the air. Then invert the vial and keep the needle's bevel tip below the level of the solution as you withdraw the prescribed dose.

■ Put the sterile needle cover over the needle.

■ Tap the stem of the ampule *to move any medication from the stem into the body of the ampule.*

■ Disinfect the neck of the ampule *to remove any medication from the stem into the body of the ampule.*

■ Disinfect the neck of the ampule using the alcohol pad, and allow it to dry completely.[2]

■ If you're using an ampule that requires use of a metal file to open, wrap a sterile gauze pad or an alcohol pad around the ampule's neck *to protect yourself from injury in case the glass splinters.*[1] Alternatively, insert the ampule's head into an ampule breaker.

■ Break open the ampule, directing the force away from you.

■ Change to a 5-micron filter needle or straw *to filter out any glass splinters.*[3,5,24]

■ Insert the needle or straw into the ampule. Be careful not to touch the outside of the ampule with the needle.

■ Draw the correct dose into the syringe.

■ Change the filter needle or straw to a safety needle to administer the injection.

■ Discard the needles and the ampule in a puncture-resistant sharps container, and discard all additional equipment appropriately.[1,25]

Mixing drugs from two multidose vials

■ Remove the vial lid and disinfect the rubber stopper on the first drug vial with an alcohol pad and allow it to dry[1,2,3] *to decrease the risk of contaminating the medication as you insert the needle into the vial.*

■ Pull back the syringe plunger until the volume of air drawn into the syringe equals the volume to be withdrawn from the drug vial.

■ Without inverting the vial, insert the needle (or needleless access device) into the top of the vial, making sure that the needle's bevel tip doesn't touch the solution. Inject the air into the vial and withdraw the needle (or needleless access device). *This step replaces air in the vial, which prevents the creation of a partial vacuum when you withdraw the drug.*

■ Repeat the steps above for the second vial. Then, after injecting the air into the second vial, invert the vial, withdraw the prescribed dose, and then withdraw the needle (as shown below).

■ Disinfect the rubber stopper of the first vial again, allow it to dry, and insert the needle (or needleless access device), taking care not to depress the plunger. Invert the vial, withdraw the prescribed dose, and then withdraw the needle (or needleless access device).

■ Change the needle (or needleless access device) on the syringe, if indicated, to a safety needle.

■ Discard any needle (or needleless access device) in a puncture-resistant sharps container, and discard all additional equipment appropriately.[22]

Mixing drugs from two ampules

■ Tap the stems of the ampules *to move any medication from the stems into the body of the ampules.*

- Disinfect the neck of each ampule with an alcohol pad and allow to dry.[2,3]
- If you're using ampules that require use of a metal file to open, open each ampule by wrapping a small gauze pad or alcohol pad around the neck of the ampule and quickly snap off the top of each ampule along the scored line at the neck.[1] Alternatively, insert the ampule's head into a ampule breaker. Snap the neck in the direction away from your body.
- Insert a syringe (with a filter needle or straw attached *to filter out any glass splinters*) into the ampule without allowing the needle to come into contact with the rim of the ampule. Be sure the needle is in the solution.[2,4,24]
- Withdraw the amount ordered from the first ampule and remove the needle from the solution.
- Repeat the previous four steps with the second ampule, changing the needle before drawing up the medication from the ampule if possible.
- When the syringe is prepared, change to a regular safety needle to administer the medication.

Completing the procedure

- Discard all equipment in appropriate receptacles.[1,25]
- Perform hand hygiene.[1,18,19,20,21,22,23]
- Document the procedure.[26,27,28,29]

Special considerations

- Insert the needle through the vial's rubber stopper at a slight angle, bevel up, and exert slight lateral pressure. *This way you won't cut a piece of rubber out of the stopper, which can then be pushed into the vial.*
- When mixing drugs from a multidose vial and ampule, be careful not to contaminate one drug with the other. Ideally, the needle should be changed after drawing the first medication into the syringe, although this isn't always possible *because many disposable syringes don't have removable needles.*
- Never combine drugs if you're unsure of their compatibility, and never combine more than two drugs. *Although drug incompatibility usually causes a visible reaction, such as clouding, bubbling, or precipitation, some incompatible combinations produce no visible reaction, even though they alter the chemical nature and action of the drugs.* Check appropriate references and consult a pharmacist when you're unsure about specific compatibility. When in doubt, administer two separate injections.
- Some medications are compatible for only a brief time after being combined and should be administered within 10 minutes after mixing. After this time, environmental factors, such as temperature, exposure to light, and humidity, may alter compatibility.
- Always follow manufacturer's instructions for storage and use of medication vials, and label multidose vials with the date immediately upon opening.
- Keep multidose vials away from the immediate patient environment.[1,2]
- *To reduce the risk of contamination*, most facilities dispense parenteral medications in single-dose vials. Insulin is one of the few drugs still packaged in multidose vials. Be careful when mixing regular and long-acting insulin. Draw up the regular insulin first *to avoid contamination with the long-acting suspension.* (If a minute amount of the regular insulin is accidentally mixed with the long-acting insulin, it won't appreciably change the effect of the long-acting insulin.)
- Multidose vials should only if there is no other alternative, and should be dedicated for a single patient if possible. Immediately after piercing, label multidose vials with the date and time, your name and signature, and the patient's name.[1,30]
- Use vials labeled by the manufacturer as "single dose" or "single use" for a single patient. These medications may lack antimicrobial preservatives and can become contaminated and serve as a source of infection if used inappropriately. *Evidence shows that improper use of single-dose vials for more than one patient increases the risk of infection.*[31]
- *To reduce the risk of contamination*, most facilities dispense parenteral medications in single-dose vials.

Complications

Infection may result from failure to adhere to sterile technique.

Documentation

Record the drugs administered, injection site, and time of administration. Document any adverse drug reactions and other pertinent information.

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ADVANCE DIRECTIVES

The Patient Self-Determination Act of 1990 requires health care facilities to provide information about the patient's right to choose and refuse treatment.[1] An advance directive is a legal document used as a guideline for providing life-sustaining medical care to a patient with an advanced disease or disability who is no longer able to indicate his or her own wishes.[2] Advance directives include living wills and health care proxies.

A living will instructs health care providers about a patient's preferences for receiving life-sustaining treatment in the event that a patient becomes unable to communicate his or her choices owing to such conditions as terminal illness, persistent vegetative state, or coma. In making a living will, a legally competent patient states which procedures the patient does or doesn't want carried out, such as intubation and mechanical ventilation, feeding tube insertion, parenteral or enteral nutrition and hydration, antibiotic therapy, dialysis, and cardiopulmonary resuscitation. The living will goes into effect when a patient can no longer communicate his or her choices regarding medical care. (See *Understanding the living will*, page 10.)

In the health care proxy (also called *durable power of attorney for health care*), the patient designates another person to make decisions; this person is commonly referred to as a health care agent. (See *Understanding the health care proxy*, page 11.)

Equipment

Advance directive forms or a copy of the previously established advance directive ■ Optional: written or audiovisual information on advance directives.

Implementation

- Perform hand hygiene.[3,4,5,6,7,8]
- Confirm the patient's identity using at least two patient identifiers.[9]
- Provide privacy.[10,11,12,13]
- Ask the patient whether the patient has an advance directive.[1]

If the patient has an advance directive

- Review the advance directive with the patient and confirm that it still reflects the patient's wishes.
- Place the advance directive in the medical record *so that it's easily accessible to all health care providers.*[2,14,15,16,17]
- Notify the practitioner and the rest of the health care team that the patient has an advance directive *so that it can be used to guide care.*[2,18]
- Determine whether the health care agent has a copy of the advance directive.
- Encourage the patient to discuss the advance directive with family and health care agent *so that they understand the patient's wishes and can ask questions while the patient is competent and can explain his decisions.*
- Perform hand hygiene.[3,4,5,6,7,8]
- Document the procedure and that the patient has an advance directive.[2,14,16,19,20,21,22]

If the patient doesn't have an advance directive

- Provide the patient with verbal and written information about advance directives *so that the patient can make an informed decision about developing one.*[2,18,23]
- Answer the patient's questions about advance directives or have a social worker or patient representative discuss advance directives with the patient *to provide accurate information.*[2,18]
- Assist in the assessment of the patient's level of competency *to ensure that the patient can make decisions.* This process may include assessing the patient's ability to understand information, consider the alternatives, evaluate the alternatives in relation to his or her own situation, make a decision, and communicate his or her choice. A doctor or advanced practice nurse may determine the patient's capacity for making decisions.
- As necessary, determine the need for a multidisciplinary conference to provide the patient and the patient's family with complete, comprehensive, and accurate information *to prevent them from receiving conflicting or confusing information from various health care providers.*
- Encourage the patient to discuss developing an advance directive with family.[24] If the patient would like to make an advance directive, assist the patient and family with coming to terms with the patient's decisions.
- If indicated, have the patient sign the advance directive and obtain witness signatures as required by state law.[24]
- Perform hand hygiene.[3,4,5,6,7,8]
- Document the procedure and note that the patient doesn't have an advance directive.[2,14,16,19,20,21,22]

Special considerations

- Arrange for a translator, if necessary, *to ensure that the patient and the patient's family can communicate their concerns and understand health care providers' explanations.*[25,26]
- If family members express opposition to the patient's advance directive, notify the patient's practitioner, the nursing supervisor, and the risk manager. Encourage family members to discuss their feelings with the patient and these individuals. A consult with the facility's ethics committee may be requested, as indicated.
- The patient may revoke or change an advance directive at any time.[18,24] For example, the patient may revoke the directive if the patient has a change of mind about the previous decision or if the patient's condition mandates that the directive be revised. The patient can revoke an advance directive either orally or in writing.

Documentation

Document the presence of an advance directive and that the practitioner was notified of its presence.[2,18] Include the name of the practitioner and the time of notification. Include the name, address, and telephone number of the health care agent. If the patient's wishes differ from those of the practitioner or family, note the discrepancies.

If the patient doesn't have an advance directive, document that the patient was given written information concerning rights under state law to make decisions regarding health care. If the patient refuses information on an advance directive, document this refusal using the patient's own words, in quotes, if possible. Record any conversations with the patient regarding this decision making. Document that proof of competence was obtained.

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Understanding the Living Will

A living will is an advance care document that specifies a patient's wishes with regard to medical care should the patient become terminally ill, incompetent, or unable to communicate. A living will is commonly used in combination with a health care agent.

All states and the District of Columbia have laws that outline the documentation requirements for living wills. The sample document below is from Ohio.

Living Will

If my attending doctor and one other practitioner who examines me determine, to a reasonable degree of medical certainty and in accordance with reasonable medical standards, that I am in a terminal condition or in a permanently unconscious state, and if my attending doctor determines that at that time I no longer am able to make informed decisions regarding the administration of life-sustaining treatment, and that, to a reasonable degree of medical certainty and in accordance with reasonable medical standards, there is no reasonable possibility that I will regain the capacity to make informed decisions regarding the administration of life-sustaining treatment, then I direct my attending doctor to withhold or withdraw medical procedures, treatment, interventions, or other measures that serve principally to prolong the process of my dying, rather than diminish my pain or discomfort.

I have used the term "terminal condition" in this declaration to mean an irreversible, incurable, and untreatable condition caused by disease, illness, or injury from which, to a reasonable degree of medical certainty as determined in accordance with reasonable medical standards of my attending doctor and one other practitioner who has examined me, both of the following apply:

1. There can be no recovery.
2. Death is likely to occur within a relatively short time if life-sustaining treatment is not administered.

I have used the term "permanently unconscious state" in this declaration to mean a state of permanent unconsciousness that, to a reasonable degree of medical certainty, is determined in accordance with reasonable medical standards by my attending doctor and one other practitioner who has examined me, as characterized by both of the following:

1. I am irreversibly unaware of myself and my environment.
2. There is a total loss of cerebral cortical functioning, resulting in my having no capacity to experience pain or suffering.

Nutrition and hydration

I hereby authorize my attending doctor to withhold or withdraw nutrition and hydration from me when I am in a permanent unconscious state if my attending doctor and at least one other practitioner who has examined me determine, to a reasonable degree of medical certainty and in accordance with reasonable medical standards, that nutrition or hydration will not or no longer will serve to provide comfort to me or alleviate my pain.

[Sign here for withdrawal of nutrition or hydration] _____

I hereby designate [Print name of person to decide] as the person whom I wish my attending doctor to notify at any time that life-sustaining treatment is to be withdrawn or withheld pursuant to this Declaration.

_____ _____

[Sign your name here] [Today's date]

Witnessed by: _____

[Living will person's name] voluntarily signed or directed another individual to sign this Living Will in the presence of the following who each attests that the Declarant appears to be of sound mind and not under or subject to duress, fraud, or undue influence.

_____ _____

[First witness signs here] [Second witness signs here]

Adapted from: Midwest Care Alliance. (2010). "State of Ohio living will declaration" [Online]. Accessed via the Web at http://ohiohospitals.org/OHA/media/Images/Membership%20Services/Energy/Choices-Advance-Directives-Packet.pdf

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Understanding the Health Care Proxy

The sample document below is an example of a health care proxy, which allows a competent patient to delegate to another person the authority to consent to or refuse health care treatment for the patient. This document helps the patient ensure that the patient's wishes will be carried out if the patient should become incompetent.

Each state with a health care proxy law has specific requirements for executing the document. The sample form below is from Nebraska.

Power of attorney for health care

I appoint _____

whose address is _____

and whose telephone number is _____

as my attorney-in-fact for health care. _____

I appoint _____

whose address is _____

and whose telephone number is _____

as my successor attorney-in-fact for health care. _____

I authorize my attorney-in-fact appointed by this document to make health care decisions for me when I am determined to be incapable of making my own health care decisions. I have read the warning that accompanies this document and understand the consequences of executing a power of attorney for health care.

I direct that my attorney-in-fact comply with the following instructions or limitations (optional): _____

_____

I direct that my attorney-in-fact comply with the following instructions on life-sustaining treatment (optional): _____

_____

I direct that my attorney-in-fact comply with the following instructions on artificially administered nutrition and hydration (optional):

_____

I have read this power of attorney for health care. I understand that it allows another person to make life and death decisions for me if I am incapable of making such decisions. I also understand that I can revoke this power of attorney for health care at any time by notifying my attorney-in-fact, my physician, or the facility in which I am a patient or resident. I also understand that I can require in this power of attorney for health care that the fact of my incapacity in the future be confirmed by a second physician.

_____ _____

[signature of person making designation] [date]

Adapted from: Nebraska Department of Health & Human Services, Division of Medicaid & Long-Term Care. (n.d.). "Nebraska Power of Attorney for Health Care" [Online]. Accessed via the Web at http://dhhs.ne.gov/medicaid/Documents/Power-of-Attorney.pdf

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AIRBORNE PRECAUTIONS

Airborne precautions, used in addition to standard precautions, prevent the spread of infectious droplet nuclei, which are small particles (less than 5 micrometers) suspended in the air and disperse over long distances by air currents. Susceptible individuals can inhale these suspended particles even without having face-to-face contact with the source of the particles (i.e., the infected individual).[1] (See *Conditions requiring airborne precautions.*)

NURSING ALERT **Please refer to the latest recommendations from the Centers for Disease Control and Prevention (CDC), located at http://www.cdc.gov/vhf/ebola/hcp/index.html, when caring for a patient with known or suspected Ebola virus infection.**

Effective airborne precautions require an airborne infection isolation room—a single-patient room that's equipped with monitored negative pressure (in relation to the surrounding area). An airborne infection isolation room should have 12 air exchanges/hour if the room has been newly constructed or renovated, or 6 air exchanges/hour if it's an existing room. The air is either vented directly to the outside of the building or filtered through high-efficiency particulate air (HEPA) filtration before recirculation.[1,5] According to the Centers for Disease Control and Prevention (CDC), air pressure should be monitored daily, using visual indicators, while the room is in use.[5] The door to the room should be kept closed to maintain the proper air pressure balance between the isolation room and the adjoining hallway or corridor. An anteroom is preferred.

All people who enter an airborne infection isolation room must wear respiratory protection, provided by a disposable respirator (such as an N95 respirator or a HEPA respirator) or a reusable respirator (such as HEPA respirator or a powered air-purifying respirator [PAPR]).[1,5] Regardless of the type, ensure proper fit to your face each time you wear a respirator by performing a user seal check.[1,5] When using a PAPR, ensure proper functioning of the unit.

NURSING ALERT **When a patient comes to your facility complaining of respiratory symptoms and an airborne infection is suspected, put a surgical mask on the patient (if tolerated) and immediately place him or her in a private room with the door closed until an airborne infection isolation room is available. If the patient is unable to tolerate a mask, place him or her in a private room with the door closed and wear a respirator during care.**

Equipment

Respirators (either disposable N95 or HEPA respirators, or reusable HEPA respirators or PAPRs) ■ surgical masks ■ isolation sign ■ patient care reminders ■ tissues ■ no-touch receptacle.

Preparation of equipment

Keep all airborne precaution supplies outside the patient's room in a wall- or door-mounted cabinet, a cart, or an anteroom.

Implementation

- Review the patient's medical record and verify the need for airborne precautions.
- Gather and prepare the necessary equipment.
- Perform hand hygiene.[6,7,8,9,10,11]
- Confirm the patient's identify using at least two patient identifiers.[12]
- Situate the patient in a single-patient airborne infection isolation room with the door closed *to maintain negative pressure.*[1,13] If possible, the room should have an anteroom. If a private bathroom is available, make sure the bathroom is also under negative air pressure. Monitor negative pressure according to regulations.
- Explain isolation precautions to the patient and family *to ease patient anxiety and promote cooperation.*
- Keep the patient's door (and the anteroom door) closed at all times *to maintain negative pressure and contain the airborne pathogens.*[1] Put an AIRBORNE PRECAUTIONS sign on the door *to notify anyone entering the room of the situation.*
- Put on a respirator according to the manufacturer's instructions.[1] Adjust the straps for a firm but comfortable fit. Check the seal. (See *Respirator seal check*, page 14.)
- If you're using a PAPR, check for proper function, battery life, and air flow.
- Enter the patient's room and remove the patient's mask, if the patient is wearing one.
- Provide the patient with tissues, and instruct the patient to cover the nose and mouth with a tissue when coughing or sneezing. Place a sign in the patient's room as a reminder.[1]
- Provide the patient with a no-touch receptacle for used tissue disposal. Instruct the patient to dispose of tissues in the receptacle after use and to perform hand hygiene after contact with respiratory secretions and contaminated objects.[15]
- Perform hand hygiene.[6,7,8,9,10,11]
- Remove your respirator after leaving the patient's room and closing the door. To remove your respirator, grasp the bottom and then the top elastic; avoid touching the front of the respirator *because the front is considered contaminated.*[14]
- Discard the respirator in the appropriate receptacle, or store it for reuse. You may reuse an N95 respirator according to the manufacturer's recommendations if it's not damaged or soiled.
- Perform hand hygiene.[6,7,8,9,10,11]
- Document the procedure.[16,17,18,19]

Special considerations

- All health care workers should wear a respirator when entering an airborne infection isolation room *to minimize the transmission of airborne organisms such as* Mycobacterium tuberculosis.[5]
- Fit testing is performed to confirm that the respirator adequately fits the user. It's performed initially and then periodically at a frequency determined by federal, state, and local regulations.[5,20] Fit testing should also be performed with changes in physical features that could affect the respirator (such as scarring, weight loss or gain, or dental changes).[20]
- Teach visitors the proper way to wear respiratory protection, and make sure that they wear respiratory protection while in the patient's room.[5]
- Limit the patient's movement from the room. If the patient must leave for essential procedures, make sure the patient wears a surgical mask that covers the nose and mouth.[1,5,13] Notify the receiving staff of the patient's isolation precautions *so that the precautions will be maintained and the patient will be promptly returned to the patient's room.*
- Depending on the type of respirator and recommendations from the manufacturer, discard your respirator or store it until the next use.[1] A reusable respirator should be stored in a dry, well-ventilated place (not a plastic bag) *to prevent microbial growth* and should be cleaned according to the manufacturer's recommendations.
- If a patient on airborne precautions requires surgery, schedule the procedure when a minimal number of health care workers and other patients are present. If possible, schedule it as the last case of the day *so that more time is available to clean and disinfect the operating room.* Use an operating room with an anteroom, if possible. Ensure that all health care workers involved in the surgery wear respiratory protection.[5,13]
- After a patient with suspected or confirmed *M. tuberculosis* leaves an airborne infection isolation room, allow adequate time to elapse before allowing entry of another patient *to ensure removal of contaminated air from the room.* The CDC recommends that a room with 6 air exchanges/hour be left empty for 69 minutes to effectively remove 99.9% of airborne contaminants.[5]

Complications

Social isolation is a complication of airborne precautions.

