

UNIT 1

CORE PROCEDURES



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CHAPTER 1

Aseptic Technique

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GOALS

- ▶ Identify the steps necessary to achieve and preserve a sterile field for invasive procedures taking place outside of an operating room or interventional suite.
- ▶ Highlight the knowledge and performance steps needed to achieve asepsis.
- ▶ Gain the knowledge necessary for aseptic technique and understand information on the performance elements necessary for achieving asepsis when performing invasive procedures.
- ▶ Achieve and maintain a sterile field.
- ▶ Properly break down a field.
- ▶ Remove **personal protective equipment** following completion of a procedure.

OBJECTIVES

1. Recognize the importance of asepsis during invasive procedures and its role in patient safety.
2. Appreciate the value and importance of proper hand hygiene before and after the performance of an invasive procedure.
3. Examine the importance of creating and maintaining a sterile field.
4. Determine the utility, relevance, and applicability of full sterile protective clothing.
5. Contrast “clean technique” with “aseptic technique.”
6. Employ sterile technique while putting on appropriate personal protective equipment (e.g., face mask, cap, gown, gloves).
7. Perform the correct method for preparing and draping a sterile field for commonly performed bedside procedures.
8. Manage a break in aseptic technique.
9. Demonstrate the removal of personal protective equipment.
10. Illustrate how to safely dispose of sharps post-procedure.

RATIONALE

- **Asepsis** is the state of being free from living pathogenic microorganisms (e.g., bacteria, viruses, fungi, and parasites) that have the possibility of causing disease or illness.
- There are two categories of asepsis: (1) general asepsis, which applies to patient care procedures outside an operating room, and (2) surgical asepsis, which is related to those procedures that take place within an operating room and is designed to prevent surgical site infections. The scope of this chapter focuses on the establishment of general asepsis.¹
- Establishing and maintaining asepsis is a vital first step for all invasive procedures. Failure to protect patients undergoing invasive procedures through the creation of a germ-free, safe area in which to complete a procedure may lead to life-threatening illnesses or death. Fortunately, general asepsis and environmentally safe areas can be easily attained and maintained by learning the steps outlined in this chapter.

EVIDENCE-BASED INDICATIONS

- Infections acquired during a hospital stay, regardless of the mechanism of cause, are known as **healthcare-associated** infections (HAIs). Strict adherence to proper hand hygiene among healthcare providers and proper assignment of clean, sterile, and aseptic techniques appropriate for procedures performed on patients are important in the prevention of HAIs. These infections significantly affect patient safety, costs associated with hospital care, and morbidity and mortality of patients.
- It has been estimated that upwards of 1.7 million HAIs are acquired annually by patients hospitalized in the United States, and HAI is among the leading causes of preventable deaths in the United States.¹ According to the U.S. Department of Health and Human Services (HHS), HAIs alone are

responsible for \$28–33 billion in preventable healthcare expenditures each year.²

Numerous types of aseptic techniques are utilized in bedside and surgical suite settings. **TABLE 1-1** provides information for the most commonly used aseptic techniques. In general the approach taken is dictated by the planned procedure.

- Aseptic technique is a stepwise approach to the construction and continuation of a sterile field (an area free of disease-causing microorganisms) in which the performance of any procedure that will create or expose a break in the skin's integrity can be safely performed. Included in this chapter are information and supplemental tools that will assist in the instruction and understanding of aseptic technique for bedside procedures.
- These tools include:
 - A mnemonic that can facilitate recall in planning for the preparation of oneself and the sterile field
 - A checklist that can also be used for recall and planning or for evaluating performance
 - Numerous charts

CONTRAINDICATIONS

None

COMPLICATIONS

- Unavailable supplies may lead to infection. For example, if **chlorhexidine** is not available and alcohol is used as a substitute during a central line placement, the patient may contract an infection.
- Break in sterile technique (see **TABLE 1-2**).

PLANNING FOR THE PROCEDURE

- Proper planning is an important first step in establishing any procedural environment; the acronym **SCRIPT**⁴ can aid in remembering initial considerations for a variety of procedural conditions (see **BOX 1-1**).

TABLE 1-1: Types of Techniques

	Clean Technique	Modified Aseptic Technique	Aseptic Technique	Surgical Asepsis
Goal	Reduction of transient* microorganisms	Reduction of transient microorganisms	Elimination of transient microorganisms	Elimination of transient and resident† microorganisms
Setting	Any healthcare area	Bedside or procedure area	Bedside or procedure area	Operating room
Examples of Procedures	Taking blood pressure or temperature, feeding a patient, general examination	Peripheral intravenous line placement, routine phlebotomy, intubation	Central venous catheter placement, paracentesis, lumbar puncture	Surgical procedure
Hand Hygiene	Routine‡	Routine‡	Routine‡	Surgical scrub
Personal Protective Equipment	None usually	Mask and face shield or goggles if splashing is a possibility	Hat, mask with/without face shield, sterile gown	Hat, mask with/without face shield, sterile gown
Glove Type	None or clean	Clean	Sterile	Sterile
Field	None	Clean area	Sterile field	Sterile field
Patient/Site Prep	None	None or alcohol	Chlorhexidine or Povidone-iodine	Chlorhexidine or Povidone-iodine

*Transient microorganisms are those that are found in the environment and are picked up on the hands of healthcare workers (HCWs) during the course of routine daily work. These types of organisms do not generally take up permanent residence as normal flora.

†Resident microorganisms are those that are found as normal flora on the hands of HCWs.

‡In healthcare settings, hand hygiene should be performed with an antimicrobial soap.

TABLE 1-2: Types of Breaks in Peri-procedural Sterile Technique

Breaks in sterile technique can be divided into the following four types:³

- Type 1—Immediate recognition
- Type 2—Recognition shortly after it occurs
- Type 3—Delayed recognition
- Type 4—Unrecognized (noted after completion of the procedure)

BOX 1-1: SCRIPT

Space and workflow?
 Clean, aseptic, or sterile technique?
 Routine, aseptic, or surgical hand hygiene?
 Instruments and supplies?
 Personal protective equipment?
 Trash: sharps, infectious waste, radioactive waste,
 pathology waste, or routine waste?

- A checklist is another tool that can aid in remembering crucial steps in a complex procedure. Research supports the use of checklists when completing multiple-step tasks such as the establishment of a procedural environment. According to Hales and Pronovost, the checklist is an important tool in error management and contributes significantly to reducing the risk of costly mistakes and the improvement of overall outcomes.³ A checklist, such as the one developed by the procedure program at the University of Miami-Jackson Memorial Hospital Center for Patient Safety,⁵ may also serve as a valuable tool for learning the proper steps in preparing for invasive bedside procedures, and for ensuring that no steps are missed.

PROCEDURAL INSTRUCTIONS

- This section addresses each of the steps as listed in the gowning, gloving, and aseptic technique checklist presented in the supplemental materials for this chapter; steps are listed in chronological order.
- ### Step 1: Obtain the Proper Personal Protective Equipment (PPE) for the Planned Procedure
- Full PPE is necessary for many of the invasive procedures that are performed outside a surgical suite and includes hat, mask (with or without a face shield), goggles (if no face shield), a sterile gown, gloves (sterile or clean), and draping materials.
 - All materials should be obtained and present at the bedside prior to beginning the procedure. Leaving the environment to obtain missing items may lead to a break in asepsis.
 - Proper training and education in the correct use of PPE are required per **Occupational Safety and Health Administration (OSHA)** standards.⁵ Such training should include the following:
 - When PPE is necessary
 - What PPE is necessary
 - How to properly put on, take off, adjust, and wear the PPE
 - The limitations of PPE
 - Proper care, maintenance, useful life, and disposal of PPE
 - Employers should make sure that each employee demonstrates an understanding of the PPE training and the ability to properly wear and use PPE before he or she is allowed to perform work requiring the use of PPE.
 - The primary roles of PPE are to protect staff, reduce opportunities for transmission of microorganisms in hospitals, and reduce infection in patients.⁶ Prior to beginning any procedure, a hazard assessment is recommended to establish exposure risk for the healthcare provider, as well as the infection transmission risk for the patient, in order to determine the proper PPE needed for the procedure planned. Such a hazard assessment should include a survey of the following:
 - Does the patient's infectious disease status pose a risk to the healthcare provider or other patients?
 - Is the patient immunocompetent or immunocompromised?
 - Is body fluid exposure possible or likely?
 - Is there a risk of a needlestick injury, or will sharp instruments be used?
 - There are common and customary PPE for most invasive bedside procedures. **TABLE 1-3** presents required PPE for a variety of procedures that occur at a patient's bedside.