Documentation

Record the need for airborne precautions on the nursing care plan and as otherwise determined by your facility. Document initiation and

Conditions requiring airborne precautions

If a patient is known to have a condition requiring airborne precautions, the facility should follow the Centers for Disease Control and Prevention's (CDC's) isolation precautions *to prevent the spread of organisms spread by the airborne route*.[2] This table outlines some common conditions that require airborne precautions, including the required duration and any special considerations.[1]

CONDITION	PRECAUTIONARY PERIOD	SPECIAL CONSIDERATIONS (AS APPLICABLE)
Avian influenza	■ For 14 days after onset of signs and symptoms or until an alternate diagnosis is confirmed	■ N/A
Chickenpox (varicella)	■ Until lesions are crusted and no new lesions appear	■ Susceptible health care workers shouldn't enter the room if immune caregivers are available. ■ Contact precautions should be instituted.
Herpes zoster (disseminated disease [rash affects three or more dermatomes][3] in *any* patient or localized disease in *immunocompromised* patient until disseminated disease is ruled out)	■ Duration of illness	■ Susceptible health care workers shouldn't enter the room if immune caregivers are available. ■ Contact precautions should be instituted.
Measles (rubeola)	■ For 4 days after onset of rash ■ For duration of illness in immunocompromised patients	■ Susceptible health care workers shouldn't enter the room if immune caregivers are available.
Monkeypox	■ Until disease is confirmed and smallpox is excluded	■ Contact precautions should be instituted until lesions have crusted.
Severe acute respiratory syndrome	■ For duration of illness plus 10 days after resolution of fever	■ Eye protection (goggles or face shield) should be worn. ■ Contact precautions should be instituted. ■ Vigilant environmental disinfection should be performed.
Smallpox	■ For duration of illness until all scabs have crusted and separated (typically 3 to 4 weeks)	■ Contact precautions should be instituted. ■ Unvaccinated health care workers shouldn't provide care when immune health care workers are available.
Tuberculosis, extrapulmonary, draining lesion	■ Until patient improves clinically and drainage has ceased or until three consecutive negative cultures of continued drainage are obtained[4]	■ Contact precautions should be instituted.
Tuberculosis, pulmonary or laryngeal disease, confirmed	■ Until patient improves clinically while on effective therapy (such as a decreased cough and fever or improved chest X-ray results) and has three consecutive sputum smears negative for acid-fast bacillus, collected on separate days	■ N/A
Tuberculosis, pulmonary or laryngeal disease, suspected	■ Until active tuberculosis is deemed highly unlikely and either another diagnosis explains the clinical findings or the results of three consecutive sputum smears for acid-fast bacillus, collected 8 to 24 hours apart, are negative	■ At least one of the three sputum specimens should be collected in the morning.

maintenance of the precautions, the patient's tolerance of the procedure, and any patient or family teaching performed and the patient's and family's understanding of that teaching. Also document the date airborne precautions were discontinued.

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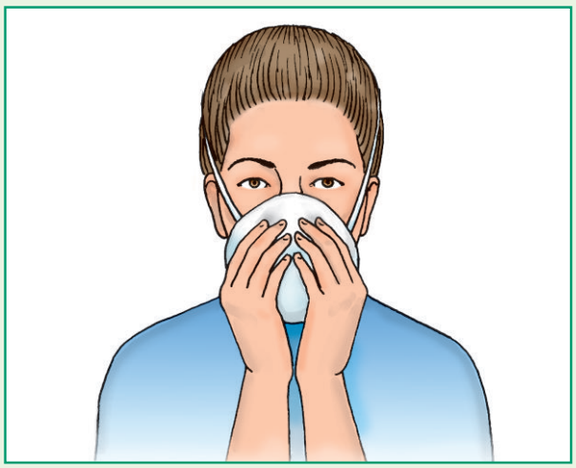
EQUIPMENT

Respirator seal check

After you put on your respirator, perform a seal check by placing your hands over the face piece, as shown below, and then exhale gently. The seal is considered satisfactory if a slight positive pressure builds up inside the face piece without air leaking from the seal.[14] Air leaking is evidenced by the fogging of your glasses, a feeling of air trickling down your uncovered face, and lack of pressure buildup under the face piece.

If the respirator has an exhalation valve, cover the filter surface with your hands as much as possible and then inhale. The seal is considered satisfactory if the face piece collapses on your face and you don't feel air passing between your face and the face piece.



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AIR-FLUIDIZED THERAPY BED USE

Originally designed for managing burns, the air-fluidized therapy bed is now used for patients with various debilities. By allowing harmless contact between the bed's surface and grafted sites, the bed promotes comfort and healing. The surface of the bed conforms to the patient's body as it is immersed into the bed's surface, which lowers the interface pressure by increasing the surface pressure distribution area.[1]

The traditional air-fluidized therapy bed is actually a large tub that supports the patient on a thick layer of silicone-coated microspheres of lime glass. Another version combines the air-fluidized section with a low-air-loss or cushioned section. (See *The air-fluidized therapy bed.*) A monofilament polyester filter sheet covers the microsphere-filled tub. Warmed air, propelled by a blower beneath the bed, passes through it. The resulting fluid-like surface reduces pressure on the skin to avoid obstructing capillary blood flow, which helps to prevent pressure ulcers and to promote wound healing.[2,3] The air-fluidized bed's air temperature can be adjusted to help control hypothermia and hyperthermia. The microprocessor technology also allows manipulation of various sections of the unit for optimum adjustment. Some models come with adjustable back and leg supports to promote positioning.

An air-fluidized therapy bed may be indicated for patients with large Stage 3 or 4 pressure injuries or injuries on multiple turning surfaces.[4] An air-fluidized therapy bed may be contraindicated in a patient with an unstable spine. It also may be contraindicated in a patient who can't mobilize and expel pulmonary secretions, because the bed's lack of back support impairs productive coughing. Operation of an air-fluidized therapy bed is complex and requires special training.

Equipment

Air-fluidized therapy bed with microspheres ■ filter sheet ■ flat sheet ■ elastic cord ■ friction-reducing device or lateral transfer board for a patient who weighs less than 200 lb (91 kg); celling lift with spine sling, mechanical transfer device, or air-assisted device for a patient who weighs more than 200 lb (91 kg)[5] ■ cushioning device or pillows ■ Optional: gloves, gown, mask with face shield, mask, goggles, foam wedge, breathable underpad.

Preparation of equipment

A manufacturer's representative or a trained staff member usually prepares the bed for use. If you must help with the preparation, make sure the microspheres reach to within ½″ (1.3 cm) of the top of the tank. Then position the filter sheet on the bed with its printed side facing up. Match the holes in the sheet to the holes in the edge of the bed's frame. If the bed has detachable aluminum rails, place them on the frame, with the studs in the proper holes. Depress the rails firmly, and then secure them by tightening the knurled knobs to seal the filter sheet. Place a flat sheet over the filter sheet or use the specialized sheet provided by the bed company, and secure it with the elastic cord. If using a flat sheet, place only one sheet *so that the patient is as close to the therapeutic surface as possible.*[6] If an underpad is necessary, don't use a reusable underpad; use only a breathable underpad *so that the permeability of the filter sheet is not altered.*[6,7] Turn on the air current *to activate the microspheres and to ensure that the bed is working properly;* then turn off the air current.

Implementation

- Consult with a wound, ostomy, and continence nurse or an educated skin care team member before using an air-fluidized bed *to make sure it's the best choice of support surface for the patient.*
- Gather the equipment and help prepare the air-fluidized therapy bed, if necessary.
- Perform hand hygiene,[8,9,10,11,12,13] then put on gloves and, as needed, other personal protective equipment *to comply with standard precautions.*[14,15]
- Confirm the patient's identity using at least two patient identifiers.[16]
- Provide privacy.[17,18,19,20]
- Explain and, if possible, demonstrate the operation of the air-fluidized therapy bed. Tell the patient the reason for its use and explain that the patient will feel as though floating while on the bed.
- With the help of three or more coworkers, transfer the patient to the bed using an appropriate patient transfer device.

- If the patient has an enteral feeding tube, use a foam wedge to elevate the head of the bed at least 30 degrees, unless contraindicated, *to help prevent aspiration.*[21]
- Place cushioning devices or pillows between the patient's legs, ankles, and other bony prominences *to help maintain alignment and prevent bony prominences from touching.*[4]
- Turn on the air current pressure *to activate the air-fluidized therapy bed.*
- Remove the patient transfer device.
- Monitor the patient's fluid and electrolyte status *because an air-fluidized therapy bed increases evaporative water loss.*
- Reposition the patient at a frequency determined by the patient's condition and the support surface.[22] *Specialty beds don't eliminate the need for frequent assessment and position changes.*
- Adjust the bed's temperature for patient comfort according to the manufacturer's instructions. (Usual comfort range is 88°F [31°C] to 94°F [34.5°C].[6]
- Remove and discard your gloves and any other personal protective equipment if worn.
- Perform hand hygiene.[8,9,10,11,12,13]
- Document the procedure.[23,24,25,26]

Special considerations

- *Because of the bed's drying effect*, always cover a patient's mesh graft for the first 2 to 8 days, as ordered. If the patient has excessive upper respiratory tract dryness, use a humidifier and mask, as ordered. Encourage coughing and deep breathing.
- To position a bedpan, roll the patient away from you; place the bedpan on the flat sheet and push it into the microspheres, then reposition the patient. To remove the bedpan, hold it steady and roll the patient away from you. Turn off the air pressure and remove the bedpan. Then turn the air on and reposition the patient.
- Take care to avoid puncturing the bed when giving injections. Repair holes or tears that occur with iron-on patching tape. Sieve the microspheres in the fluidized tank of the bed monthly or between patients *to remove any clumped microspheres*. Handle them carefully to avoid spills; *spilled microspheres may cause falls*. Treat a soiled filter sheet and clumped microspheres as contaminated items. Change the filter sheet and operate the unit unoccupied for 24 hours between patients.
- Note that the air-fluidized therapy bed has an emergency STOP/DEFLATE button that stops the action of the bed in the event the patient needs cardiopulmonary resuscitation.
- Perform a pressure injury risk assessment and skin assessment upon a patient's admission to the health care setting, and repeat the assessments on a regularly scheduled basis, or when there's a significant change in the patient's condition (e.g., surgery, a decline in health status).[4] Use a standardized pressure injury risk assessment tool.[22]

HOSPITAL-ACQUIRED CONDITION ALERT **Keep in mind that a Stage 3 or 4 pressure injury is considered a hospital-acquired condition, *because it may be prevented reasonably using best practices.* Make sure to follow pressure injury prevention practices (e.g., performing risk assessments, moisturizing the patient's skin, providing adequate hydration and nutrition, using specialty support surfaces) to reduce the risk of pressure injuries.**[22,27,28,29]

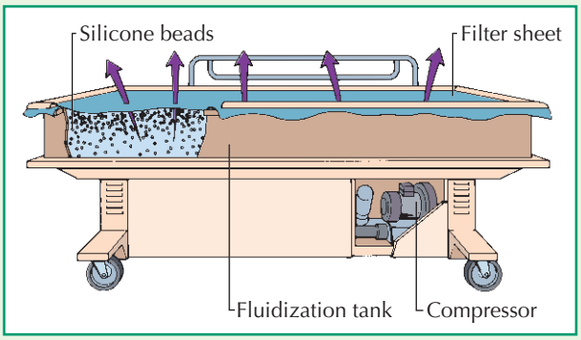
Documentation

Record the duration of therapy and the patient's response to it. Document the condition of the patient's skin, pressure injuries, and other wounds.

EQUIPMENT

The air-fluidized therapy bed

The air-fluidized therapy bed is a large tub filled with microspheres that are suspended by air pressure and give the patient fluid-like support. The bed provides the advantages of flotation without the disadvantages of instability, patient positioning difficulties, and immobility.



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ALIGNMENT AND PRESSURE-REDUCING DEVICES

Various assistive devices can be used to maintain correct body positioning and to help prevent complications that commonly arise when a patient must be on prolonged bed rest. Alignment and pressure-reducing devices, or pressure-redistribution devices, include the cradle boot, abduction pillow, trochanter roll, hand roll, and wheelchair cushion. (See *Common alignment and pressure-reducing devices*.) Several of these devices—the cradle boot, trochanter roll, hand roll, and wheelchair cushion—are especially useful when caring for patients who have a loss of sensation, mobility, or consciousness.

Equipment

Cradle boots ■ abduction pillow ■ trochanter rolls ■ hand rolls ■ wheelchair cushion ■ Optional: washcloth, blanket or towel, roller gauze, hypoallergenic or adhesive tape.

Implementation

- Gather the appropriate equipment. If you're using a device that's available in different sizes, select the appropriate size for the patient.
- Perform hand hygiene.[2,3,4,5,6,7]
- Confirm the patient's identity using at least two patient identifiers.[8]
- Provide privacy.[9,10,11,12]
- Explain the purpose of the alignment and pressure-reducing device.
- Assess the patient's skin and perform a pressure injury risk assessment,[13] paying special attention to the location(s) where you'll be applying the device. Note and record any areas of redness or swelling, and pay close attention to pressure points at the elbows, heels, trochanters, sacrum, and ischium *because these areas are more likely to develop pressure injuries.*[14]

HOSPITAL-ACQUIRED CONDITION ALERT **Keep in mind that a stage 3 or 4 pressure injury is considered a hospital-acquired condition by the Centers for Medicare and Medicaid Services *because it can be reasonably prevented using best practices*. Make sure to follow pressure injury prevention practices (such as performing a skin assessment, using support surfaces, and managing moisture) to reduce the risk of pressure injury.**[13,15,16,17]

Applying a cradle boot

- Position the patient comfortable in either a sitting or supine position with the legs in a neutral position.
- Open the slit on the superior surface of the boot, place the patient's heel in the circular cutout area, then fasten the Velcro strap(s) according to the brand of boot used. Check that you can insert two fingers beneath the strap(s) *to prevent a tight fit that might impair circulation*.
- Repeat the procedure with the patient's other foot, as needed.
- Position the patient's legs in a comfortable, neutral position *to prevent internal and external rotation.*
- Make sure that both knees are flexed 5 to 10 degrees *to prevent hyperextension of the knee and to decrease the risk of deep vein thrombosis.* Ensure that both heels are suspended off the bed, and that there isn't any pressure on the Achilles tendon.[13]

Applying an abduction pillow

- Place the patient in the supine position, slide the pillow between the patient's legs, and gently arrange the straps beneath the patient's legs, making sure the straps are flat on the bed.
- Place the upper part of both of the patient's legs in the pillow's lateral indentations.
- Bring the straps around the patient's legs, securing them to the top of the pillow.
- Place the patient's legs in a neutral position *to prevent external hip rotation.*

Applying a trochanter roll

- Place the patient in a supine position.
- Position a trochanter roll, rolled towel, or blanket along the outside of the patient's thigh from the iliac crest to the mid-thigh. If you're using a rolled towel or blanket, tuck a few inches of material under the patient's hip and thigh *to hold the roll in place.*
- Place another roll along the other thigh.
- Make sure neither roll extends to the knee *to prevent peroneal nerve compression and palsy, which can lead to footdrop*.
- Place the patient's legs in a neutral position *to prevent external hip rotation*.

Applying hand rolls

- Place a hand roll or rolled washcloth in each of the patient's hands *to maintain a neutral position*.
- Secure the straps, if present, or apply roller gauze and secure with hypoallergenic or adhesive tape.

Applying a pressure-reducing wheelchair cushion

- Place the cushion into the wheelchair seat before the patient sits.
- Ensure the wheelchair width is adequate by checking that the patient's hips don't touch the sides of the wheelchair at their widest point.

Completing the procedure

- Reposition the patient periodically, at a frequency determined by the patient's condition and the support surface,[13] *to reduce the duration and magnitude of pressure over affected body surfaces.*[13,17,18,19] If the patient can reposition himself, teach the patient how to make small, frequent position changes.[17] Avoid positioning the patient on reddened areas.[13]
- Perform structured pressure injury risk assessments at a frequency determined by the patient's condition.[13]
- Perform hand hygiene.[2,3,4,5,6,7]
- Document the procedure.[20,21,22,23]

Special considerations

- Remember that the use of assistive devices doesn't preclude regularly scheduled patient positioning, range-of-motion exercises, and skin care. Turn the patient a minimum of every 2 hours, removing the device as needed.[17]

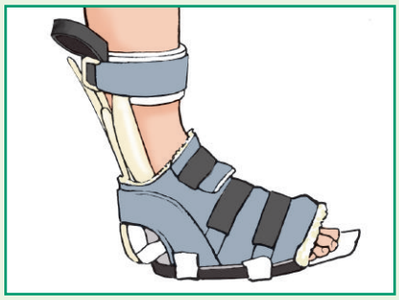
EQUIPMENT

Common alignment and pressure-reducing devices

Some common alignment and pressure-reducing devices include the cradle boot, abduction pillow, trochanter roll, hand roll, and wheelchair cushion.

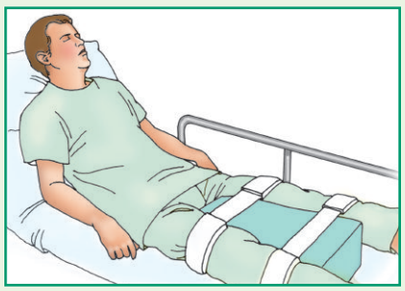
Cradle boot

A cradle boot, made with a heel cutout, cushions the ankle and foot without completely enclosing it. It helps to prevent footdrop, skin breakdown, internal and external rotation of the hip, strain on hip ligaments, and pressure on bony prominences.



Abduction pillow

An abduction pillow is a wedge-shaped piece of sponge rubber with lateral indentations for the patient's thighs. Its straps wrap around the patient's thighs and maintain correct positioning by preventing internal rotation and adduction of the hip. Although a properly shaped bed pillow may temporarily substitute for a commercial abduction pillow, it's difficult to apply and fails to maintain proper lateral alignment.