TABLE 1-3: PPE Requirements for Common Procedures

Procedure	Hat	Mask	Face Shield	Sterile Gown	Glove	Draping
Peripheral intravenous line placement, routine phlebotomy	No	No	No	No	Clean	Clean Chux
Arterial line placement	Yes	Yes	Yes	Yes	Sterile	Local area
Central venous catheter insertion	Yes	Yes	Yes	Yes	Sterile	Full maximum barrier
Paracentesis	Yes	Yes	Yes	Yes	Sterile (optional)	Local area
Thoracentesis, pericardiocentesis	Yes	Yes	Yes	Yes	Sterile	Local area
Bone marrow aspiration	No	No	No	No	Sterile	Local area
Joint aspiration	No	No	No	No	Sterile	Local area
Lumbar puncture, ventriculostomy, and intracranial pressure monitor insertion	Yes	Yes	Yes	Yes	Sterile	Local area
Indwelling urinary catheter insertion	No	Recommended	Recommended	No	Sterile	Local area

Step 2: Obtain Proper Antiseptic for the Procedure

- Skin antiseptics is the process of applying a cleaning agent to the patient's skin in order to eliminate transient microorganisms and reduce resident skin flora that may present an infection risk if transferred to the bloodstream. Selecting the appropriate agent will depend on the procedure, patient sensitivities or allergies, and its institutional availability.
- Chlorhexidineⁱⁱ has gained popularity as a **skin antiseptic** since the 1970s. It has several advantages over the more traditional povidone-iodine solutions. Chlorhexidine is applied in repeated back-and-forth strokes, going over the same area multiple times, akin to applying several coats of paint. In contrast, povidone-iodine is applied in outwardly

concentric circles, never going over the same area more than once. Chlorhexidine does not pose a risk of skin irritation or allergic reaction like povidone-iodine solutions and, therefore, does not need to be removed following completion of the procedure. Lastly, chlorhexidine appears to have superior skin antiseptics efficacy. A meta-analysis compared the use of chlorhexidine gluconate with povidone-iodine solution in preventing catheter-related bloodstream infections and found the incidence of bloodstream infections was significantly reduced in patients who underwent site preparation with chlorhexidine gluconate versus povidone-iodine.⁷ However, chlorhexidine is not appropriate for every procedure, so care must be taken to select the correct agent for the procedure being performed. **TABLE 1-4** presents skin-prep agents used for common procedures.

Step 3: Obtain Proper Kit or Supplies for the Procedure Planned

- Select an appropriate kit or supplies for the procedure planned, paying close attention to size requirements based on the age and size of your patient, as applicable.

Step 4: Prepare a Proper Working Surface

- Having a clean table on which to place needed equipment and the procedural kit facilitates completion of the procedure in a way that is safe for the patient and the healthcare provider. The common practice of using the sterile field may not be the best area to place all the items you will need. Patient movements can sometimes cause items to fall and subsequently become contaminated. A bedside table or instrument stand is commonly used and is a readily available alternative to using the patient or his/her bed as a holding area for equipment. If a bedside table or instrument stand is used, it should be clean, dry, and prepared appropriately for the sterile or clean procedure.

Step 5: Put on Hat

- Surgical hats or caps should be used for those procedures for which full PPE is required (see Table 1-3). Use of a hat or cap prevents the healthcare provider's hair from falling onto the sterile field and contaminating it. Surgical or bouffant type, disposable, or reusable hats are all acceptable choices.

TABLE 1-4: Skin Prep Agents for Common Procedures

Procedure	Skin Prep Agent
Peripheral intravenous line	Alcohol acceptable, but chlorhexidine may have superior infection protection
Indwelling urinary catheter	Povidone-iodine
Routine phlebotomy	Alcohol acceptable, but chlorhexidine may have superior infection protection
Central venous catheter	Chlorhexidine-gluconate
Lumbar puncture	Povidone-iodine
Thoracentesis, paracentesis, and most other invasive procedures	Povidone-iodine acceptable, but chlorhexidine has been shown to have superior infection protection

FIGURE 1-1: Place hat**FIGURE 1-2: Place mask**

- Donning of a hat or scrub cap is simple (see [FIGURE 1-1](#)). Place the hat or cap over the head, ensuring that all hair is tucked into the hat; providers with long hair may need to secure their hair prior to donning the hat. If there are ties, they should be comfortably secured at the back.