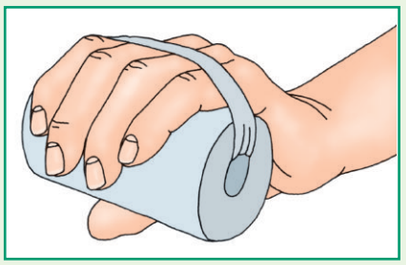


Trochanter roll

A trochanter roll is used to prevent hip external rotation by keeping the hip and thigh in a neutral position. A commercial trochanter roll is made of sponge rubber. You can also improvise a trochanter roll using a rolled blanket or towel if a commercial one is not available. To hold an improvised roll in place, gently tuck a few inches of the material beneath the patient's hip and thigh as he lies in a supine position, allowing his leg to rest against the rolled blanket or towel (as shown below)

Hand roll

A hand roll, designed to prevent hand contractures, is available in hard and soft materials and is held in place by fixed or adjustable strap(s). You can improvise one from a rolled washcloth secured with roller gauze and adhesive tape if a commercial device is unavailable.



Wheelchair cushion

A wheelchair cushion is a pressure-reducing device filled with air, viscous fluid and foam, or gel and foam. When used with a properly fitted wheelchair, a pressure-reducing cushion can significantly reduce pressure injury formation at the sacrum and ischium in patients who need to use a wheelchair for 6 or more hours per day.[1] A convoluted foam cushion should be avoided because it doesn't protect the patient's skin from pressure injuries while seated.

- Monitor the skin integrity of skin underneath a strap.
- Consult with a wound, ostomy, and continence nurse, as needed.

Patient teaching

Explain the use of appropriate devices to the patient and caregiver. Demonstrate the proper use of each device, emphasizing proper alignment of extremities, and have the patient or caregiver give a return demonstration so you can check for proper technique. Emphasize measures needed to prevent pressure injuries.

Complications

Contractures and pressure injuries can occur with the use of a hand roll and possibly other assistive devices. To avoid these problems, remove hand rolls every 2 hours.

Documentation

Record the use of alignment and pressure-reducing devices in the patient's medical record and in the nursing care plan, including the reason for the device. Include your assessment for complications. Document the findings of pressure injury risk assessments.[13] In addition, document any patient teaching performed and the patient's understanding of that teaching. Reevaluate the patient care goals as needed.

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ANTIEMBOLISM STOCKING APPLICATION

Elastic antiembolism stockings help prevent venous thromboembolism (VTE), a disorder that includes deep vein thrombosis (DVT) and pulmonary embolism. They do so by compressing superficial leg veins. This compression increases venous return by forcing blood into the deep venous system rather than allowing it to pool in the legs and form clots. Antiembolism stockings should provide graduated compression and produce a calf pressure of 14 to 15 mm Hg.[1,2]

HOSPITAL-ACQUIRED CONDITION ALERT **Keep in mind that VTE in patients who underwent total knee replacement or hip replacement is considered a hospital-acquired condition *because it can be reasonably prevented using best practices*.[3,4] Be sure to follow VTE prevention practices (such as using mechanical compression devices, including antiembolism stockings and an intermittent pneumatic compression device, early ambulation, and pharmacologic prophylaxis) *to reduce the risk of VTE*.[5,6,7]**

Patients who usually require antiembolism stockings include postoperative patients, elderly patients, and those who are bedridden, have varicose veins, or are otherwise at risk for DVT. Compression therapy has proven beneficial for the treatment of venous ulcers and chronic venous insufficiency and, therefore, is considered a standard of care for patients with these conditions.[8] For patients with chronic venous problems, practitioners may order the use of intermittent pneumatic compression stockings for the duration of surgery and postoperatively. (See the "Sequential compression therapy" procedure.)

Guidelines caution against using antiembolism stockings in patients with dermatoses or open skin lesions, gangrene, severe arteriosclerosis or other ischemic vascular diseases, pulmonary edema or any massive edema, recent vein ligation, vascular or skin grafts, and severe leg deformity.[1] Studies show that graduated compression stockings don't reduce the risk of DVT in stroke patients and may even increase the risk of skin complications in these patients.[9]

There's no evidence to support the use of one type of antiembolism stocking (knee-length, thigh-length, or waist-length) over another. Thus, patient compliance, ease of use, and cost will indicate the best choice of stocking type.[10]

Equipment

Tape measure ■ antiembolism stockings of correct size.

Preparation of equipment

Before applying a knee-length stocking

Measure the patient using a tape measure *to ensure a proper fit*. (See *Measuring for antiembolism stockings*.)

Before applying a thigh-length stocking

Measure the upper thigh circumference at the gluteal fold, then the calf circumference at the greatest dimension, and lastly the leg length from the gluteal fold to the base of the heel.[1]

Before applying a waist-length stocking

To measure for a waist-length stocking, first measure the upper thigh circumference at the gluteal fold.[1] Next, measure the calf circumference at the greatest dimension.[1] Last, measure the leg length by measuring from the gluteal fold to the base of the heel.[1]

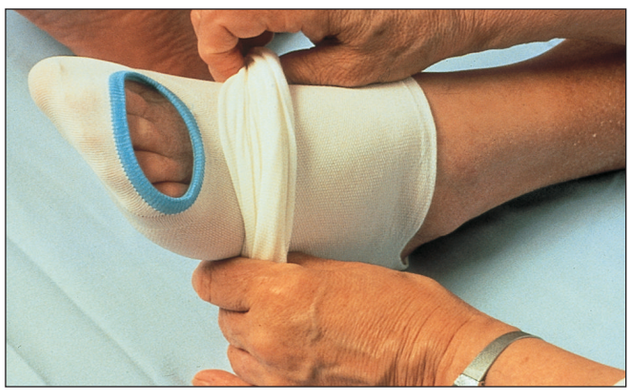
If the patient's thigh measurements are outside of the specified recommended range, consider knee-length stockings as another option.[1]

Implementation

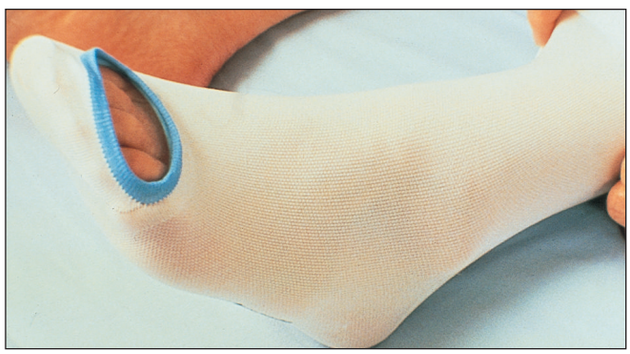
- Gather and prepare the necessary equipment
- Verify the practitioner's order.
- Review the patient's medical record for contraindications to antiembolism stocking use.
- Perform hand hygiene.[11,12,13,14,15,16]
- Confirm the patient's identity using at least two patient identifiers.[17]
- Provide privacy.[18,19,20]
- Explain the procedure to the patient and family (if appropriate) according to their individual communication and learning needs *to increase their understanding, allay their fears, and enhance cooperation*.[21]
- Help the patient lie down if the patient isn't already doing so.
- Raise the patient's bed to waist level when providing care *to prevent caregiver back strain*.[22]
- Assess the condition of the patient's legs. If you suspect arterial disease, notify the practitioner before applying the stockings.[2]

Applying a knee-length stocking

- Insert your hand into the stocking from the top and grasp the heel pocket from the inside. Holding the heel, turn the stocking inside out. *This method allows easier application than gathering the entire stocking and working it up over the foot and ankle.*[1]
- Position the stocking over the foot and heel, making sure the heel is centered in the heel pocket.[1]
- Grasp a few inches of the stocking up around the patient's ankle and calf,[1] as shown below.



- Continue pulling the stocking up the patient's leg using short, alternating front and back pulls, as shown below. The bottom of the band (or change in the stocking's stitching) should fall 1″ to 2″ (2.5 to 5 cm) below the popliteal fold.[1]



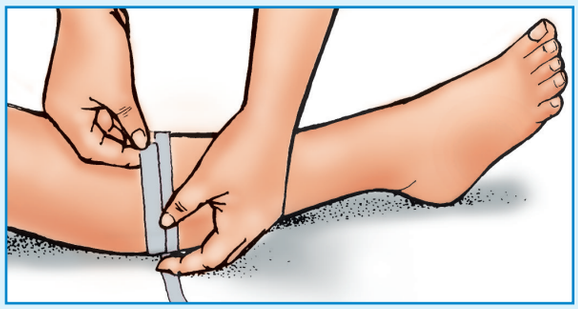
- Continue easing the stocking upward. As you apply the thigh portion of the stocking, start rotating the stocking inward so the panel (if present) is slightly toward the inside of the patient's leg, as shown below. When the stocking is fully applied, the top band of the stocking should rest at the patient's gluteal fold.[1]

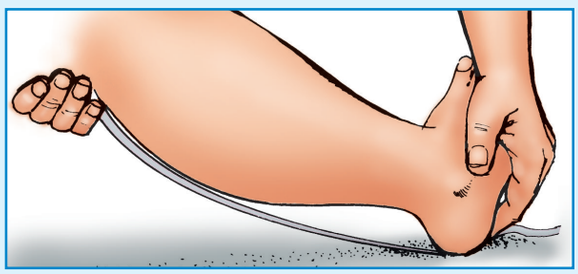
- Smooth out wrinkles in the stocking fabric *to prevent skin breakdown.*[1]
- Make sure the patient's toes are visible through the toe inspection area, if present; the patient's toes shouldn't stick out of the inspection area opening.[1]

Measuring for antiembolism stockings

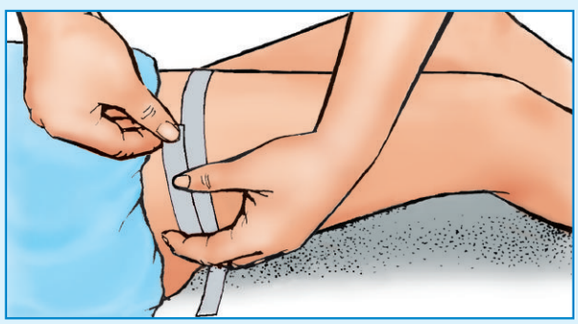
Measure the patient carefully ***to ensure that the antiembolism stockings provide enough compression for adequate venous return***. Measure both legs, because if the right and left leg measure differently, you many need to order two different stocking sizes.[1]

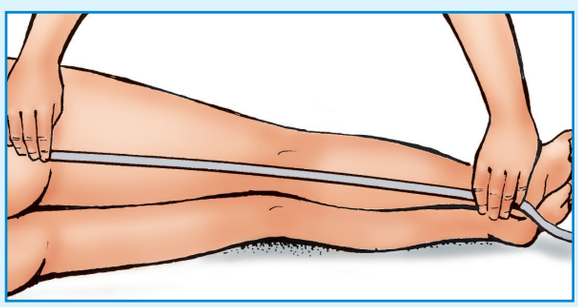
To choose the correct knee-length antiembolism stocking, measure the circumference of the calf at its widest point (*top*)[1] and the leg length from the popliteal fold (bend of the knee) to the base of the heel (*bottom*).[1]





To choose a thigh-length stocking, measure the calf as for a knee-length stocking and the thigh at its widest point (*top*). Then measure leg length from the bottom of the heel to the gluteal fold (*bottom*).





- Repeat the procedure for the second stocking, if ordered.
- Return the bed to the lowest position *to prevent falls and maintain patient safety.*[23]
- Perform hand hygiene.[11,12,13,14,15,16]
- Document the procedure.[24,25,26,27]

Applying a thigh-length stocking

- Follow the procedure for applying a knee-length stocking, taking care to distribute the fabric evenly below the knee before continuing the procedure.
- As you apply the thigh portion of the stocking, start rotating the stocking inward so the panel (if present) is slightly toward the inside of the patient's leg. When you've applied the stocking fully, the top band of the stocking should rest at the patient's gluteal fold.
- Smooth out any wrinkles in the stocking fabric *to prevent skin breakdown.*[1]
- Make sure the patient's toes are visible through the toe inspection area, if present; the patient's toes shouldn't stick out of the inspection area opening.[1]
- Repeat the procedure for the second stocking, if ordered.
- Perform hand hygiene.[11,12,13,14,15,16]
- Document the procedure.[24,25,26,27]

Applying a waist-length stocking

- When the stocking reaches the patient's knee, begin turning the stocking to position the side panel. The stocking should be positioned so that the upper thigh hem rests in the groin and at the gluteal fold. Make sure the seam is flat against the body and the side panel is at the hip bone.[1]
- Repeat the procedure for the second stocking.
- Unfold the waist belt and bring it around the patient's waist. The smooth side of the belt should rest against the patient's skin. Fasten the waist belt snaps to the stockings.[1]
- Connect the waste belt buckle and adjust the waist belt *so that it's tight enough to secure the stockings in place.*[1]
- Smooth out wrinkles in the stocking fabric *to prevent skin breakdown.*[1]
- Pull the toe area forward to smooth the ankle and instep area to promote toe comfort.[1] Make sure the patient's toes are visible through the toe inspection area, if present; the toes shouldn't stick out of the inspection area opening.[1]
- Perform hand hygiene.[11,12,13,14,15,16]
- Document the procedure.[24,25,26,27]

Special considerations

- If the patient has a fluctuation in weight or develops edema or postoperative swelling, remeasure the patient and obtain stockings of the appropriate size.[1,2]
- Encourage the patient to wear the stockings day and night until the patient no longer has significantly reduced mobility.[2]
- Remove the stockings at least once daily *to bathe the skin and observe for irritation and breakdown*. Inspect the skin, provide skin care, and then reapply the stockings.[1,2] Inspect the skin (especially the ankles and heels) at least every 8 hours.[1]
- Discontinue the use of antiembolism stockings if you note marking, blistering, or discoloration of the skin, especially over heels and bony prominences, or if the patient experiences pain or discomfort. Notify the practitioner; a foot impulse device or a sequential compression device may be prescribed as an alternative to antiembolism stockings.[2]
- Don't allow the stockings to roll or turn down at the top or toe *because the excess pressure could cause venous strangulation*. Have the patient wear the stockings in bed and during ambulation *to provide continuous protection against VTE.*
- Be alert for an allergic reaction *because some patients can't tolerate the sizing in new stockings*. Laundering the stockings before applying them reduces the risk of an allergic reaction to sizing.
- Using warm water and mild soap, wash the stockings when they become soiled. Keep a second pair handy *so that the patient can wear them while the other pair is being laundered.*

Patient teaching

If the patient will require antiembolism stockings after discharge, teach the patient or a family member how to apply them correctly and explain why the patient needs to wear them *to increase compliance, which maximizes the effectiveness of treatment.*[28] Instruct the patient, family member, or caregiver to wash the stockings every 2 to 3 days, or more frequently if they become visibly soiled.[1,29] Advise the patient, family, or caregiver to follow the manufacturer's washing instructions. Inform them that, with proper care, stockings commonly last for 2 to 3 months.

Complications

Obstruction of arterial blood flow—characterized by cold and bluish toes, dusky toenail beds, decreased or absent pedal pulses, and leg pain or cramps—can result from application of antiembolism stockings. Less serious complications, such as an allergic reaction and skin irritation, can also occur.

Documentation

Record the date and time of stocking application, stocking style and size, the condition of the leg, foot, and toes before application. Document any patient and family or caregiver teaching performed and their understanding of the teaching.

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AQUAPHERESIS

Aquapheresis is a therapy that involves using ultrafiltration to remove fluid from the blood. It provides an alternative method for relieving congestion caused by fluid overload in patients with decompensated heart failure who are resistant to diuretics.[1]

Aquapheresis is provided using venovenous access and a device known as the Aquadex FlexFlow ultrafiltration system (as shown on top right). This device mechanically withdraws blood through a catheter and passes it through a hemofilter, which removes excess sodium and water, restoring fluid balance. After the patient's blood is filtered, it's returned to the patient through the infusion port of the catheter. Sterile technique must be followed during therapy.[2]

NURSING ALERT **Only individuals who have received specialized training in administering Aquapheresis therapy are permitted to administer the therapy.**

Equipment

Aquadex FlexFlow pump ■ sterile, disposable, single-use extracorporeal blood circuit set ■ scale ■ electronic infusion device (preferably a smart pump with dose-error reduction software) ■ prescribed IV heparin bolus ■ prescribed heparin infusion ■ 500-mL bag of normal saline solution ■ 10-mL prefilled syringes containing preservative-free normal saline solution ■ graduated liquid waste receptacle ■ gloves ■ sterile end caps ■ disinfectant (10% bleach solution or 95% isopropyl alcohol) ■ soft cloth ■ tape ■ vital signs monitoring equipment ■ stethoscope ■ disinfectant pad ■ appropriately sized venovenous access device (common sizes include #6 French dual-lumen extended-length peripheral catheter; #7 or #8 French dual-lumen central venous access catheter; and #8.5 French dual-lumen central venous access catheter [14G or 16G lumens])[3] ■ Optional: IV tubing labels, blood sampling equipment.

Preparation of equipment

Before therapy begins, the practitioner inserts a venovenous access device. The catheter must be able to accommodate a blood flow of 10 to 40 mL/minute.[2,4]

Inspect the sterile packages *to make sure they're intact*. Don't use a blood circuit system that's damaged.

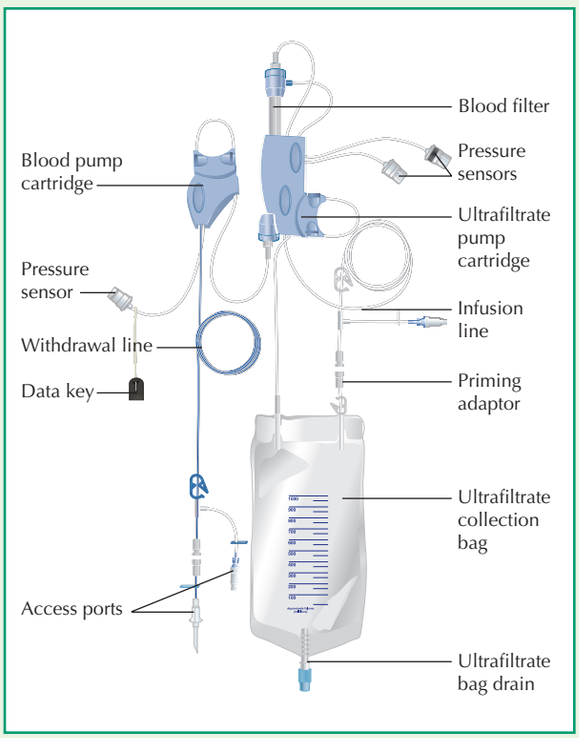
Implementation

- Verify the practitioner's order for Aquapheresis in the patient's medical record, and ensure that diuretic and electrolyte replacement therapy has been discontinued before initiating therapy.
- Make sure that preprocedure laboratory test results are available and documented in the patient's medical record; report any abnormalities.
- Verify that the practitioner has obtained written informed consent and that the consent form is in the patient's medical record.[5,6,7,8]
- Gather and prepare the necessary equipment in the patient's room.
- Perform hand hygiene.[9,10,11,12,13,14]
- Confirm the patient's identity using at least two patient identifiers.[15]
- Provide privacy.[16,17,18,19]
- Explain the procedure to the patient *to allay fears and promote cooperation*.
- Obtain the patient's weight in kilograms *to prevent medication dosing errors*.[20]

EQUIPMENT

A look at the Aquapheresis circuit

Aquapheresis requires a circuit such as the one below to filter fluid and sodium from the blood of patients with fluid overload.



- Raise the bed to waist level during patient care *to prevent caregiver back strain.*[21]
- Perform hand hygiene.[9,10,11,12,13,14]
- Put on gloves.[22,23,24]
- Perform a vigorous mechanical scrub of the access port for at least 5 seconds using an antiseptic pad[25] and allow it to dry completely.[25,26]
- While maintaining sterility of the syringe tip, attach a prefilled syringe containing preservative-free normal saline solution to the access port. (Use a 10-mL syringe or a syringe specially designed to generate lower injection pressure.) Unclamp the catheter and slowly aspirate for a blood return that is the color and consistency of whole blood. If you don't obtain a blood return, take steps to locate an external cause of the obstruction.
- If you obtain a blood return, slowly inject preservative-free normal saline solution into the catheter. Use a minimum volume of twice the internal volume of the catheter system. Don't forcibly flush the device; further evaluate the device if you meet resistance.[27]

Priming the blood circuit

- Plug the power cord into a grounded electrical outlet.
- Press the ON/OFF key on the front panel. (See *A look at the Aquapheresis circuit.*)
- Place the blood pump cartridge into the blood pump on the machine console and snap it into place. Then turn the knob clockwise until you hear a beep.
- Insert the ultrafiltrate cartridge in the side of the console and snap it into place. Then turn the knob clockwise until you hear a beep.
- Insert the tubing into the blood leak and air sensors.
- Put the pressure sensor cables into their proper connectors, located on the console.
- Insert the data key provided with the blood circuit system into the reader on the front of the console; *this data key facilitates many of the system's functions.*[2]
- Hang the empty ultrafiltrate collection bag on the machine's weight scale hook, and close the drain valve located at the bottom of the bag.
- Remove the end caps from the infusion tubing of the circuit and the priming adapter on the ultrafiltrate drainage bag, and then attach the circuit infusion tubing to the priming adapter on the ultrafiltrate drainage bag.
- Remove the end caps from the withdrawal tubing and the priming spike adapter, and then attach the withdrawal tubing to the withdrawal priming spike adapter.
- Spike the 500-mL priming bag of normal saline solution with the priming spike, and then hang the bag on the priming hook, making sure that the ultrafiltrate bag hangs freely.
- Open the clamps on the withdrawal tubing, infusion tubing, and ultrafiltrate bag priming adapter.
- Press the PRIME key and follow the onscreen instructions; priming should be completed and the system should be free from air in about 4 minutes.
- Empty the priming solution from the fluid collection bag before starting therapy. *Priming solution drains into the collection bag; emptying the collection bag ensures accuracy of the patient's output measurement.*
- Close the clamps on the blood circuit set, remove the end cap on the withdrawal catheter lumen, disconnect the withdrawal line from the IV spike, and connect the withdrawal line to the withdrawal catheter lumen.
- Remove the end cap from the infusion catheter lumen, disconnect the infusion line from the ultrafiltrate priming adapter, and connect the infusion line to the infusion catheter lumen.
- Trace the tubings from the patient to their points of origin *to make sure that you've attached them to the proper catheter lumens.*[28,29]
- If the patient has multiple infusions, route tubing using a standardized approach, keeping IV lines routed toward the head and enteric lines routed toward the feet, to prevent dangerous misconnections.[30] If you're using different access sites, label each tube at the distal end (near the patient connection) and proximal end (near the source container) to distinguish the different tubes and prevent misconnections.[30]
- Put sterile end caps on the priming spike and the ultrafiltrate priming adapter.

Beginning anticoagulant therapy

- Begin anticoagulant therapy at least 30 minutes before the procedure, as ordered, following safe medication administration practices. Typically, an IV bolus dose of heparin is given, followed by a continuous heparin infusion *to reduce the risk of clot formation within the system.*
- Avoid distractions and interruptions when preparing and administering medication *to prevent medication errors.*[31,32]
- Compare the medication label with the order in the patient's medical record.[33,34,35,36]
- Check the patient's medical record for an allergy or contraindication to the prescribed medication. If an allergy or contraindications exist, don't administer the medication and instead notify the practitioner.[33,34,35,36]
- Check the expiration date on the medication. If the medication is expired, return it to the pharmacy and obtain new medication.[33,34,35,36]
- Visually inspect the solution for particles or discoloration or other loss of integrity; don't administer the medication if integrity is compromised.[33,34,35,36]
- Discuss any unresolved concerns about the medication with the patient's practitioner.[33,34,35,36]
- If the patient is receiving the medication for the first time, teach him or her about potential adverse reactions, and discuss any other concerns related to the medication.[33,34,35,36]
- Verify that the medication is being administered at the proper time, in the prescribed dose, and by the correct route *to reduce the risk of medication errors.*[33,34,35,36]
- If your facility uses a barcode technology, scan your identification badge, the patient's identification bracelet, and the medication's bar code.[35]

NURSING ALERT Heparin, when administered IV, is considered a high-alert medication *because it can cause significant patient harm when used in error.*[37]

- Before beginning the heparin infusion, have another nurse perform an independent double-check if required by your facility. (See *Double-checking high-alert medications.*)

- If an independent double-check is required, compare the results. If no discrepancies exist, begin infusing the heparin through the withdrawal port of the access device. If discrepancies exist, rectify them before beginning the infusion.[38]
- Make sure that the infusion pump alarm limits are set appropriately for the patient's condition and that the alarms are turned on, functioning properly, and audible to staff.[39,40,41]

Beginning Aquapheresis therapy

- Open the withdrawal and infusion tubing clamps.
- Press the RUN key to begin therapy.[2]
- If your unit has a hematocrit (HCT) monitor, make sure that the sensor clip is attached to the blood chamber on the blood circuit. Allow 5 to 10 minutes to elapse in the RUN mode *to complete the initial baseline measurement of the patient's HCT*. The text "Baselining" will appear; after baselining is complete, press the HCT key and then set the HCT limit, using the up and down arrows. *The HCT limit automatically restricts the fluid removal rate to help prevent excessive volume depletion*.[2]
- Set the blood flow rate by pressing the BLOOD FLOW key. Use the arrow keys to adjust the value. For a central venous catheter, begin the flow rate at 40 mL/minute. For a peripheral dual-lumen extended-length catheter, begin the flow rate at 25 mL/minute.
- After the blood flow rate is stable, increase the rate in increments of 10 mL/hour until an adequate rate is determined. Use the arrow keys to adjust the rate. The average removal rate is 250 mL/hour.[42] Patients in volume-sensitive states, such as those with right-sided heart failure, hepatic disease, or cardiogenic shock, usually require lower rates (50 to 100 mL/hr).[2,3]
- Monitor the patient and the system for 10 minutes after beginning therapy. If after 10 minutes the system functions without alarming, secure the catheter.
- Monitor and record vital signs every 15 minutes during the first hour of treatment, and then hourly or more frequently as indicated by the patient's condition.[43,44]
- Record intake and output hourly; include the ultrafiltrate in the patient's output volume.[2,43,44]
- Monitor the system and respond to any alarms according to the manufacturer's guidelines. *The system has sensors to detect air bubbles in the blood circuit line, blood leaks in the ultrafiltrate line, and pressure in both lines*.[2]
- Monitor the system for signs of clotting, such as frequent and unexpected infusion or withdrawal occlusions.[2]
- Maintain the patient's fluid restriction.
- Monitor the patient for signs of hypovolemia, such as tachycardia, hypotension, and diminished urinary output. Obtain blood samples for blood urea nitrogen and creatinine levels, as ordered, and monitor the results. (See the "Venipuncture" procedure.)[45]
- Return the bed to the lowest level to prevent falls and maintain patient safety.[46]
- When the system alarms (indicating that the ultrafiltrate collection bag is full), empty the bag into a graduated liquid waste receptacle.[2]

Discontinuing Aquapheresis therapy

- Press the STOP key *to stop the pumps*.[2]
- Trace each tubing from the patient to its point of origin before clamping *to make sure that you're clamping the correct tubing*.[28,29]
- Clamp the withdrawal catheter extension tubing.
- Disconnect the withdrawal blood circuit connection from the withdrawal catheter extension.
- Flush the withdrawal catheter IV access and cap with preservative-free normal saline solution.
- Clamp the infusion line.
- Disconnect the infusion line.
- Flush the infusion IV access and cap with preservative-free normal saline solution.
- Return the HCT sensor to its dock on the back of the console.
- Remove the blood circuit from the console by pressing the clips on the front and side cartridges and rotating the knobs while removing the tubing. Discard the system in an appropriate biohazard waste container.[2,47]
- Power off the console by holding the ON/OFF key for 1 second.
- Obtain the patient's weight in kilograms.[20]
- Discard used supplies in appropriate receptacles.[23]

Double-checking high-alert medications

If required by your facility, have another nurse perform an independent double-check of your preparation of a high-alert medication such as heparin *to ensure safe administration*.[38] The second nurse must perform the following tasks:

- Verify the patient's identity.
- Ensure that the correct medication is being administered and is in the prescribed concentration.
- Ensure that the medication's indication corresponds with the patient's diagnosis.
- Verify that the dosage calculations are correct and that the dosing formula used to derive the final dose is correct.
- Verify that the route of administration is safe and appropriate for the patient.
- Ensure that pump settings are correct and that the infusion line is attached to the correct port.

- Remove and discard your gloves.
- Perform hand hygiene.[9,10,11,12,13,14]
- Clean and disinfect your stethoscope using a disinfectant pad.[48,49]
- Perform hand hygiene.[9,10,11,12,13,14]
- Document the procedure.[50,51,52,53]

Cleaning the unit after each use

- Put on clean gloves.[22,23]
- Using a mild soap solution, clean the surface of the console.
- Disinfect the console surfaces using 10% bleach solution or 95% isopropyl alcohol. Apply the solution to a soft cloth to clean the console.[2,54]
- Clean the tubing path through the air and blood leak sensors; use a "flossing" action to clean inside the detector with a lint-free cloth and warm water. Dry thoroughly.[2]
- Remove the pumps, clean them, and reassemble them. Refer to the manual for instructions on removing and cleaning pumps. In some facilities, this is performed in the biomedical department.[2,54]
- Remove and discard your gloves.
- Perform hand hygiene.[9,10,11,12,13,14]

Special considerations

- When flushing the access catheter, consider using a pulsatile flushing technique; short boluses of 1 mL each interrupted by brief pauses may be more effective at removing deposits (such as fibrin, drug precipitate, and intraluminal bacteria) than a continuous low-flow technique.[27]
- The Joint Commission issued a sentinel event alert concerning medical device alarm safety *because alarm-related events have been associated with permanent loss of function and death*. Among the major contributing factors were improper alarm settings, alarm settings inappropriately turned off, and alarm signals not audible to staff. Make sure alarm limits are set appropriately and that alarms are turned on, functioning properly, and audible to staff. Follow facility guidelines for preventing alarm fatigue.[55]
- Monitor partial thromboplastin time at specific intervals during therapy, as ordered; the recommended therapeutic range for therapy is 80 to 100 seconds.[44]
- Patients receiving warfarin who have an International Normalized Ratio greater than 2 typically start on a continuous heparin infusion and aren't given an initial bolus of the drug. If heparin is contraindicated, the practitioner may prescribe argatroban.[2,56]
- Aquapheresis can safely remove up to 500 mL or 0.5 kg of fluid per hour. The average treatment is 24 hours, with 6 L or 6 kg of fluid removed.[2]
- Although patients can sit up in a chair and walk to the bathroom using the unit's battery backup, blood is pumped more efficiently through the filter with less patient movement, decreasing the length of the procedure.[2,37]
- Magnetic resonance imaging (MRI) is contraindicated with the use of a dual-lumen catheter, *because the reinforcement coil may experience rotational or translational forces or temperature increases due to the magnetic field and pulsed radio-frequency fields*. Affix an AVOID MRI label to these catheters *to denote this risk*. Check with the MRI provider and the catheter manufacturer for MRI safety information.

- Adjust the ultrafiltration rates if the patient's blood pressure drops 10 mm Hg below baseline or if the patient's heart rate is greater than 130 beats/minute after two consecutive measurements within 5 minutes. Obtain orders to reduce the ultrafiltration or briefly stop ultrafiltration *to allow the patient time to recover*.
- The Joint Commission has issued a sentinel event alert related to managing risk during transition to new International Organization for Standardization tubing standards designed to prevent dangerous tubing misconnections, which can lead to serious patient injury and death. During the transition, trace the tubing and catheter from the patient to the point of origin before connecting or reconnecting any device or infusion, at any care transition (such as a new setting or service), and as part of the handoff process. Route tubes and catheters with different purposes in different standardized directions. Label the tubing at the distal and proximal ends when there are different access sites or several bags hanging. Use tubing and equipment only as intended. Store medications for different delivery routes in separate locations.[30]

Complications

An ultrafiltration alarm activates when ultrafiltrate pressure deviates from the usual range; this usually means clotting of the filter has occurred, requiring that the filter be replaced. In this situation, contact the practitioner to determine if the practitioner wants to continue treatment. Then, as applicable, follow the manufacturer's procedure for replacement of the circuit and filter, as outlined in the *Aquadex FlexFlow User's Guide*.[2]

Documentation

Record the date and time that therapy began; the reason for the therapy; the patient's weight before and after the treatment; vital signs and withdrawal, infusion, and ultrafiltrate pressures throughout the treatment; patency and condition of catheter access sites; initial Aquadex FlexFlow settings, changes made, and the reasons for such changes; intake and output; laboratory values; and the patient's tolerance of the procedure.

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ARTERIAL AND VENOUS SHEATH REMOVAL

The number of endovascular procedures performed by cardiologists and vascular surgeons has increased dramatically in the past decade. During these procedures, surgeons may place an arterial sheath, venous sheath, or both. Sheath removal can improve patient comfort and shorten the required time on bed rest, resulting in positive patient outcomes. Only those who have received special training should perform sheath removal because of its association with potentially life-threatening adverse events.

Methods used to control bleeding following sheath removal include manual compression (used alone or with a hemostasis pad), mechanical compression devices, staple or clip-mediated closure devices, and percutaneous suture-mediated closure devices. Manual compression can cause a nurse fatigue and injury, which can result in carpal tunnel syndrome. Mechanical compression techniques effectively prevent hematoma formation, and the incidence of bleeding doesn't differ significantly for different methods of compression.[1] When using a plug-type device, staple-mediated closure device, or suture-mediated closure device, sheath removal can happen immediately after the procedure, regardless of the patient's coagulation status.

Equipment

Gloves ■ gown ■ mask and goggles or mask with face shield ■ sterile gloves ■ cardiac monitor ■ blood pressure monitor ■ permanent marker ■ antiseptic solution (chlorhexidine-based, povidone-iodine) ■ sterile gauze ■ hypoallergenic tape ■ fluid-impermeable pad ■ prescribed analgesic ■ emergency resuscitation equipment (code cart with cardiac medications, defibrillator, handheld resuscitation bag with mask, intubation equipment ■ Optional: suture removal kit, IV catheter insertion equipment, sterile normal saline solution, transparent dressing, mechanical compression device, noninvasive hemostasis pad, prescribed local anesthetic (10 to 20 mL of 1% lidocaine).[2]

Preparation of equipment

Make sure resuscitation equipment is readily available and functioning properly. Administer an analgesic 20 to 30 minutes before the procedure[3], and assist with local anesthetic administration,[2] as ordered, following safe medication administration practices *to promote patient comfort.*[4,5,6,7]

Implementation

- Verify the practitioner's order for sheath removal.
- Review the patient's medical record to assess for conditions that increase the patient's risk of bleeding and check the patient's platelet count, prothrombin time, international normalized ratio, partial thromboplastin time, complete blood count, blood urea nitrogen and creatinine levels, and activated clotting time *to ensure that hemostasis can be achieved.*[3]

NURSING ALERT **Keep in mind that patients receiving potent oral and IV antiplatelet and antithrombin medications who have conditions such as hypertension and renal dysfunction (defined as creatinine clearance of less than 60 mL/minute) are at increased risk for bleeding during percutaneous coronary intervention.**[8]

- Gather and prepare the necessary equipment.
- Perform hand hygiene.[9,10,11,12,13,14,15,16]
- Confirm the patient's identity using at least two patient identifiers.[17]

Preparing for sheath removal

- Provide privacy.[18,19,20,21]
- Explain the procedure to the patient and family (if appropriate) according to their individual communication and learning needs *to increase their understanding, allay their fears, and enhance cooperation.*[22] Include anticipated postprocedure activity restrictions, discomfort caused by pressure to the site, and signs and symptoms to report.
- Raise the patient's bed to waist level when providing care *to prevent caregiver back* strain.[23]
- Perform hand hygiene.[9,10,11,12,13,14,15,16]
- Put on gloves as needed.[24,25,26,27,28]
- Ensure the patient is connected to the cardiac monitor *to enable prompt recognition and treatment of complications that may occur during the procedure.* Make sure that alarm limits are set properly for the patient's current

condition and that the alarms are turned on, functioning, and audible to staff.[29,30,31,32]

- Obtain the patient's vital signs and assess the ECG tracing on the cardiac monitor *to establish baselines*. Notify the practitioner if the patient's blood pressure is elevated *because the practitioner may order medication to lower the patient's blood pressure before sheath removal, to decrease postprocedure bleeding*.[3,8]
- Assess neurovascular status in the extremity distal to the sheath insertion site *to establish a baseline*.[3]
- Mark the pulses distal to the sheath insertion site using a permanent marker *to facilitate finding the pulses for subsequent assessment*.[3]
- Confirm that the patient has a patent IV catheter in place *in case the patient requires emergency IV fluids or medications.* If a catheter is not in place, insert one.[2,3,33] (See the "IV catheter insertion and removal" procedure.)
- Position the patient with the head of the bed flat *to promote hemostasis*.[3]
- Place a fluid-impermeable pad under the affected extremity *to keep the bed linens clean and to provide a place to set the sheath after removal.*
- Remove and discard your gloves, if worn, in the appropriate receptacle.[24,27,34]
- Perform hand hygiene.[9,10,11,12,13,14,15,16]
- Put on gloves and personal protective equipment, if you have not already done so, *to comply with standard precautions.*[24,25,26,27,28]
- If you're using a mechanical compression device, place it under the patient before sheath removal *to reduce patient movement and the risk of bleeding after sheath removal.*[3] If you're using a hemostasis pad, open it using sterile, no-touch technique, and open the sterile normal saline solution. (See the "Sterile technique, basic" procedure.)
- If the sheath is sutured in place, open a suture removal kit using sterile no-touch technique.
- Carefully remove the dressing covering the sheath insertion site.
- Clean the insertion site with the antiseptic solution.[3]
- Remove and discard your gloves in the appropriate receptacle.[24,27,34]
- Perform hand hygiene.[9,10,11,12,13,14,15,16]
- Put on sterile gloves.[3]
- Remove the sutures, if present. (See the "Suture removal" procedure.)