Step 6: Put on Mask

- Masks should be worn for all procedures for which full PPE is indicated (see Table 1-3). If splashing or spraying of bodily fluids is likely, a face shield or goggles should be worn. Masks prevent microorganisms from transferring to the patient from the healthcare provider's mouth or nasopharynx during talking, coughing, or sneezing. Further, masks and face shields offer protection for the provider in the event of a bodily fluid splash or spray.
- Masks should be secured comfortably by tying both sets of ties, one at the top of the head and one along the nape of the neck or looping earpieces over the ears (see [FIGURES 1-2](#) and [1-3](#)). The nosepiece of the mask should be gently pinched at the bridge of the nose to create a tapered area where the mask covers the nose. The bottom aspect of the mask should be pulled down below the chin and any facial hair. If goggles are being used, they should fit snugly over

FIGURE 1-3: Tie mask**FIGURE 1-4: Place eye protection**

and around the eyes (see [FIGURE 1-4](#)). Personal eyeglasses are not a sufficient substitute for goggles. If eyeglasses are worn, goggles can be fitted over them.

Step 7: Prepare and Position the Patient for Comfort and for the Procedure Being Performed

- Draping requirements and positioning for various procedures can sometimes be uncomfortable for the patient. Verbally prepare the patient for what to expect and ensure that he or she is as comfortable as possible, while still in the best position for the procedure (see [FIGURE 1-5](#)).
- For procedures that require the face and head to be draped, one should discuss any potential issues with this preparation (e.g., claustrophobia). Drapes can often be tented to create room between the patient's face and the drape, which can lessen the feeling of enclosure. But, sterility of the site must be maintained.

FIGURE 1-5: Prepare and position patient



Step 8: Wash Hands

- Handwashing is a critical step in the prevention of HAIs. Prior to beginning any invasive procedure, providers should thoroughly wash their hands with a broad-spectrum antimicrobial agent with the goal being hand antisepsis (see [FIGURE 1-6](#)).^{8,9}
- Ideally, handwashing prior to performing an invasive procedure should include removal

FIGURE 1-6: Wash hands



of rings, watches, and bracelets and begin with removal of debris from underneath the fingernails using a nail cleaner. Next, vigorously rub all surfaces of the hands and fingers up to 2–3 inches above the wrists, taking care to angle the hands upward so that dirty water runs down the arms toward the elbows and away from clean surfaces. Scrub time should be at least 15–20 seconds. Hands should be rinsed completely to remove residual soap and then dried with clean single-use paper towels. Faucets should be shut off using a clean paper towel to avoid recontamination of hands. If a sink is not available, an alcohol-based hand rub may be used. A scrub with this type of agent should be done for at least 15–20 seconds.

- Gowning and gloving should take place within 1–2 minutes of completing hand hygiene. Touching of potentially contaminated surfaces should not be done between hand hygiene and donning of PPE. [TABLE 1-5](#) contains information on required hand hygiene for conditions encountered by healthcare providers caring for patients.

Step 9: Dry Hands

- Following handwashing, hands should be thoroughly dried using a clean single-use paper towel, taking care to dry between fingers (see [FIGURE 1-7](#)). A patting, rather than

TABLE 1-5: Types of Hand Care

	Purpose	Method
Hand Wash	To remove soil, visible dirt, and transient microorganisms	Soap or detergent for at least 10–15 seconds
Hand Antisepsis	To remove and/or destroy transient microorganisms	Antimicrobial soap or detergent, or alcohol-based hand rub for at least 10–15 seconds
Surgical Hand Scrub	To remove and/or destroy transient microorganisms and reduce resident flora	Antimicrobial soap or detergent preparation with brush to achieve friction for at least 120 seconds, or alcohol-based preparation designed for surgical hand antisepsis*

Source: Larsen EL. APIC guideline for handwashing and hand antisepsis in health care settings. *Am J Infect Control*. 1995 Aug;23(4):251–69.