Arterial sheath removal using manual or mechanical compression

- Locate the femoral pulse proximal to the insertion site *so that you can properly position compression (manual or mechanical) 1 to 2 cm above the insertion site*.[3]
- Hold the sheath with one hand while applying firm manual or mechanical pressure over the femoral artery with the other hand *to reduce bleeding*.
- Remove the sheath slowly while the patient exhales *to prevent the patient from bearing down during removal, which can cause a vasovagal response*. Continue to apply pressure manually or with the mechanical device.[3]

NURSING ALERT **If you meet resistance while withdrawing the sheath, stop the procedure and notify the practitioner.**[3]

- Apply continuous, firm pressure to the artery for approximately 20 minutes.[3] Ensure that the pressure is strong enough to stop the bleeding but not so strong that it obscures the pedal pulse. Continue to assess pulses distal to the insertion site (you might need a coworker to do this).

Arterial sheath removal using a noninvasive hemostasis pad with manual compression

- Apply pressure 1 to 2 cm proximal to the insertion site.[3]
- Place the pad directly over the insertion site.
- Remove the sheath slowly while the patient exhales *to prevent the patient from bearing down during removal, which can cause a vasovagal response*.
- Momentarily reduce proximal pressure to let a small amount of blood from the insertion site moisten the noninvasive hemostasis pad *to activate the hemostasis mechanism*, and then reapply proximal pressure.[3]
- After 3 to 4 minutes, slowly decrease pressure proximal to the insertion site while continuing to apply pressure to the insertion site for no less than 10 minutes. Continue to assess pulses distal to the insertion site (you might need a coworker to do this).[3]
- Leave the hemostasis pad in place for 24 hours.[3]
- Remove manual pressure after hemostasis is achieved.

Venous sheath removal

- Remove the venous sheath, if present, 5 to 10 minutes after removal of the arterial sheath *because pressure at the arterial site must be maintained for a longer time*.[3]
- Apply pressure over the venous and arterial sites for 10 more minutes or until the bleeding stops.[3]
- If a hemostasis pad is used, momentarily reduce proximal pressure to let a small amount of blood from the insertion site moisten the noninvasive hemostasis pad *to activate the hemostasis mechanism* and then reapply proximal pressure.[3] After 3 to 4 minutes, slowly decrease pressure proximal to the insertion site while continuing to apply pressure to the insertion site for no less than 10 minutes. Then apply another sterile gauze pad over the hemostasis pad, cover the site with a transparent dressing, and leave it in place for 24 hours.

NURSING ALERT **Avoid prolonged pressure on the femoral vein.** ***Prolonged venous occlusion, especially with pressure devices, may cause venous thrombosis.*** **Assess for neurovascular changes.**[2]

Follow-up care

- Apply sterile dressings to the arterial and venous insertion sites *to keep the areas clean and reduce the risk of infection*.[35]
- Assess the patient's neurovascular status, vital signs, and the insertion site in the affected limb every 15 minutes for 1 hour, every 30 minutes for the next hour, and then every hour for 4 hours *to detect signs of complications*.[3]
- Tell the patient not to elevate the head of the bed greater than 30 degrees *to reduce the risk of disrupting homeostasis and relieve back discomfort.*
- Return the bed to the lowest position *to prevent falls and maintain safety*.[36]
- Instruct the patient to report any bleeding from the site, saturation of the dressing, or wetness or warmth on the groin or leg.
- Tell the patient to report coolness, numbness, tingling, or pain in the affected extremity.
- Keep the patient on bed rest for 2 to 6 hours when applying mechanical or manual pressure after arterial sheath removal *to reduce the complications of bed rest and back discomfort*.[3,37]
- Keep the patient on bed rest for 1 to 4 hours when achieving hemostasis through percutaneous suture–mediated closure and hemostasis pads.
- Keep the patient on bed rest for no more than 4 hours following venous sheath removal.
- Discard used supplies in the appropriate receptacle.[24,27,34]
- Remove and discard your gloves and other personal protective equipment, if worn.[24,27,34]
- Perform hand hygiene.[9,10,11,12,13,14,15,16]
- Perform a comprehensive pain assessment using techniques appropriate for the patient's age, conditions, and ability to understand.[38] Administer pain medication as ordered and indicated, using safe medication administration practices.[4,5,6,7]
- Document the procedure.[39,40,41,42,43]

Special considerations

- Some practitioners prefer to use the radial artery for catheterization. *Because the radial artery is much smaller and located closer to the skin surface*, accessing this artery eliminates internal bleeding and enables easy compression of any external bleeding. After the catheter and sheath are removed from the radial artery, a compression device is placed around the wrist *to apply pressure*. Radial catheterization also eliminates the need for the patient to remain immobile. In general, patients find radial catheterization more comfortable than femoral catheterization *because they are able to sit up, walk, and eat immediately following removal.*[44]
- If the patient is obese, you may need a second person to assist in holding back skin and abdominal folds.[3]
- In a patient with hypertension, you may need to apply pressure for a longer period of time *to ensure hemostasis*.[3]
- Be sure to read the manufacturer's instructions for correct use of mechanical compression devices. *Tissue damage can occur with incorrect use of the devices.*
- The compression time required to control bleeding depends on several factors, including the size of the sheath, administration of heparin and antiplatelet drugs, and blood coagulation levels.[2,3]

- If you can't stop the bleeding following sheath removal, notify the practitioner.[3]
- The Joint Commission issued a sentinel event alert concerning medical device alarm safety *because alarm-related events have been associated with permanent loss of function or death*. Among the major contributing factors were improper alarm settings, alarm settings turned off inappropriately, and alarm signals not audible to staff. Make sure alarm limits are set appropriately and that alarms are turned on, functioning properly, and audible to staff. Follow facility guidelines for preventing alarm fatigue.[39]

Patient teaching

Provide the patient and his family with written and oral discharge instructions. Tell the patient to avoid lifting anything heavier than 10 lb (4.5 kg) for 3 days and to avoid driving or operating machinery for 24 hours. Tell the patient that it's permissible to remove the dressing and shower after 24 hours, but that a tub bath or swimming is to be avoided until the skin is healed. After the initial 24 hours, the patient may clean the site with soap and water and apply a small adhesive bandage. Tell the patient to inspect the site daily and to notify the practitioner as soon as possible of any bleeding, redness, or discharge at the site or if a fever develops.

Complications

The most common complication following sheath removal is bleeding, which occurs most commonly at the femoral artery access site. Retroperitoneal bleeding may also occur. Vascular complications include hematoma, pseudoaneurysm, arteriovenous fistula, embolus, and thrombus formation.[45] Sensory or motor impairment may occur in the affected limb. Vasovagal complications may also occur.

Documentation

Record the date and time of sheath removal. Note whether an arterial sheath, a venous sheath, or both were removed and their locations. Record patient and family teaching about the removal procedure and activity restrictions following sheath removal, as well as their understanding of the teaching. Note the patient's pain assessment, any interventions you provided, and the patient's response to those interventions. Document the laboratory values before sheath removed and that they were within normal limits. Record vital signs, neurovascular status, and heart rhythm before sheath removal. Record vital signs, neurovascular status, and heart rhythm before sheath removal. State whether pulses distal to the sheath insertion sites were marked.

Note whether the patient has a patent IV line. Include that the patient was placed in a flat position for sheath removal. Describe the condition of the sheath insertion sites, noting redness, skin breakdown, drainage, bleeding, or hematoma formation. Note how many sutures were removed, if applicable. Explain any difficulties encountered during sheath removal. Record the method of hemostasis used and the time required for hemostasis to be achieved. Document your assessments of neurovascular status, vital signs, and sheath insertion site. Note the patient's tolerance of the procedure.

Record any complications, the time and name of the person notified, practitioner's orders, your interventions, and the patient's response to those interventions. Include the patient's position following sheath removal and the duration of bed rest.

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ARTERIAL PRESSURE MONITORING

Arterial catheters provide direct arterial pressure monitoring, which permits continuous measurement of systolic, diastolic, and mean arterial pressures and allows for arterial blood sampling. Because direct measurement reflects systemic vascular resistance (SVR) as well as blood flow, it's generally more accurate than indirect methods (such as palpation and auscultation of Korotkoff [audible pulse] sounds), which are based on blood flow.

Direct monitoring is indicated when highly accurate or frequent blood pressure measurements are required, such as for patients with low cardiac output and high SVR. It can also be used for hospitalized patients who are obese or have severe edema—conditions that make indirect measurement difficult to perform—as well as for patients receiving titrated doses of vasoactive drugs and for those who require frequent blood sampling.

Arterial pressure monitoring is used in critical care settings. Catheter insertion, which can be performed at the beside under surgically sterile conditions, is performed by a practitioner. Guidelines recommend the radial, brachial, and dorsalis pedis sites over the femoral and axillary sites to reduce the risk of infection.[1,2] The catheter should be removed as soon as possible to decrease the risk of complications.[1,3,4]

HOSPITAL-ACQUIRED CONDITION ALERT **Keep in mind that vascular catheter–associated infection is considered a hospital-acquired condition because various best practices can reasonably prevent it. Make sure to follow infection prevention techniques (such as performing hand hygiene, maintaining sterile technique, limiting catheter manipulations, and removing the catheter as soon as it's no longer needed) when maintaining an arterial line to reduce the risk of vascular catheter–associated infection.**[1,5,6]

A nurse caring for a patient undergoing arterial pressure monitoring must have an understanding of cardiac anatomy and physiology, the physiology of fluid and electrolyte balance, the pathophysiology of heart disease, and the hemodynamic alterations expected with cardiac interventions and surgery. Competence in setting up and maintaining arterial monitoring equipment, evaluating waveforms, and making clinical decisions about changes in a patient's therapy are also crucial. (See *Understanding an arterial waveform*.)

Equipment

Disposable pressure transducer system ■ bag of IV flush solution ■ arterial catheter ■ sterile nonvented or dead-end caps ■ pressure tubing ■ pressure infuser bag ■ transducer holder in an IV pole ■ monitoring system and equipment (module, bedside monitor, and cable ■ vital signs monitoring equipment ■ labeling device ■ Optional: single-patient-use joint stabilization device.

Preparation of equipment

If necessary, set up and prime the disposable pressure transducer system. (See the "Transducer system setup" procedure.) Make sure you keep all parts of the pressure monitoring system sterile.[1] When you've completed equipment preparation, turn on the bedside monitor and set the appropriate scale *to visualize the correct waveform.*[3]

Implementation

- Gather and prepare the necessary equipment.
- Perform hand hygiene.[1,7,8,9,10,11,12,13]
- Confirm the patient's identity using at least two patient identifiers.[14]
- Provide privacy.[15,16,17,18]
- Explain the procedure to the patient and family (if appropriate) according to their individual communication and learning needs *to increase their understanding, allay their fears, and enhance cooperation.*[19]. Include the purpose of arterial pressure monitoring and the anticipated duration of catheter placement.
- Raise the patient's bed to waist level when providing care *to prevent caregiver back strain.*[20]
- Position the patient for easy access to the catheter insertion site.
- Obtain vital signs *to provide baseline date for comparison.*
- If the patient doesn't already have an arterial catheter in place, assist the practitioner, as needed, during catheter insertion.
- Immobilize the insertion site if necessary. With a radial or brachial site, use a single-patient-use joint stabilization device to facilitate infusion delivery and maintain device patency.[21] With a femoral site, maintain the patient on bed rest with the head of the bed raised no more than 30 degrees *to prevent the catheter from kinking.*

NURSING ALERT **Keep the catheter site visible at all times. Don't allow linens to cover the site. Arterial catheter dislodgement requires prompt recognition and intervention** ***to reduce the risk of exsanguination.***

Zeroing the transducer

- Using the leveling device, level the zeroing stopcock of the transducer with the phlebostatic axis (fourth intercostal space, at the midpoint of the anterior-posterior diameter of the chest wall), which reflects central arterial pressure.[3,22]
- Zero the system to atmospheric pressure *to negate the effects of atmospheric pressure and prepare the monitoring system for accurate arterial*

pressure monitoring.[3] Zero the transducer system only with initial setup, if the transducer system is disconnected from the monitoring cable, if the monitoring cable is disconnected from the monitor, and when blood pressure values don't correspond with the patient's clinical status *to minimize the number of entries into the pressure monitoring system and subsequently reduce the risk of vascular catheter–associated infection.*[1,3]

- Observe the monitor for the arterial waveform and pressure reading. Perform a square wave test to determine whether the system correctly reflects arterial pressure; note that the square wave test is affected by such system problems as air bubbles in the tubing, excessive tubing length, loose connections, and catheter patency.[3] (See *Performing a square wave test*.)

Completing the procedure

- Make sure that alarms are set appropriately for the patient's current condition, and that alarms are turned on, functioning properly, and audible to staff.[23,24,25,26]
- Continuously observe the arterial waveform quality on the monitor and record variances *to ensure the accuracy of the waveform and detect changes in the patient's hemodynamic status.* A normal waveform has a peak systole, clear dicrotic notch, and end diastole.[3]
- Monitor the patient's vital signs and note trends in arterial pressure waveform readings at least every 2 hours. Correlate pressure readings with the patient's clinical condition and response to therapies.
- Evaluate the patient regularly for signs and symptoms of fluid imbalance and vascular catheter–associated infection, which can include (but are not limited to) fever, chills, tachycardia, increased white blood cell count, redness and swelling at the catheter insertion site, and positive blood cultures.
- Monitor for potential complications of the arterial catheter, such as impaired circulation distal to the catheter insertion site; immediately notify the practitioner if any occur.
- Evaluate the arterial pressure monitoring system regularly for air bubble formation, which can lead to potentially lethal air emboli. Remove air bubbles by flushing them through a system stopcock.
- Troubleshoot the arterial waveform, as needed. Notify the practitioner, as appropriate. If the waveform suddenly becomes dampened, check the patient before attempting to determine its cause or fix the problem *because a sudden hypotensive episode can look like a dampened waveform on the monitor and can be potentially life-threatening if not treated properly.* (See *Recognizing abnormal waveforms*, page 30.)
- Return the bed to the lowest position to prevent falls and maintain patient safety.[27]
- Perform hand hygiene.[1,7,8,9,10,11,12,13]
- Document the procedure.[28,29,30,31,32]

Special considerations

- Be aware that erroneous pressure readings can result from a catheter that's clotted or positional, loose connections, addition of extra stopcocks or extension tubing, inadvertent entry of air into the system, or improper calibrating, leveling, or zeroing of the monitoring system. If the catheter lumen clots, the flush system may be pressurized improperly. Regularly assess the amount of flush solution in the IV bag, and maintain 300 mm Hg of pressure in the pressure infuser bag.[3]
- Change disposable transducer systems, including flush device and flush solution used for invasive hemodynamic monitoring every 96 hours, immediately upon suspected contamination, or when integrity of the system has been compromised. Limit the number of manipulations and entries to the system.[1,33]
- Note that you shouldn't perform routine site care and dressing changes on short peripheral catheters unless the dressing is damp, loosened, or visibly soiled.[34]
- Perform hand hygiene before performing dressing changes, and use sterile technique and sterile gloves when redressing the site.[1,34] When removing the current dressing, observe for signs of infection (such as redness, warmth, swelling, and purulent drainage) and note complaints of tenderness.
- Don't routinely change arterial catheters to reduce the risk of vascular catheter–associated infections.[1]

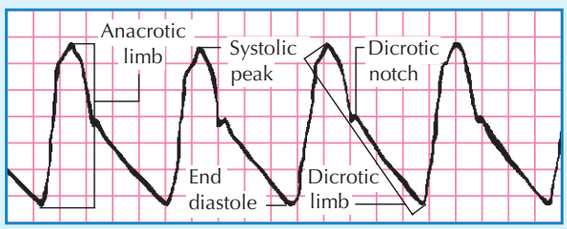
Understanding an arterial waveform

Normal arterial blood pressure produces a characteristic waveform, representing ventricular systole and diastole. The waveform has five distinct components: the anacrotic limb, the systolic peak, the dicrotic limb, the dicrotic notch, and end diastole.

The *anacrotic limb* marks the waveform's initial upstroke, which results as blood is rapidly ejected from the ventricle through the open aortic valve into the aorta. This rapid ejection causes a sharp rise in arterial pressure, which appears as the waveform's highest point, called the *systolic peak*.

As blood continues into the peripheral vessels, arterial pressure falls, and the waveform begins a downward trend. This part is called the *dicrotic limb*. Arterial pressure usually will continue to fall until pressure in the ventricle is less than pressure in the aortic root. When this decrease occurs, the aortic valve closes. This event appears as a small notch (called the *dicrotic notch*) on the waveform's downside. When the aortic valve closes, diastole begins, progressing until the aortic root pressure gradually descends to its lowest point. On the waveform, this point is known as *end diastole*.

Normal arterial waveform



- The Joint Commission issued a sentinel event alert concerning medical device alarm safety *because alarm-related events have been associated with permanent loss of function and death.* Among the major contributing factors were improper alarm settings, alarms turned off inappropriately, and alarm signals not audible to staff members. Make sure that alarm limits are set appropriately and that alarms are turned on, functioning properly, and audible to staff. Follow facility guidelines for preventing alarm fatigue.[23]

Complications

Arterial catheter insertion and pressure monitoring can cause such complications as arterial bleeding; infection at the insertion site, which can spread into the bloodstream; clot formation within the catheter, which can then be carried into the general circulation; catheter perforation of the vessel wall, which can be associated with excessive bleeding and extravasation of flush solution into the surrounding tissue; air embolism; arterial spasm; and impaired circulation to the extremity distal to the catheter insertion site, which, if not treated promptly, can lead to loss of tissue and, ultimately, loss of limb.

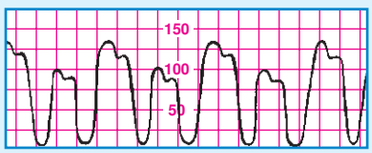
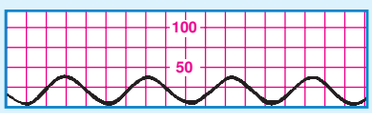
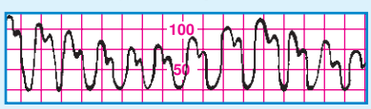
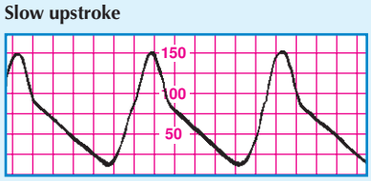
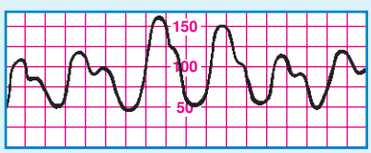
Additionally, if insertion uses the radial artery, prolonged hyperextension of the wrist can cause transient median nerve conduction deficits.

Documentation

If you assisted with insertion, record the insertion site location; specific site preparation; local anesthetic (if used); infection prevention and safety precautions taken; the type, length, and gauge of the catheter inserted; date and time of insertion; device functionality; method of catheter stabilization; type of flush solution used; and the patient's tolerance of the procedure. Document the color, warmth, sensation, and pulse strength of the extremity distal to the catheter insertion site before insertion, immediately after insertion, and at regular intervals determined by your facility. Note alarm settings and confirmation that the alarms are turned on. Record the patient's position for zeroing the transducer so that other health care team members can replicate the placement. Record the patient's vital signs, including manual blood pressure in comparison to the blood pressure obtained through the arterial catheter. Document dressing, tubing, and flush solution changes when appropriate. Note patient and family (if applicable) teaching and their understanding of your teaching.

Recognizing abnormal waveforms

Understanding a normal arterial waveform is relatively straightforward. However, an abnormal waveform is more difficult to decipher. Abnormal patterns and markings may provide important diagnostic clues to the patient's cardiovascular status, or they may simply signal trouble in the monitor. Use this chart to help you recognize and resolve waveform abnormalities.

Abnormality	Possible causes	Nursing interventions
Alternating high and low waves in a regular pattern 	■ Ventricular bigeminy ■ Cardiac tamponade	■ Assess the patient's electrocardiogram *to confirm ventricular bigeminy*. The tracing should reflect premature ventricular contractions every second beat. ■ Assess the patient for signs and symptoms of cardiac tamponade, such as dyspnea, tachycardia, tachypnea, cool and clammy skin, pericardial friction rub, and diminished heart sounds.
Flattened waveform 	■ Overdamped waveform ■ Hypotension	■ Perform the square wave test. ■ Check for kinks, obstructions, or disconnections in the catheter or tubing. Clear the line of catheter of air or blood. Repeat the square wave test *to verify an optimal waveform*. ■ If the square wave test indicates optimal waveform, assess and treat the patient for hypotension.
Slightly rounded waveform with consistent variations in systolic height 	■ Mechanical ventilation with positive end-expiratory pressure	■ Assess the patient's systolic blood pressure regularly. The difference between the highest and lowest systolic pressure reading should be less than 10 mm Hg. If the difference exceeds that amount, suspect pulsus paradoxus, possibly from cardiac tamponade.
Slow upstroke 	■ Aortic stenosis	■ Auscultate the patient's heart sounds for signs of aortic stenosis, such as a prolonged systolic ejection murmur and paradoxical splitting of the S_2 heart sound. Also notify the practitioner, who will document suspected aortic stenosis in the practitioner's notes.
Diminished amplitude on inspiration 	■ Pulsus paradoxus, possibly from cardiac tamponade, constrictive pericarditis, or lung disease	■ Note systolic pressure during inspiration and expiration. If inspiratory pressure is at least 10 mm Hg less than expiratory pressure, call the practitioner. ■ If you're also monitoring pulmonary artery pressure, observe for a diastolic plateau. This abnormal waveform occurs when the mean central venous pressure (right atrial pressure), mean pulmonary artery pressure, and mean pulmonary artery wedge pressure are within 5 mm Hg of one another.

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ARTERIAL PUNCTURE FOR BLOOD GAS ANALYSIS

Arterial blood gas (ABG) analysis evaluates ventilation by measuring blood pH and the partial pressures of arterial oxygen (Pa_{O2}) and carbon dioxide (Pa_{CO2}). Blood pH measurement reveals the blood's acid-base balance, Pa_{O2} indicates the amount of oxygen in the blood, and Pa_{CO2} indicates the lungs' capacity to eliminate carbon dioxide. ABG samples can also be analyzed for total hemoglobin, oxygen saturation, saturation of dyshemoglobins, bicarbonate values, and base excess or deficit.[1] Obtaining an arterial blood sample requires percutaneous puncture of the brachial, radial, or femoral artery or withdrawal of a sample from an arterial line.

Typically, ABG analysis is ordered when respiratory distress or failure is suspected. It's also performed during episodes of shock and after coronary artery bypass surgery, resuscitation from cardiac arrest, changes in respiratory therapy or status, and prolonged anesthesia.

Most ABG samples can be drawn by a respiratory therapist or specially trained nurse; however, collection from the femoral artery is usually performed by a practitioner. The radial artery is the preferred site because it is small and easy to stabilize.[2,3]

Equipment

Preheparinized ABG plastic Luer-lock syringe specially made for drawing blood for ABG analysis ■ 20G to 25G 1″ to 1½″ (2.5-cm to 3.8-cm) needle ■ gloves ■ antiseptic pad or swab (alcohol, chlorhexidine, or povidone-iodine)[2,3,4] ■ two 2″ × 2″ (5-cm × 5-cm) gauze pads ■ rubber cap for syringe hub ■ laboratory biohazard transport bag ■ label ■ laboratory request form ■ small towel ■ adhesive bandage ■ Optional: Mask and goggles or mask with face shield, gown, sterile gloves, 1% lidocaine solution without epinephrine or eutectic mixture of local anesthetics cream, 1-mL syringe with 22G needle, 1-mL ampule of aqueous heparin (1:1,000), plastic bag, crushed ice, Doppler ultrasound device, pulse oximeter.

Many health care facilities use a commercial ABG kit that contains some of the equipment listed above.

Preparation of equipment

If time allows, administer local anesthetic cream at least 1 hour before the procedure *because it requires at least 1 hour to achieve its effect*.

Open the ABG kit and remove the sample label and the plastic bag. If the syringe isn't heparinized, you will have to heparinize it *to prevent the sample from clotting*. To do so, first attach the 22G needle to the syringe. Then open the ampule of heparin. Draw all the heparin into the syringe. Hold the syringe upright, and rotate the barrel while pulling the plunger back *to allow the heparin to coat the entire inside surface of the syringe*. Then slowly force the heparin toward the hub of the syringe, and expel all of the heparin.

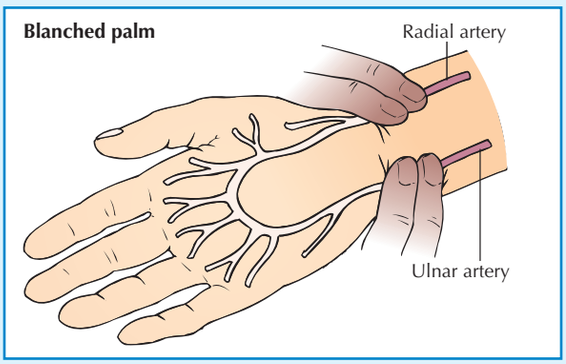
ABG analysis should be performed within 10 minutes of obtaining the blood sample.[6] Fill a plastic bag with enough crushed ice to contain the syringe if you anticipate a delay in analysis.

Implementation

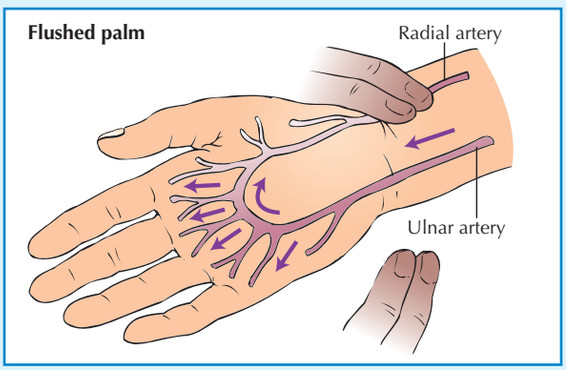
- Verify the practitioner's order.
- Review the patient's medical record for current anticoagulation therapy, clotting disorders, and pertinent laboratory values *to determine the patient's risk of prolonged bleeding after the procedure*. Discuss any concerns with the patient's practitioner.
- Confirm steady state conditions *to ensure accurate test results*. If the patient is receiving oxygen, make sure that this therapy has been underway for 20 to 30 minutes before collecting an arterial sample. If the patient has received a nebulizer treatment, wait 20 minutes before collecting the sample. If the patient recently underwent suctioning or was placed on mechanical ventilation or the fraction of inspired oxygen concentration has been changed, wait at least 15 minutes before collecting a blood sample.[4,6]
- Gather and prepare the necessary equipment.
- Perform hand hygiene.[7,8,9,10,11,12]
- Confirm the patient's identity using at least two patient identifiers.[13]
- Explain the procedure to the patient *to help ease anxiety and promote cooperation*. Tell the patient that the needle stick will cause some discomfort but that the patient must remain still during the procedure.

Performing an Allen test

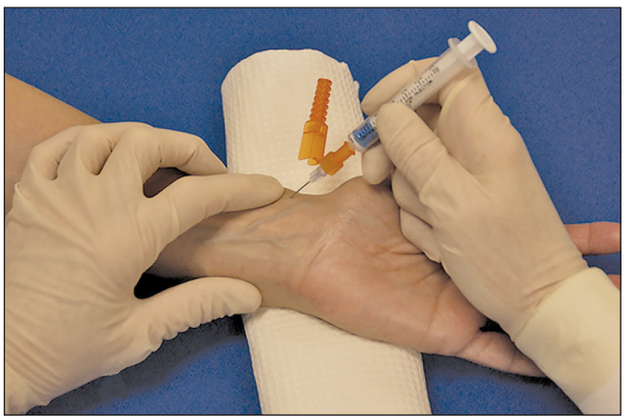
The Allen test is a collateral circulation test performed to assess whether ulnar collateral blood flow is sufficient to allow for puncture of the radial artery. To perform the Allen test, position the patient with the wrist extended about 30 degrees. Place a rolled towel under the wrist to provide support. Instruct the patient to make a fist. Occlude the radial and ulnar arteries with your index and middle fingers while the patient's fist remains clenched. Then ask the patient to slowly unclench his fist. The palm will be blanched from the lack of arterial blood flow, as shown below.



Release the pressure on the patient's ulnar artery. If the patient's hand becomes immediately flushed, indicating that the arterial circulation has resumed, you can safely proceed with radial artery puncture at that site. If the hand doesn't appear flushed, the test is negative, indicating that blood flow is inadequate; you'll need to select an alternative puncture site, such as the other radial artery or a brachial artery.[2] If you choose the other radial artery, you'll need to perform the Allen test before proceeding. If both radial sites are inadequate, consider using the femoral artery, if permitted by your facility.[2] If the patient is unable to cooperate with the Allen test, assess circulation manually with the help of an assistant.



- Raise the bed to waist level while providing care *to prevent caregiver back strain.*[18]
- Perform hand hygiene.[7,8,9,10,11,12]
- Assess the radial pulse in both wrists *to determine the best site from which to draw the specimen.*
- Assess circulation to the patient's hand by assessing the radial and ulnar pulses or by performing the Allen test, pulse oximetry, or a Doppler flow study.[19] If the test is negative, do not use the radial artery; instead, select another site.[4] (See *Performing an Allen Test.*)
- Position the patient and place a rolled towel under the patient's wrist for support, if one is not already present. Once you have identified a site, note anatomic landmarks to be able to find the site again.[2]
- If visibly soiled, clean the intended puncture site with soap and water and then dry it with a towel.
- Perform hand hygiene.[7,8,9,10,11,12]
- Put on gloves and, as needed, a gown and a mask and goggles or a mask with face shield to comply with standard precautions.[2,20,21]
- If indicated and ordered, administer a local anesthetic, such as lidocaine, following safe medication administration practices.[22,23] Consider the use of lidocaine carefully because it delays the procedure, the patient might be allergic to the drug, and the resulting vasoconstriction might prevent successful puncture.[24] To administer lidocaine, draw up 0.5 mL of 1% lidocaine into a 1-mL syringe with a 25G needle. Disinfect the site with an antiseptic pad and then allow it to dry. Inject 0.2 to 0.3 mL intradermally around the artery. Wait for the anesthetic to take effect.
- Clean the intended puncture site with an antiseptic pad or swab[2,4,5,25] according to the manufacturer's recommendations and then allow it to dry completely.[3,5,25]
- Stabilize the artery with the index and middle fingers of your nondominant hand while holding the syringe over the puncture site with the other hand. If you need to palpate the site again, put on sterile gloves.[2,3,19]
- Hold the needle bevel up at a 30- to 60-degree angle (as shown below).



- Puncture the skin and the arterial wall in one motion, following the path of the artery.
- Watch for blood backflow in the syringe. Don't pull back on the plunger, *because arterial blood should enter the syringe automatically*. Obtain 1 mL of blood.
- Withdraw the needle while stabilizing the syringe
- Press a gauze pad firmly over the puncture site for 5 minutes or until the bleeding stops. If the patient is receiving anticoagulant therapy or has a blood dyscrasia, apply pressure for 10 to 15 minutes; if necessary, ask a coworker to hold the gauze pad in place while you prepare the sample for transport to the laboratory. Don't ask the patient to hold the pad *because failure to apply sufficient pressure can lead to formation of a painful hematoma, hindering future arterial punctures at that site.*
- Check the syringe for air bubbles. If any appear, remove them by holding the syringe upright and slowly ejecting some of the blood onto a 2″ × 2″ (5-cm × 5-cm) gauze pad *to prevent alteration of the test results.*[1]
- Use the syringe safety device to cover the needle, and then remove the needle and place a rubber cap directly on the syringe tip *to prevent the sample from leaking and to keep air out of the syringe.*
- Gently roll the syringe in your hands for 30 seconds *to mix the heparin, which prohibits the sample from clotting.*
- Label the syringe in the presence of the patient *to prevent mislabeling.*[13] The label should contain the patient's full name, another patient identifier (such as the patient's date of birth or medical record number), the date and time you collected the sample, and the measured fraction of inspired oxygen (F_{IO2}) or supplemental oxygen liter flow.[1]
- Put the labeled sample in the laboratory biohazard transport bag and attach a properly completed laboratory request form, and immediately send the sample to the laboratory.[1,26] If the sample can't be sent to the laboratory immediately, put it on ice.[6]
- When the site stops bleeding, apply a small adhesive bandage to the site.
- Monitor the patient for signs of circulatory impairment, such as swelling, discoloration, pain, numbness, and tingling in the arm or leg. Also watch for bleeding at the puncture site.

- Return the bed to the lowest position *to prevent falls and maintain patient safety.*[27]
- Discard used equipment in the appropriately.[28]
- Remove and discard your gloves and other personal protective equipment, if worn.
- Perform hand hygiene.[7,8,9,10,11,12]
- Document the procedure.[29,30,31,32]

Special considerations

- Chilling the sample extends the time to test the sample for up to 1 hour; if more than an hour has elapsed since collection, discard the sample.[4,6]
- Unless ordered, don't turn off existing oxygen therapy before collecting an arterial blood sample.
- Be sure to indicate on the laboratory request slip the amount and type of oxygen therapy the patient is receiving. If the patient isn't receiving oxygen, indicate that he's breathing room air.

Complications

If you use too much force when attempting to puncture an artery, the needle may touch the periosteum of the bone, causing the patient considerable pain. You may advance the needle through the opposite wall of the artery. If this happens, slowly pull the needle back a short distance and check to see if you obtain blood return. If blood still fails to enter the syringe, withdraw the needle completely and attempt the puncture with a new needle and syringe. Don't make more than two attempts to withdraw blood from the same site. *Probing the artery may injure it and the radial nerve. Also, hemolysis will occur, altering test results.*

If arterial spasm occurs, blood won't flow into the syringe and you won't be able to collect the sample. If this happens, replace the needle with a smaller one and try the puncture again because a smaller-bore needle is less likely to cause arterial spasm.

Documentation

Record the results of the Allen test, the time the sample was drawn, the patient's temperature, the site of the arterial puncture, the amount of time that pressure was applied to the site to control bleeding, and the type and amount of oxygen therapy the patient was receiving. Also document specific preparation, the type and amount of local anesthetic administered (if used), the size of the needle used, and the number of attempts.[33]

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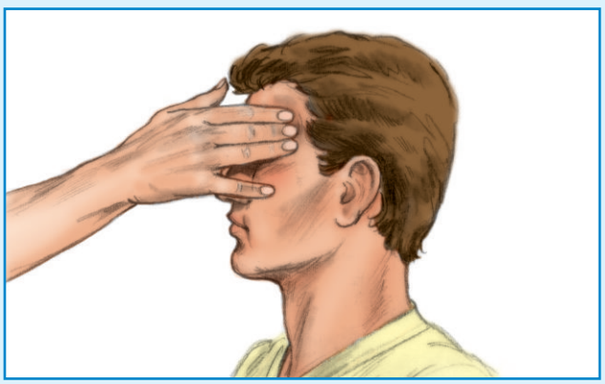
Performing palpation

You should be familiar with four palpation techniques: light palpation, deep palpation, light ballottement, and deep ballottement. Remember to use the flattened finger pads for palpating tender tissues, feeling for crepitus (crackling) at the joints, and lightly probing the abdomen. Use the thumb and index finger for assessing hair texture, grasping tissues, and feeling for lymph node enlargement. Use the back, or dorsal, surface of the hand when feeling for warmth.

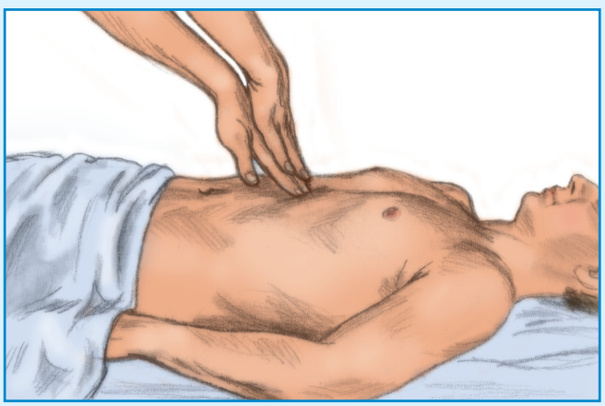
Light palpation

With the tips of two or three fingers held close together, depress the skin, indenting ½" (1.3 cm). Use the lightest touch possible, *because too much pressure blunts your sensitivity*.[15]



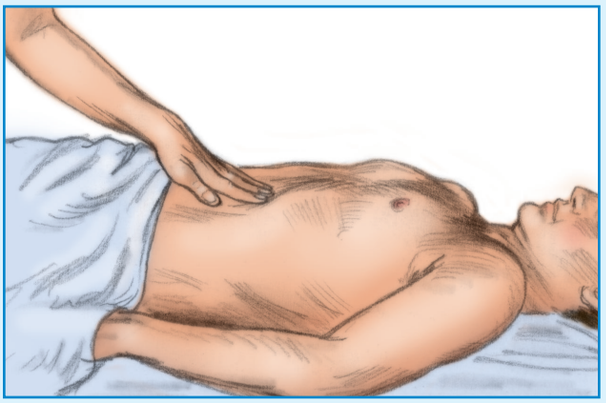
Deep palpation (bimanual palpation)

If the patient tolerates light palpation and you need to assess deeper structures, palpate deeply by increasing your fingertip pressure, indenting the skin about ¾" to 1½" (2 to 4 cm). Place your other hand on top of the palpating hand, *to control and guide your movements*.[15]



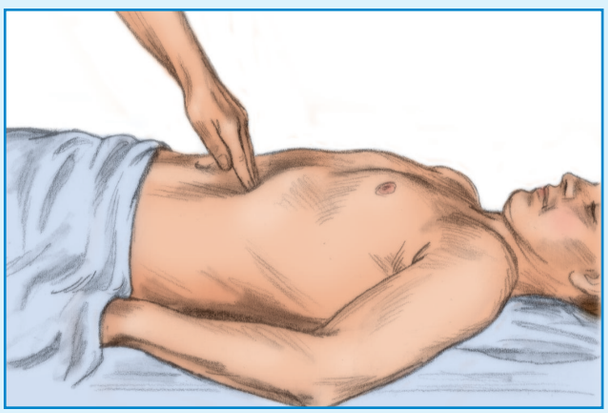
Light ballottement

Apply light, rapid pressure to the abdomen, moving from one quadrant to another. Keep your hand on the skin surface *to detect tissue rebound*.



Deep ballottement

Apply abrupt, deep pressure on the patient's abdomen. Release the pressure completely, but maintain fingertip contact with the skin.