*Purcell® surgical scrub requires a two-step application with dry time between each application.

a rubbing, motion should be employed when drying hands to avoid friction on the skin, which can cause breakdown. The paper towel included with most sterile gowns should be used for this purpose if this gown is required PPE.

- If an alcohol-based hand rub is used, care should be taken to allow for the agent to completely dry prior to donning PPE.

Step 10: Don Gown

- Gowning is best done with the help of an assistant. The assistant may open the package and remove the gown in an upward motion, freeing it from its packaging. Next, the gown should be held at the neck band on the inside of the gown. Then, the assistant should step back from the procedure table or area to an unobstructed space and allow the gown to partially unfold (without coming into contact with any unsterile surfaces); if the gown does not completely unfold, a second assistant can pull the bottom of the gown by grasping the inside bottom of

FIGURE 1-7: Dry hands

the gown and guiding it down. The inside of the gown should remain in front of the person donning it. Arms should enter first, extended straight out in front, and remain

at shoulder height while entering the gown. If the open glove technique is employed, the hands should exit the sleeve cuffs to the point of the wrist. If, however, the closed glove method is being employed, the hands should remain mostly within the cuffs of the sleeves, exiting only to the point of the thumbs (see [FIGURE 1-8](#)).

FIGURE 1-8: Don gown



- If an assistant is not being used, remove the gown from the package, grasping the gown on the inside at the armholes, step back to a clear area, free of any obstructions. Next, gently shake the gown to unfold it. Once it is unfolded, enter the gown one arm at a time taking care to keep the arms extended straight out, or up toward the ceiling, being careful not to touch anything (see [FIGURE 1-9](#)).

FIGURE 1-9: Don gown



Step 11: Fasten the Gown with the Help of an Assistant

- Once the gown is donned, an assistant pulls the gown up and over the shoulders of the gowned person and fastens the neckband. Next, the inner waist ties are carefully secured, such that the inner aspect of the gown is the only surface handled. Following donning of sterile gloves (see next section), the person wearing the gown grasps the tie card (in the area indicated on the card) at the front of the gown that holds the outer ties, separates the left tie from the card, and holds it in his or her left hand. The card is then handed to the assistant, who grabs the card in the indicated area. Next, the scrubbed person turns to the right, completing the turn when his or her front is facing the assistant. The assistant extends the right tie to its full length, and the gowned person grasps it and ties the left and right ties together at the waist on the left.

Step 12: Don Gloves

- Choose either sterile or clean gloves depending on the procedure being performed. Choosing the appropriate glove size is important. Clean gloves come in extra small, small, medium, and large, while sterile gloves come in numbered sizes from 5.5 to 9, with 5.5 being the smallest. Both clean and sterile gloves come in latex and non-latex varieties. Choose one based on the sensitivities or allergies of the patient and healthcare provider.
- For sterile gloves:
 - Open the outer package of gloves, laying the inner package on a flat surface, and carefully open the right and left sides of the package to expose the gloves. There is a 1-inch “safety margin” at the folded edge of the packaging that can be used to pull open the package. While opening the inner package, take care to touch only the outside edge of the paper and ensure that it stays open by gently bending the flaps out and down as they are opened. The

gloves should be positioned with the cuff openings facing the gowned person.

- To start, choose either the right or left hand (depending on which is the dominant hand) and apply the glove in front of the hand that will be gloved first. If the closed glove method is being used, grasp the cuff of the glove with the non-dominant hand still in the gown sleeve and push the opposite (dominant) hand into the glove, lining up the thumb of the glove with the thumb of the dominant hand. As the hand enters the glove, allow it to come out of the sleeve. If all five fingers are not placed correctly in the glove, wait until both gloves are on to adjust them. Repeat the process for the second glove, and adjust gloves as necessary (see [FIGURE 1-10](#)).