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ASSESSMENT TECHNIQUES

A physical assessment involves four basic techniques: inspection, palpation, percussion, and auscultation. Performing these techniques correctly helps elicit valuable information about a patient's condition.

Inspection requires the use of vision to observe the details of the patient's appearance, behavior, and movement.[1] Special lighting and various pieces of equipment—such as an otoscope, a tongue blade, and an ophthalmoscope—may be used to enhance vision or examine an otherwise hidden area. Inspection begins during the first patient contact and continues throughout the assessment.

Palpation usually follows inspection, except when examining the abdomen or assessing infants and children, in which case auscultation precedes percussion and palpation. Palpation involves touching the body to determine the size, shape, and position of structures; to detect and evaluate temperature, pulsations, and other movement; and to elicit tenderness. The four palpation techniques include light palpation, deep palpation, light ballottement, and deep ballottement. Ballottement is the technique used to evaluate a flowing or movable structure. It involves gently bouncing the structure by applying pressure against it and then waiting to feel it rebound. This technique may be used, for example, to check the position of an organ or a fetus.

Percussion involves quick, sharp tapping of the fingers or hands against body surfaces to produce sounds, detect tenderness, or assess reflexes. Percussing for sound helps locate organ borders, identify organ shape and position, and determine whether an organ is solid or filled with fluid or gas. Organs and tissues produce sounds of varying loudness, pitch, and duration, depending on their density. For example, air-filled cavities such as the lungs produce markedly different sounds from those produced by the liver and other dense organs and tissues. Percussion techniques include indirect percussion, direct percussion, and blunt percussion.

Identifying percussion sounds

Percussion produces sounds that vary according to the tissue being percussed. This chart lists important percussion sounds along with their characteristics and typical sources.

SOUND	INTENSITY	PITCH	DURATION	QUALITY	SOURCE
Resonance	Moderate to loud	Low	Long	Hollow	Normal lung
Tympany	Loud	High	Moderate	Drumlike	Gastric air bubble, intestinal air
Dullness	Soft to moderate	High	Moderate	Thudlike	Liver, full bladder, pregnant uterus
Hyperresonance	Very loud	Very low	Long	Booming	Hyperinflated lung (as in emphysema)
Flatness	Soft	High	Short	Flat	Muscle

Auscultation involves listening to various sounds of the body—particularly those produced by the heart, lungs, vessels, stomach, and intestines. Most auscultated sounds result from the movement of air or fluid through these structures. Auscultation is usually performed after the other assessment techniques. When examining the abdomen, however, auscultation occurs after inspection but before percussion and palpation, which can alter bowel sounds. Auscultation is also best performed first on infants and young children, who may start to cry when palpated or percussed. Auscultation is most successful when performed in a quiet environment with a properly fitted stethoscope.

Equipment

Flashlight or gooseneck lamp ■ patient drape ■ stethoscope ■ disinfectant pad ■ Optional: gloves.

Implementation

- Gather all of the necessary equipment.
- Perform hand hygiene.[2,3,4,5,6,7]
- Confirm the patient's identity using at least two patient identifiers.[8]
- Provide privacy.[9,10,11,12]
- Explain all aspects of the procedure to the patient.
- Ask the patient to undress, and then drape the patient appropriately.
- Make sure the room is warm and adequately lit *to make the patient comfortable and aid visual inspection.*
- Warm your hands and the stethoscope.
- Put on gloves if needed *to comply with standard precautions*.[13,14]

Inspection

- Use your eyes to observe the patient. Pay close attention to the details of the patient's appearance, behavior, and movement, such as facial expressions, mood, physique, and conditioning.[1] Focus on areas related to the patient's chief complaint.
- To inspect a specific body area, first make sure the area is sufficiently exposed. Survey the entire area, noting key landmarks and checking its overall condition. Focus on specifics—color, shape, texture, size, and movement. Note unusual findings as well as predictable ones.

Palpation

- Tell the patient what to expect, such as occasional discomfort as you apply pressure. Encourage the patient to relax, *because muscle tension and guarding can interfere with performance and results of palpation.*
- Provide just enough pressure to assess the tissue beneath one or both hands. Then release pressure and gently move to the next area, systematically covering the entire surface to be assessed. (See *Performing palpation.*)
- Use both hands (bimanual palpation) to trap a deep, underlying, hard-to-palpate organ (such as the kidney or spleen) or to fix or stabilize an organ (such as the uterus) with one hand while you palpate it with the other.

Percussion

- First, decide which of the percussion techniques best suits your assessment needs. Indirect percussion helps reveal the size and density of underlying thoracic and abdominal organs and tissues. Direct percussion helps assess an adult's sinuses for tenderness and elicits sounds in a child's thorax. Blunt percussion aims to elicit tenderness over organs, such as the kidneys, gallbladder, or liver. When percussing, note the characteristic sounds produced. (See *Identifying percussion sounds.*)
- To perform indirect percussion, place one hand on the patient and tap the middle finger with the middle finger of the other hand. (See *Performing indirect percussion.*)
- To perform direct percussion, tap your hand or fingertip directly against the body surface.
- To perform blunt percussion, strike the ulnar surface of your fist against the body surface. Alternatively, place the palm of one hand against the body, make a fist with the other hand, and strike the back of the first hand.

Auscultation

- First, determine whether to use the diaphragm or bell of the stethoscope. Use the diaphragm to detect high-pitched sounds, such as breath and bowel sounds. Keep in mind that bowel sounds shouldn't be described as absent until no sound is heard for 5 minutes.[16] Use the bell to detect lower-pitched sounds, such as heart and vascular sounds.
- Place the diaphragm or bell of the stethoscope over the appropriate area of the patient's body and place the earpieces in your ears.
- Listen intently to individual sounds, and try to identify their characteristics. Determine the intensity, pitch, and duration of each sound, and check the frequency of recurring sounds.

Completing the procedure

- Remove and discard your gloves if worn and perform hand hygiene.[2,3,4,6,7]
- Clean and disinfect your stethoscope using a disinfectant pad.[17,18]
- Perform hand hygiene.[2,3,4,6,7]
- Document the procedure.[19,20,21,22]

Special considerations

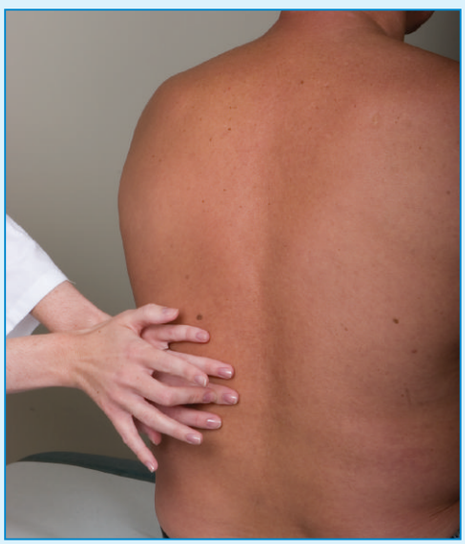
- Avoid palpating or percussing an area of the body known to be tender at the start of your examination. Instead, work around the area, and then gently palpate or percuss it at the end of the examination. *This progression minimizes the patient's discomfort and apprehension.*
- *To pinpoint an inflamed area deep within the patient's body*, perform a variation on deep palpation: Press firmly with one hand over the area you suspect is involved, and then lift your hand away quickly. If the patient reports that pain increases when you release the pressure, then you've identified rebound tenderness.

NURSING ALERT **Suspect peritonitis if you elicit rebound tenderness when examining the abdomen.**

- If you can't palpate because the patient fears pain, try distracting the patient with conversation. Then perform auscultation and gently press your stethoscope into the affected area *to try to elicit tenderness.*

Performing indirect percussion

To perform indirect percussion, place your nondominant hand firmly against the patient's body surface. With your wrist flexed loosely, use the middle finger of your dominant hand to tap the middle finger beneath the distal joint of your nondominant hand (as shown). Tap lightly and quickly, removing your dominant middle finger as soon as you deliver each tap. Move your nondominant hand and repeat the procedure, coving the entire area to be percussed.



Complications

Palpation may cause an enlarged spleen or infected appendix to rupture.

Documentation

Document your assessment findings and the technique used to elicit each finding—for example, "Right lower quadrant tenderness on deep palpation, no rebound tenderness." Indicate who you notified of any abnormal findings and the time of the notification. Document interventions required to treat those findings as well as the patient's response to them.

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AUTOLOGOUS BLOOD COLLECTION, PREOPERATIVE

Preoperative autologous blood collection is the collection, processing, and storage of the patient's own blood before a scheduled procedure that's likely to cause significant bleeding.[1]

Autologous blood transfusion has several advantages over transfusion of blood from a blood bank. First, it minimizes the risk of infectious disease transmission (with the exception of bacterial sepsis) and alloimmunization of red cell, platelet, and leukocyte antigens. It also provides a source of blood for individuals who have rare blood types or antibodies that make it difficult to find compatible blood. Last, some individuals who refuse blood from donors because of religious or other beliefs may be willing to accept a transfusion of their own blood.[1]

Despite the advantages, there may be rare adverse effects associated with autologous blood transfusion, including septic transfusion reactions that can result from white blood cell cytokine release during storage. In addition, if the recipient is misidentified before transfusion, a hemolytic reaction may occur or the patient may be exposed to a transfusion-transmitted disease.[1,2]

Sepsis or suspected bacteremia is a contraindication to autologous donation. The practitioner may also prefer not to use blood from a patient who has an infectious disease or active infection, and patients with certain

other medical conditions may not be candidates for preoperative donation. There are no specific age requirements; children younger than age 17 and older adult patients may participate. The hemoglobin level of the patient should be 11 g/dL or higher, or the hematocrit, if used, should be 33% or higher. Moreover, if the patient weighs less than 110 lb (50 kg), it may be necessary to reduce the volume of blood obtained.[1]

Equipment

Gloves ■ vital signs monitoring equipment ■ 18G or 20G catheter and equipment for venipuncture and IV catheter insertion ■ blood collection bags with phlebotomy administration set ■ AUTOLOGOUS BLOOD label ■ laboratory biohazard transport bag ■ Optional: prescribed IV fluids, mask, protective eyewear or mask with face shield, gowns or aprons, blood scale, vascular visualization technology.

Preparation of equipment

Inspect all IV equipment and supplies; if a product is expired, has compromised integrity, or is defective, remove it from patient use, label it as expired or defective, and report the expiration or defect as directed by your facility.[3]

Implementation

- Verify the practitioner's order for autologous blood collection.[1]
- Review the patient's medical record for factors that may affect peripheral vasculature, such as conditions that result in structural vessel changes (such as diabetes and hypertension), history of frequent venipuncture or lengthy infusion therapy, skin variations, skin alterations (such as scars or tattoos), patient age, obesity, fluid volume deficit, or history of IV drug abuse, to determine the need for vascular visualization technology.[4]
- Verify that the patient's hemoglobin level is 11 g/dL or higher and that hematocrit, if used, is 33% or higher.[1]
- Confirm that the practitioner has obtained written informed consent and that the consent form is in the patient's medical record.[1,5,6,7,8,9]
- Perform hand hygiene.[10,11,12,13,14,15,16]
- Confirm the patient's identity using at least two patient identifiers.[17]
- Provide privacy.[18,19,20,21]
- Explain the procedure to the patient and family (if appropriate) according to their individual communication and learning needs *to increase their understanding , allay their fears, and enhance cooperation.*[22,23] Make sure the patient understands that autologous blood may not be received exclusively if there's unexpected blood loss, if there's an emergency need for more units than collected, or if a less-than-desired number of units was collected. Also, make sure the patient understands that a risk of certain adverse effects still exists with autologous blood transfusion. Explain that all collections should be completed more than 72 hours before the anticipated surgery or transfusion.[1]
- *To prevent hypovolemia*, encourage the patient to drink plenty of fluids before collection. Explain that he may feel light-headed during the collection but that the problem can be treated.[1]
- Obtain and record vital signs before starting the collection *to provide a baseline*.[1]
- Help the patient into a reclining supine position.
- Raise the bed to waist level when providing care *to prevent caregiver back strain*.[24]
- Perform hand hygiene.[10,11,12,13,14,15,16]
- Prepare the collection bags according to the manufacturer's instructions.
- Place the blood collection bag below the venipuncture site; close the clamp on the administration set.[25]
- Prepare replacement IV fluids, if ordered.
- Perform hand hygiene.[10,11,12,13,14,15,16]
- Put on gloves, as needed, and other personal protective equipment *to comply with standard precautions.*[26,27,28,29,30]
- Select an appropriate IV catheter insertion site.[31]
- Prepare the patient's arm and IV catheter insertion site. Insert an 18G or 20G catheter.[32] (See the "IV catheter insertion and removal" procedure.)
- Connect the collecting system to the IV catheter according to the manufacturer's instructions; slowly open the clamp to allow retrograde blood flow into the administration set and blood collection bag.[25]
- Monitor the patient for adverse reactions.

NURSING ALERT Monitor the patient's vital signs closely for signs of hypotension during this process.

- Administer replacement IV fluids, if ordered.
- Monitor the volume or weight of the collected blood until the prescribed quantity is withdrawn.[25]
- When blood collection is complete, reclamp the administration set tubing, remove the IV catheter, and perform site care.
- Recheck the patient's vital signs *to evaluate the patient's response to the procedure*.[25]
- Obtain a blood sample from the patient for a coagulation profile, hemoglobin, hematocrit, and calcium level. Label the specimens in the presence of the patient *to prevent mislabeling*.[2,17] Place the sample in a laboratory biohazard transport bag[26] and sent it to the laboratory immediately.
- Clearly label the blood collection bag with the patient's name, at least two patient identifiers, and an AUTOLOGOUS BLOOD label. Make sure there's a mechanism to clearly determine the date of collection and the identity of the person who collected the blood *to prevent blood administration errors*.[1,25]
- Send the blood to the blood bank.
- Return the bed to the lowest position *to prevent falls and maintain* safety.[33]
- Discard all used supplies in appropriate receptacles.[26,27,34]
- Remove and discard your gloves and any other personal protective equipment, if worn.[26,27,34]
- Perform hand hygiene.[10,11,12,13,14,15,16]
- Document the procedure.[35,36,37,38,39]

Special considerations

- In the 4 to 6 weeks before surgery, the patient may be prescribed iron supplements *to improve preoperative hemoglobin levels*.[2]
- Monitor the patient closely during and after the collection. Although vasovagal reactions are usually mild and easy to treat, they can quickly progress to severe reactions, such as loss of consciousness and seizures.
- Have the patient remain in a reclining supine position for 10 minutes after the collection. If the patient feels light-headed or dizzy, advise the patient to sit down immediately and to lower the head between the knees. The patient may also lie down with the head lower than the body until symptoms resolve.
- Instruct the patient to drink more fluids than usual for a few hours after the collection and to eat heartily at the next meal.
- Instruct the patient to monitor the IV site for a few hours after the collection. If some bleeding occurs, the patient should apply firm pressure for 5 to 10 minutes. If the bleeding continues, instruct the patient to notify his practitioner.
- The practitioner should order discontinuance of anticoagulation drugs before elective or nonemergent surgery.[2]

Complications

Preoperative collection may cause vasovagal reactions and hypovolemia.

Documentation

Document the time the collection began and ended; the amount of blood the patient collected; your assessments before and after the procedure, including vital signs; and the patient's tolerance of the procedure. Note the condition of the IV site and the dressing applied. Record that the blood sample was sent to the laboratory and that the blood was sent to the blood bank. Document patient teaching topics covered and the patient's understanding of this teaching.[25,36]

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AUTOLOGOUS BLOOD TRANSFUSION, PERIOPERATIVE

Perioperative autologous blood transfusion is the collection and transfusion of the patient's own blood collected intraoperatively from the operative site or from an extracorporeal circuit. One benefit of this procedure is that the patient can receive autologous blood, thereby, minimizing the need for allogenic blood transfusion.[1,2] It may be used during vascular or orthopedic surgery because considerable bleeding can result from these surgeries, and during the treatment of traumatic injury.

Perioperative autologous blood transfusion is contraindicated in situations (such as trauma) that increase the risk of blood contamination with bacteria, tumor cells, or other harmful substances.[1]

Various types of devices can be used to retrieve blood from the operative site; apheresis devices are available to prepare the components intraoperatively. (See *Autologous blood recovery systems*.) Follow the manufacturer's instructions when collecting, storing, and transfusing the patient's blood using an autologous blood recovery system.[1]

Equipment

Gloves ■ data recoding form ■ vital signs monitoring equipment ■ antiseptic pad (chlorhexidine-based, povidone-iodine, or alcohol) ■ 250-mL bag of normal saline solution ■ blood administration set with microaggregate filter ■ 14G to 24G venous access catheter ■ IV pole ■ wall suction with pressure gauge, as needed ■ autologous blood recovery system device system with necessary supplies; for a Cell Saver® 5+ unit, suction tubing and collection kit (an autotransfusion drain usually has stand-alone functioning) ■ AUTOLOGOUS BLOOD label ■ Optional: mask with face shield or mask and goggles, gown, labels, IV catheter insertion equipment.

Preparation of equipment

Inspect all IV equipment and supplies; if a product is expired, has compromised integrity, or is defective, remove it from patient use, label it as expired or defective, and report the expiration or defect as directed by your facility.[3]

Implementation

- Verify the practitioner's order for the rate of reinfusion and the amount of blood to be reinfused.
- Confirm that the practitioner has obtained written informed consent for blood and blood product transfusion and that the consent form is in the patient's medical record.[4,5,6,7,8]
- Call the perfusionist to set up the autologous blood recovery system device and connect the tubing to the setup following the manufacturer's instructions. (Note that the person responsible for this step may vary by facility. The perioperative nurse or anesthesia care provider may set up the device in some facilities.)
- Perform hand hygiene.[9,10,11,12,13,14,15,16]
- Confirm the patient's identity using at least two patient identifiers.[17]
- Put on gloves and, as needed, other personal protective equipment *to comply with standard precautions*.[18,19,20,21,22,23]
- Make sure the collection chamber and the blood transfer bag are clearly marked with the patient's first and last name, identifying numbers, date and time of the collection initiation, and an AUTOLOGOUS BLOOD label. If applicable, include the time of, or condition for, expiration.[1,24]
- Obtain and record the patient's vital signs before the transfusion *to serve as a baseline for comparison.*
- Ensure that the patient has adequate venous access, either peripheral or central, with an appropriate-size catheter (14G to 24G).[25] Verify patency by aspirating for a blood return. Insert an IV catheter if necessary. (See the "IV catheter insertion" procedure.)
- Insert one spike of the standard Y-type blood administration set into the 250-mL bag of normal saline solution. Close all clamps and hang the blood administration set on an IV pole.
- The anesthesia care provider, perioperative nurse, or perfusionist will start blood collection according to the device manufacturer's instructions. (Some devices process and centrifuge the blood automatically.)
- Monitor the patient's vital signs closely for signs of hypotension during this process. *Hypotension may occur as the result of hypovolemia.*[26]
- Monitor the status of the blood collection.
- When enough blood has been collected to transfuse, spike the blood transfer bag with the open port of the blood administration set, remove all air from the blood transfer bag, and hang the bag on the IV pole.
- Open the clamp from the normal saline solution and prime the filter and tubing *to remove all air from the tubing*. Close the clamp from the normal saline solution.
- Open the clamp from the blood transfer bag to the drip chamber of the blood administration set and prime the filter and tubing with blood *to remove all air from the tubing.*
- If you're using a postprocedure transfusion device, follow the manufacturer's instructions *to properly connect the device to the patient.* (Staff members should receive training on all transfusion devices before use.)
- Perform a vigorous mechanical scrub of the needleless connector for at least 5 seconds using an antiseptic pad. Allow it to dry completely.[27,28]
- Attach the blood administration set to the venous access device and trace the tubing from the patient to its point of origin before beginning the transfusion *to make sure it's connected to the proper port*.[29] Route the tubing in a standardized direction if the patient has other tubing and catheters that have different purposes. Label the tubing at the distal (near the patient connection) and proximal (near the source container) ends to reduce misconnection if multiple IV lines will be used.[30]
- Begin the transfusion, as ordered.
- Monitor the patient throughout the procedure.[2]
- Obtain vital signs during the transfusion at an interval indicated by the patient's condition or at a frequency determined by your facility.[25]
- Make sure the reinfusion is completed in the surgery suite or postanesthesia care unit within the time period defined by the system used[1] or within your facility's recommended time frame.
- Obtain the patient's vital signs after the transfusion is complete.
- Disconnect the blood recovery system from the patient's drains or have the anesthesia care provider, perioperative nurse, or perfusionist do so.
- Recheck the laboratory data for coagulation profile, hemoglobin, hematocrit, and calcium levels after the transfusion is complete, or as the practitioner orders. Notify the practitioner of critical test results within your facility's established time frame *so that the patient can be treated promptly*.[31]

EQUIPMENT

Autologous blood recovery systems

Autologous blood recovery systems are used in surgical procedures to salvage red blood cells (RBCs) when there's rapid bleeding or high-volume blood loss. Shed blood is collected and stored in a reservoir, where waste is separated from the healthy RBCs. The waste collects into a separate bag; healthy RBCs are then returned to the patient. This process can be performed in 3 to 7 minutes. In emergencies, the autologous blood recovery system can process up to 800 mL of blood each minute.