FIGURE 1-10: Place gloves



- Gloves that are appropriately donned cover the cuffs of the gown sleeves (see [FIGURE 1-11](#)). There are three methods for donning sterile gloves: open, closed, and assisted. If the assisted technique is being used, an already sterilely gloved assistant spreads the glove opening apart while the scrubbed person slides his or her hand into it. This method is the safest (has the least chance of contamination) of the three methods and is the preferred way to change gloves in the event of glove contamination during a procedure.¹⁰

FIGURE 1-11: Place gloves



- For clean gloves:
 - Remove a correctly sized pair of gloves from the box and fit them over the fingers and hands, pulling the cuff of the glove over the wrist. Make any finger adjustment as needed.
 - Torn, ripped, or punctured gloves need to be promptly changed.

Step 13: Prepare the Procedure Site

- Skin cleansing for procedures should be done by preparation of a large area (greater than actually required for the procedure) (see [FIGURE 1-12](#)). The leeway provided by preparation of a large area allows for adjustments in the procedure site, as well as

FIGURE 1-12: Prep skin



TABLE 1-6: Commonly Used Skin Prep Agents

Agent	Motion	Post-procedure Cleaning	Drying Time
Chlorhexidine gluconate (common brands: Chloraprep, Exidine, Bioscrub, Hibiclens)	Back and forth, going over the area many times	Not required	1–3 minutes, depending on anatomic site
Povidone-iodine solution (common brand: Betadine)	Outward concentric circles,* never going over the same area twice	Required	At least 2 minutes; ensure it is dry
Alcohol (common brand: Alco-prep)	Back and forth, going over the area many times	Not required	1–2 minutes; ensure it is dry

*For indwelling catheter insertion in a female patient, the application of povidone-iodine solution is completed using a top-to-bottom motion, cleaning each section of the insertion area.

the drape if needed, while remaining within an area of sterility. Antimicrobial agent application should be based on the type chosen (see TABLE 1-6). Following application of the skin-prep agent, allow time for the agent to fully dry. Do not fan the area, because this may cause contamination of the site.

- Subsequent to the completion of the procedure, any remaining povidone-iodine agent needs to be removed. The easiest way to complete this is to moisten a piece

of gauze with sterile saline and gently clean the area. Additionally, if there is blood at the procedure site, regardless of agent used, this too could be cleaned in the same manner.

Step 14: Drape Area

- Many procedures necessitate draping. The types of draping needed for the most commonly performed procedures are delineated in TABLE 1-7. Some procedures require full

TABLE 1-7: Draping Requirements for Common Bedside Procedures

Procedure	Drape Type	Below Site Drape
Peripheral IV, routine phlebotomy	None	Clean Chux recommended
Indwelling urinary catheter	Fenestrated optional	Sterile drape (shiny side down) below procedure site required
Central venous catheter	Fenestrated, full-body drape	Clean Chux applied below site prior to donning sterile PPE and prepping the patient
Thoracentesis, paracentesis, lumbar puncture, arterial line, and bone marrow aspiration	Fenestrated, partial drape	Sterile drape (shiny side down) below procedure site required

maximum barrier draping; for these, a large **fenestrated** (a hole in the drape through which the procedure is performed) drape is used. An adhesive area may surround the fenestration and is revealed by removal of the protective paper covering the adhesive. The fenestration is then applied over the intended site of the procedure (the intended procedure site should be in the middle of the opening) and pressed firmly down to facilitate adherence of the drape to the patient's skin. The adhesive area helps to prevent movement of the drape during the procedure and secures the sterile area in which the procedure is to be performed. The drape is then held down with one hand over the sterile site and carefully unfolded over the patient's head and body.

- Other procedures require the use of only a local barrier. These procedures may use a smaller fenestrated drape. The same principles for application are practiced. The protective paper is removed from the fenestrated area, if applicable, and applied over the intended site of the procedure (see [FIGURE 1-13](#)). Finally, the drape is secured with one hand and unfolded, as indicated earlier.
- Some procedures do not require such draping, but all require the preparation of an area in which the procedure is to be performed.
- Additional drapes may be used to build a larger sterile or clean area. This ensures a continuous field and can serve as an

absorptive area for fluids. It is good practice to include placing draping materials that have absorptive qualities below the site of the procedure to catch any body fluids that may drip. Depending on the procedure, these may be clean or sterile.

Step 15: Prepare a Sterile Field

- For many procedures, preparation of a sterile field can be accomplished by draping an area near the patient, although the bed should be avoided for housing the equipment necessary for procedural performance. For most procedures, it is necessary to obtain a bedside table or instrument stand. A sterile drape can be used to prepare the field on which the equipment will be placed. Unless absolutely necessary, drapes overlaid on the patient for use as a working surface should be avoided. For procedures that do not require sterile draping of any kind (routine phlebotomy and peripheral IVs), a clean, dry table with or without a clean drape may be used to hold equipment.

Step 16: Open and Prepare the Kit

- For sterile procedures:
 - Commercial vendors supply kits for most procedures. Becoming familiar with the types of kits used at one's institution facilitates correct sequestration and usage. Kits can be opened with or without the help of an assistant. If an assistant is not available, the outer, non-sterile covering of the kit should be opened prior to performing hand hygiene and donning sterile gloves. Once the provider has donned sterile gloves, any sterile part of the kit may be safely handled. Some kits do not contain all necessary items. Any omitted items obtained elsewhere should be removed from the non-sterile packaging and dropped onto the sterile field or into the kit with the help of an assistant.

FIGURE 1-13: Drape the area



- For clean/semi-sterile procedures (routine phlebotomy and peripheral intravenous catheters):
 - The kits and other equipment can be handled with clean hands or gloves except for the area cleaned on the patient's skin and the needle/catheter end, which will penetrate the skin.

Step 17: If Using Ultrasound, Prepare the Probe

- For procedures requiring the use of ultrasound (e.g., central venous catheter insertion), the probe must be draped with a sterile sleeve prior to use during the procedure. In order to accomplish this, the help of an assistant may be necessary. The assistant will apply non-sterile gel to the transducer head. The assistant will then hold the probe up so that the healthcare provider can grab the probe using the sterile sleeve. The healthcare provider will insert his or her hand into the probe cover, grab the end of the probe from the assistant, and hold firmly onto the probe while the assistant pulls the sleeve completely down, being careful to touch only the edge of the sleeve's end (see [FIGURE 1-14](#)).
- Rubber bands found in the sleeve package are then applied at the distal end of the probe, around its head (note: avoid rubber bands around the insulated wire connecting the probe to the ultrasound unit) so that the sleeve fits tightly over the end, without

any air between the transducer head and the sleeve. Sterile gel is then applied to the outer surface of the sleeve, to the part that will come in contact with the skin. Once sheathed, the probe may safely and sterilely rest on the sterile field until it is needed.

Step 18: Maintain the Environment

- Once the provider is fully prepared and the sterile field is set, maintenance of the environment is critical:
 - Non-sterile items may not come in contact with any part of the sterile field, the prepped procedure site, or the gloves or gown of the healthcare provider.
 - Nothing below the table, or the provider's waist, is considered sterile. Generally, the front of the gown, from the chest to the level of the sterile field, is considered the sterile window. Sleeves are considered sterile from 2 inches above the elbow to the sleeve cuff. Sleeve cuffs are considered contaminated once the provider's hands pass through them; therefore, if a glove needs to be changed, it should be done with the help of an assistant or by the open glove method. This underscores the importance of ensuring the cuffs are completely inside the sterile gloves.
 - When moving around a sterile area, the front of the healthcare provider is the only area considered sterile and therefore must always face the sterile field. When moving around other persons who are also wearing sterile gowns, passage occurs either front-to-front or back-to-back, never turning one's back directly to the sterile field.
 - Hands must always remain above the waist. While waiting to perform a procedure, and wearing PPE, hands should be clasped together and held above the waist close to the body, never down at one's sides or under the armpits.
 - All persons within the sterile field should don caps, masks, sterile gowns, and

FIGURE 1-14: Prepare the probe



sterile gloves, if applicable to the procedure. Persons within the room, but not in the sterile area, should don hats and masks at a minimum.

- Sterile fields should be prepared as close to the time of the procedure as possible. Time delay between preparation and procedural performance increases the possibility of contamination.
- The sterile working area should be prepared in close proximity to the site of ultimate procedural performance so as to ensure a contiguous sterile field. This is comprised of three aspects: the operator in a sterile gown, the sterile working area, and the sterile site of the planned procedure.
- Conversations by other personnel in the room, who may not be wearing a mask, should be kept to a minimum to reduce the possibility of droplet contamination of a sterile field.