Advantages to autologous blood recovery systems include:

- up-to-date microprocessor and sensor technologies
- automated operation and manual operation options
- platelet sequestration
- RBC bags with integrated microaggregate filters
- features to ensure consistent processing and a high-quality blood product
- fast processing
- built-in safety features.

- Discard used supplies in appropriate receptacles.[18,19,32]
- Remove and discard your personal protective equipment[18,19,32] and perform hand hygiene.[9,10,11,12,13,14,15,16]
- Document the procedure.[33,34,35,36,37]

Special considerations

- If multiple units are to be transfused, change the blood administration setup and filter after the completion of each unit or every 4 hours. If more than one unit can be infused within 4 hours, the administration set can be used for 4 hours.[25]
- Be aware that you may need to replace clotting factors, fresh frozen plasma, or platelets if you're reinfusing large volumes of blood.
- Certain religious groups refuse blood transfusions because of their beliefs. However, many of these groups permit autologous blood transfusion if it's kept in a continuous closed circuit.[26]
- The Joint Commission issued a sentinel event alert related to managing risk during transition to the new International Organization for Standardization tubing standards; the new standards were designed to prevent dangerous tubing misconnections, which can lead to serious patient injury and death. During the transition, make sure to trace all tubing and catheters from the patient to their points of origin before connecting or reconnecting any device or infusion, at any care transition (such as to a new setting or service), and as part of the handoff process. Additional protective measures include routing tubes and catheters having different purposes in different, standardized directions; labeling the tubing at the distal and proximal ends when there are different access sites or several bags hanging; using tubing and equipment only as intended; and storing medications for different delivery routes in separate locations.[30]

Complications

More complications are associated with the reinfusion of filtered, unwashed blood than with the transfusion of filtered, washed blood. These complications include fever, hypotension, myocardial infarction, infections, particulate and air embolism, and thrombocytopenia. Complications are more pronounced when the time from salvage to transfusion is greater than 6 hours. (See *Managing problems of autologous blood transfusion*, page 40.)

Documentation

Document the time the collection began, the time the transfusion started and ended, and the venous access site used for the transfusion. Include the patient's vital signs before, during, and after transfusion. Note the amount of blood collected and transfused and the system used. Also, document any posttransfusion laboratory studies obtained. Document the patient's tolerance of the procedure, any patient teaching, and the patient's understanding of your teaching.[24]

Managing problems of autologous blood transfusion

This chart describes the problems related to autologous blood transfusion, their possible causes, and interventions to manage them.

PROBLEM	POSSIBLE CAUSES	NURSING INTERVENTIONS
Citrate toxicity (rare, unpredictable)	■ Chelating effect on calcium of citrate in phosphate dextrose (CPD) ■ Predisposing factors, including hyperkalemia, hypocalcemia, acidosis, hypothermia, myocardial dysfunction, and liver or kidney problems	■ Watch for hypotension, arrhythmias, and myocardial contractility. ■ Prophylactic calcium chloride may be administered if more than 2,000 mL of CPD-anticoagulated blood is given over 20 minutes. ■ Stop infusing CPD and correct acidosis. Measure arterial blood gas values and serum calcium levels frequently to assess for toxicity.
Coagulation	■ Not enough anticoagulant ■ Blood not defibrinated in mediastinum	■ Add CPD or another regional anticoagulant at a ratio of 7 parts blood to 1 part anticoagulant. Keep blood and CPD mixed by shaking the collection bottle regularly. ■ Check for anticoagulant reversal. Strip chest tubes as needed.
Coagulopathies	■ Reduced platelet and fibrinogen levels ■ Platelets caught in filters ■ Enhanced levels of fibrin split products	■ Patients receiving autologous transfusions of more than 4,000 mL of blood may also need transfusion of fresh frozen plasma or platelet concentrate.
Emboli	■ Microaggregate debris ■ Air	■ Don't use equipment with roller pumps or pressure infusion systems. ■ Before transfusion, remove air from blood bags. ■ Transfuse with a microaggregate filter.
Hemolysis	■ Trauma to blood caused by turbulence or roller pumps	■ Don't skim the operative field and don't use equipment with roller pumps. ■ When collecting blood from chest tubes, keep the vacuum below 30 mm Hg; when aspirating from a surgical site, keep the vacuum below 60 mm Hg.
Sepsis	■ Lack of sterile technique ■ Contaminated blood	■ Give broad-spectrum antibiotics, as prescribed. ■ Use strict sterile technique. ■ Transfuse within 4 hours. ■ Don't infuse blood from infected areas or blood that contains feces, urine, or other contaminants.

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AUTOMATED EXTERNAL DEFIBRILLATION

Automated external defibrillators (AEDs) are commonly used to meet the need for early defibrillation, which is currently considered the most effective treatment for ventricular fibrillation (VF) and pulseless ventricular tachycardia. Some facilities now require every noncritical care unit to have an AED. These devices provide a means to facilitate early defibrillation in areas of a health care facility where staff members have no rhythm recognition skills and defibrillators aren't frequently used. When AEDs are used in health care facilities, first-responding staff should have training to use the AED and have a goal of delivering the first shock within 3 minutes of the patient's collapse.[1] AEDs are also commonly used in such public places as shopping malls, sports stadiums, and airplanes. Instruction in using an AED is required as part of both basic life support (BLS) and advanced cardiac life support (ACLS) training, pediatric advanced life support (PALS) training, and HeartSaver AED courses.

AEDs provide early defibrillation even when no health care provider is present. The AED interprets the victim's cardiac rhythm and gives the operator step-by-step directions on how to proceed if defibrillation is indicated. (See *Understanding an AED*, page 42.) Studies have shown that when laypersons with AED training use public defibrillation equipment to resuscitate victims of sudden cardiac arrest resulting from VF, the survival rate is 41% to 74% when cardiopulmonary resuscitation (CPR) is initiated immediately and defibrillation occurs within 5 minutes.[2]

The American Heart Association guidelines for CPR and emergency cardiovascular care recommend rapid integration of CPR with the use of an AED, as follows:[1,2,3]

- For a witnessed adult cardiac arrest when an AED is immediately available, use the defibrillator as soon as possible. For adults with unmonitored cardiac arrest or for whom an AED isn't immediately available, initiate CPR, and then use the AED as soon as it is available.[1]
- When two rescuers are available, one rescuer should begin CPR immediately while the second rescuer activates the emergency response system and obtains and prepares the defibrillator.[1,2]
- CPR and defibrillation should be coordinated to minimize the time between stopping compressions and administering the shock.[1,4]
- First-responding personnel should receive AED training with the goal of delivering the first shock for any spontaneous cardiac arrest within 3 minutes of collapse.[1,4]
- For children ages 1 to 8, the use of a pediatric dose attenuator system along with an AED is preferable. If one isn't available, a standard AED can be used.[3]
- If pediatric pads aren't available, adult pads can be used on a child. Place the pads at least 1″ (2.5 cm) apart, or use an anterior-posterior pad position.[5]
- For infants, the use of a manual defibrillator is preferred over an AED. However, if one isn't available, an AED with a pediatric dose attenuator system may be used. If neither defibrillator is available, an AED without a dose attenuator may be used as a last resort.[2,3]

Equipment

AED ■ two prepackaged, unopened AED electrodes ■ gloves ■ Optional: clippers.

Preparation of equipment

Verify that the AED is charging when not in use. Examine cables, connectors, and accessories for tears, cuts, and exposed wires, and replace as needed. Verify that the electrode pads are in sealed packages and haven't expired; obtain new ones if the integrity of the packaging is compromised or if the electrodes have expired.

Implementation

- Perform hand hygiene.[6,7,8,9,10,11]
- Put on gloves and follow standard precautions throughout the procedure.[12,13,14]
- After determining that the patient is unresponsive to questions and is apneic or only gasping, start CPR and follow BLS and ACLS protocols.[1,3]
- While you are performing CPR, ask a colleague to activate the emergency response system, bring the AED into the patient's room, and set it up as described below before the code team arrives.
- Turn on the AED and follow the visual or audible prompts.
- Open the foil packets containing the two electrode pads.
- Expose the patient's chest.
- Make sure the patient is in a dry environment and that the patient's chest is dry, *because if personnel or the patient's skin comes in contact with water, personnel may receive a shock and the patient may receive skin burns during defibrillation*. In addition, make sure that the areas where the electrodes will be applied are dry, *because moisture under the pads can decrease the effectiveness of contact with the skin.*[5]
- Remove metal objects that the patient may be wearing, *because metal conducts electricity and could cause burns during defibrillation.*[5]
- Remove transdermal patches from the patient's chest (and back, if using anterior–posterior placement), *because the medication may interfere with current conduction and produce burns.*[2,5]

EQUIPMENT

Understanding an AED

Each automated external defibrillator (AED) is equipped with a microcomputer that senses and analyzes a patient's heart rhythm at the push of a button. It then audibly or visually prompts the user to deliver a shock. AED models all have the same basic function, but each offers different operating options. For example, all AEDs communicate display directions via messages on a display screen or give voice commands, or both, but some AEDs simultaneously display a patient's heart rhythm as well.

All devices record the operator's interactions with the patient during defibrillation, either on a cassette tape or in a solid-state memory module. Some AEDs have an integral printer for immediate event documentation. The patient's practitioner may review the documented events. Local and state regulations govern who is responsible for collecting AED case data for reporting purposes.

There are two types of automated defibrillators: one with monophasic waveforms and one with biphasic waveforms. Monophasic waveform defibrillators were introduced first, and some are still in use today. The energy level on this type of device is usually preset by the manufacturer. Most AEDs use biphasic waveforms. These devices are typically set to deliver escalating energy levels for the first three shocks and then, after the third shock, deliver subsequent shocks at the same energy as the third shock. Energy levels are commonly preconfigured at 120 to 200 joules.[2] The optimal energy level for a biphasic waveform defibrillator hasn't been determined. The optimal dose for each device that has proven most effective in eliminating ventricular fibrillation should be noted on the device.

- Remove the plastic backing film from the AED electrodes.
- Place one electrode pad on the right side of the patient's bare, dry chest just below the clavicle. Place the second electrode pad on the left side of the patient's bare, dry chest to the left of the heart's apex.[2] Typically, images showing proper placement are located on the anterior surface of the electrodes (depending on the manufacturer).

NURSING ALERT Don't interrupt CPR for electrode placement; even a few seconds of interruption can decrease coronary blood flow.[4,15]

NURSING ALERT Don't place the electrode pads directly over an implantable cardioverter-defibrillator or implanted pacemaker; *this placement may damage the device*. Keep the electrodes about 3″ (7.6 cm) from the device, as recommended.[5]

- Attach one AED electrode to each electrode cable (if not already attached), and then connect the cable to the AED.
- Now the machine is ready to analyze the patient's heart rhythm. Ask everyone to stand clear, and press the ANALYZE button when the machine prompts you to do so. Be careful not to touch or move the patient while the AED is in analysis mode, *because doing so may cause a delay in the AED's ability to analyze the rhythm*.[5] (If you get a CHECK ELECTRODES message, make sure the electrodes are correctly placed and the patient cable is securely attached; then press the ANALYZE button again.)
- Wait for the AED to analyze the patient's heart rhythm. When the patient needs a shock, the AED will prompt you with a STAND CLEAR message and emit a beep that changes into a steady tone as it's charging. If no shock is needed, the AED will display a NO SHOCK INDICATED message and prompt you to CHECK PATIENT.
- When the AED is fully charged and prompts you to deliver a shock, make sure no one is touching the patient or bed, and call out "Stand clear." Then press the SHOCK button on the AED. Most AEDs are ready to deliver a shock within 15 seconds. (Note that some fully automated AEDS automatically deliver a shock within 15 seconds after analyzing the patient's rhythm.)
- After the first shock, immediately continue CPR for about five cycles, beginning with chest compressions, for about 2 minutes. Don't delay compressions to recheck rhythm or pulse. After five cycles of CPR, the AED should analyze the rhythm again and deliver another shock, if indicated.[1,2]
- If a nonshockable heart rhythm is detected, the AED should instruct you to resume CPR. Then continue the algorithm sequence until the code leader arrives.
- After the code, remove and transcribe the AED's computer memory module or tape, or prompt the AED to print a rhythm strip with code data. Analyze and store the code data as directed by your facility.
- Be sure to clean and disinfect the AED after use and replace electrodes.[16,17]
- Remove and discard your gloves.[12]
- Perform hand hygiene.[6,7,8,9,10,11]
- Document the procedure.[18,19,20,21]

Special considerations

- AEDs vary by manufacturer, so familiarize yourself with your facility's equipment.
- AED operation should be checked at an interval established by your facility, usually after each use and every 8 hours. Consider using a checklist to maintain AED in a state of readiness.[2]
- Acceptable alternative electrode placement includes bi-axillary positioning with pads placed on the right and left lateral chest walls, or placement of one pad in the standard apical position with the other pad on the right or left upper back.[2]
- Excessive chest hair can interfere with optimal AED electrode adhesion and may need to be removed. Use clippers to remove the hair, or rapidly remove the AED electrode and apply a new one.[2]
- Avoid placing the AED electrode pad on the sternum, *because bone blocks some of the energy and decreases effectiveness*.[5]
- After using an AED, give a synopsis to the code team leader that includes the patient's name, age, medical history, and chief complaint; time you found the patient in cardiac arrest, time you started CPR, and time you applied the AED; number of shocks the patient received; any time the patient regained a pulse; any post-arrest care provided; and physical assessment findings.

Complications

Defibrillation can cause accidental electric shock to those providing care and skin burns to the patient. Radio-frequency (RF) interference may result in improper device operation, a distorted electrocardiogram (ECG), or failure to detect a shockable rhythm. Avoid operation of the device near cauterizers, diathermy equipment, cellular phones, or other portable and mobile RF communication equipment.

Documentation

Document the procedure, including the patient's ECG rhythm before and after defibrillation; the number of times defibrillation was performed; the energy used with each attempt; whether a pulse returned; the dosage, route, and time of drug administration; whether CPR was performed; how the patient's airway was maintained; and the patient's outcome.

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B

BACK CARE

Regular bathing and massage of a patient's neck, back, buttocks, and upper arms allows assessment of the patient's skin condition. Massage increases the blood supply to skin and muscles, promotes comfort and relaxation, and improves sleep.[1] However, massage is no longer recommended for bedridden patients at high risk for pressure injury,[2] and back massage is contraindicated in patients with rib or vertebral fractures, open wounds, stage I pressure injuries, or burns.[1,2]

Equipment

Skin cleaner ■ bath blanket ■ bath towel ■ washcloth ■ warm water ■ skin moisturizer[3] ■ Optional: bath basin, gloves (if the patient has open lesions or has been incontinent), bed linens, hypoallergenic moisturizer, no-rinse pH-neutral skin cleanser

Preparation of equipment

Fill a bath basin with warm water. Alternatively, soak a washcloth with warm water directly from the patient's sink.

Implementation

- Gather and prepare the necessary equipment at the patient's bedside.
- Perform hand hygiene.[4,5,6,7,8,9]
- Put on gloves *to comply with standard precautions*.[10,11]
- Confirm the patient's identity using at least two patient identifiers.[12]
- Provide privacy.[13,14,15,16]
- Explain the procedure to the patient.[17] Instruct the patient to tell you if you're applying too much or too little pressure.
- Raise the patient's bed to waist level while providing care *to help prevent caregiver back strain*.[18]
- Place the patient in the prone position, if possible, or on his or her side, and lower the head of the patient's bed, if the patient's condition allows. Position the patient along the edge of the bed nearest to you *to help prevent caregiver back strain*.
- Untie the patient's gown, and expose the back, shoulders, and buttocks. Then drape the patient with a bath blanket *to prevent chills and minimize exposure*. Place a bath towel next to or under the patient's side *to protect bed linens from moisture*.
- Fold the washcloth around your hand to form a mitt *to prevent the loose ends of the cloth from dripping water onto the patient and to keep the cloth warm longer*. (See *Making a washcloth mitt*, page 44.)
- Dip the washcloth mitt into the basin of warm water and apply a skin cleanser to the washcloth. Alternatively, wet the washcloth at the patient's sink.
- Using long, firm strokes, bathe the patient's back, beginning at the neck and shoulders and moving downward to the buttocks.
- After washing the patient's back, rinse and dry the skin well. Pay special attention to the patient's buttocks *because moisture trapped between the buttocks may cause chafing, which increases the risk of pressure injury. Residual cleanser on the patient's skin may also cause itching and dryness*.
- Examine the patient's skin closely, especially the bony prominences of the shoulders, the scapulae, and the coccyx, for redness or abrasions.
- Pour a small amount of moisturizer into your palm. Rub your hands together *to warm and distribute the moisturizer*. Then apply the moisturizer to the patient's back, using long, firm strokes. *The moisturizer moisturizes the patient's skin and reduces friction, making back massage easier*. Use moisturizer from a separate container for each patient *to prevent cross-contamination*.
- If permitted by the patient's condition, massage the back, beginning at the base of the spine and moving upward to the shoulders. For a relaxing effect, massage slowly; for a stimulating effect, massage quickly. Avoid vigorous massage over bony prominences *to reduce the risk of pressure injuries.*[3] Alternate the three basic strokes: effleurage, friction, and petrissage. (See *How to perform a back massage*, page 44.) Add moisturizer as