POST-PROCEDURE

Step 19: Clean the Procedural Site and Apply a Sterile Dressing

- Procedural sites should be cleaned with sterile saline and gauze to remove residual skin-prep agents and/or blood. Once the area is clean and dry, a sterile dressing should be applied. Some procedures have specific dressing requirements, thus familiarity with the post-procedure dressing requirements is recommended.

Step 20: Remove and Dispose of the Drapes

- All draping materials should be removed with care taken not to dislodge dressings or medical equipment that has been placed. Soiled drapery, or those contaminated with any bodily fluids, should be disposed of in appropriate biohazard bags and receptacles. Drapes should be folded inward to contain bodily fluids and to avoid any spillage.

Step 21: Dispose of Sharps

- With gloves still on, all sharps should be carefully located and disposed of in the appropriate sharps container. Ensure that all sharps are indeed removed before discarding the rest of the kit and/or equipment in the biohazard receptacle.

Step 22: Discard PPE

- All PPE needs to be removed, discarded, and placed in an appropriate biohazard receptacle. Generally, the exterior gown, sleeves, and any visibly soiled surfaces are considered contaminated, so these areas should not be handled with bare hands during the removal process. Clean areas are the inside of the gloves, interior and back of the gown including the ties, and the ties of the mask; the goggles and face shield are also considered clean. Clean areas can safely be handled during the removal process. PPE should be removed in close proximity to the container in which it will be discarded.
- Gloves should be removed first, taking care to avoid touching the outer part of the gloves with bare hands. Grasp the outside edge of the cuff of the glove and peel the glove off while turning it inside out. Hold the glove in the opposite hand, and slide two fingers inside the remaining glove, touching only the inside of the glove while peeling off the glove, turning it inside out so that the first glove remains inside the second one. Next, remove the gown. Unfasten the ties at the neck and waist, peel the gown away from the neck and shoulders, turning the outside of the gown inward to contain contaminants. Fold or roll the gown into a bundle with the inside of the gown facing outward. Alternatively, the gloves can be removed as a component of gown removal as described earlier. Lastly, remove the hat, mask, and goggles or face shield.

Step 23: Wash Hands

- The final step in aseptic technique is to carry out hand hygiene. An appropriate antiseptic soap or alcohol-based hand rub should be chosen. Appropriate post-procedure handwashing with soap and water should include scrubbing of all surfaces for at least 15–20 seconds, allowing dirty water to run away from clean surfaces, and completely drying with clean disposable towels in a patting motion. If a sink is unavailable, proper hand sanitizing with an alcohol-based hand rub is an alternative to soap and water, provided there is no visible soiling of the hands. This consists of scrubbing all surfaces for at least 15–20 seconds and allowing the agent to dry.

Managing a Break in Sterility

- Any break in sterility leaves the patient and/or the provider susceptible to infection; therefore, impeccable monitoring must occur. Any breaks in sterility must be corrected as soon as they are noted, without second-guessing, debate, or hesitation.
- During procedure setup, all packaging, PPE, and sterile equipment should be examined, looking for intact seals; rips, tears, and

expiration dates should also be noted. If any aspect is compromised, those items must be replaced.

- During preparation for and during the performance of the procedure, all providers should monitor for contamination of the sterile field and medical equipment. If any item becomes contaminated at any time, that item needs to be replaced. If previously prepped skin or scrubbed hands become contaminated, prep and/or hand hygiene need to be repeated.
- Items that fall on the floor should be replaced with new items. Gloves that are ripped, torn, or punctured must be replaced. If a health-care provider encounters a needlestick or any break in the integrity of their own skin, the procedure should be safely stopped, their injury assessed, and institutional policy followed.
- Should it become necessary for a new person to step in during a procedure, the area and sterile field should be completely covered with a sterile drape while the new person performs hand hygiene and dons appropriate PPE. If a second person is not readily available, a completely new setup and prep should be completed.

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ENDNOTES

- i. Throughout the chapter when the term *asepsis* is used, it is understood to mean “general asepsis.”
- ii. Chlorhexidine gluconate is a cationic bisbiguanide developed in England in the early 1950s and was introduced in the United States in the 1970s. The antimicrobial activity of chlorhexidine is likely attributable to its attachment to, and subsequent disruption of, cytoplasmic membranes, resulting in precipitation of cellular contents.⁸