1948
Preoperative Skin Antisepsis of the Surgical Patient

AORN INDEPENDENT STUDY ACTIVITY
STUDY GUIDE WITH VIDEO

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PURPOSE/GOAL

This independent study program is intended for use by perioperative nurses and other health care professionals who participate in preoperative skin assessment and preparation for patients undergoing invasive procedures.

OBJECTIVES

Upon completion of this activity, the learner should be able to

1. state the rationale for preoperative skin preparation,
2. describe at least two techniques for skin preparation,
3. discuss the concept of prepping "clean to dirty,"
4. identify the information to be documented after surgical skin preparation, and
5. list the criteria for an antimicrobial skin preparation product.

GUIDE FOR STUDY

This study guide is intended to be used with the accompanying video. We suggest that the learner take the following steps to complete this education activity.

1. Read the overview and objectives for this education activity and compare them with your own learning objectives.
2. View the video.
3. To reinforce your learning, return to the study guide and view the content, paying particular attention to those areas that reflect the objectives.
4. Take the post test and review the answers.
5. Consult the list of suggested readings for further information.

INTRODUCTION

Two desired outcomes for all surgical patients are freedom from injury and freedom from infection. Preoperative skin antisepsis may be a primary contributor to the second outcome. Thorough preoperative skin preparation allows the surgical incision to be made with minimal danger of infection from transient and resident microbes on the skin.

Surgical site infections (SSIs) are the third most frequently reported health care-associated infections (HAIs). These infections account for 14% to 16% of all health care-associated infections.[6] Depending on the type of surgery and pre-existing health condition of the patient, the incidence of postoperative surgical site infections can be 20% or higher.

The perioperative team is dedicated to minimizing or eliminating the risk of acquiring an SSI. A patient who acquires an SSI may experience increased pain and delayed recovery that could result in loss of work and income or even loss of life.

These potential complications are costly for patients, hospitals, and third-party payers. Each postoperative infection is estimated to increase a hospital stay by an average of 2.8 days and add $1,398 in hospital expenses.[6] In addition, if the infection is found to be preventable, the facility will incur even more costs. These additional costs cannot be passed on to Medicare or Medicaid and may not be able to be passed on to third-party payers because facilities receive reimbursement from Medicare, Medicaid, and some insurance companies based on set fees for a given diagnosis, thereby leaving hospitals to bear increased costs.

Effective preoperative skin preparation of the patient is the first line of defense against postoperative wound infection. The perioperative nurse is often asked to perform the surgical skin prep and perhaps teach the correct methods to other medical personnel. It is important that the perioperative nurse have extensive knowledge of skin preparation for the surgical patient. A positive patient outcome consisting of the absence of an SSI would be enhanced by the perioperative nurse's attention to the skin preparation of surgical patients. This study guide and its accompanying video are provided as a resource from which to draw this information.

THE SKIN

The three goals of preoperative skin preparation are to:

- reduce the risk of postoperative wound infections;
- reduce the resident microbial count to subpathogenic levels; and
- inhibit the rapid, rebound growth of microorganisms.

The first goal – reducing the risk of postoperative infection – is primarily accomplished by removing soil and transient microbes from the skin.

The second goal – reducing the resident microbial count to subpathogenic levels – must be accomplished in a short period of time and with the least amount of tissue irritation.

The third goal – inhibiting rapid, rebound growth of microorganisms – is attained by using microbial agents approved or cleared by the Food and Drug Administration (FDA) for use in the health care facility. The skin cannot be sterilized; however, it can be chemically disinfected. The skin consists of two layers called the dermis and epidermis. The epidermis is the outer layer that is constantly being worn away and replaced by cells from the dermis (underneath layer). The dermis is composed of blood vessels, lymphatics, nerves, sebaceous glands, the secreting portions of the sebaceous glands, and hair follicles.

Two types of bacteria are found on the skin– transient bacteria and resident bacteria. Transient organisms are loosely attached to the skin surface by sweat, oil, and dirt. They are effectively reduced with mechanical scrubbing for three to five minutes. Resident bacteria live and multiply on the skin and adhere to the epithelial cells. They extend down between the cells into hair follicles and glands.

Resident bacteria are not easily removed by mechanical scrubbing. If you scrub your skin too frequently, especially with anti-bacterial soap, you could upset the balance of resident bacteria, resulting in overpopulation of certain species of bacteria and causing a local skin infection. It would take several minutes of mechanical scrubbing with plain soap to decrease the population of resident bacteria by 50%, and their regrowth would begin as soon as you stopped scrubbing.

Common resident bacteria are candida, *Staphylococcus epidermidis*, aerobic and anaerobic diphtheroid bacilli, and aerobic and anaerobic streptococci of several types. Other resident bacteria include *Staphylococcus aureus*, sarcina, micrococci, proteus, coliforms, mycobacteria, and klebsiella.

SKIN ASSESSMENT

According to AORN's recommended practices, the perioperative nurse must assess the condition of each patient's skin before beginning any surgical prep. This assessment assists in planning nursing care. The perioperative nurse must check for patient allergies and assess the condition of the surgical site and surrounding tissue.

Allergies may affect the choice of antiseptic agent. The presence of rashes, abrasions or other lesions must be brought to the attention of the surgeon, as they could be a contraindication to proceeding with the surgical intervention. Documentation of preoperative assessment is essential for comparison with postoperative assessment of the skin condition.

Many factors influence preoperative skin integrity. Pediatric and elderly patients have more fragile skin, and geriatric patients often have drier, less resilient skin. Altered nutritional status (e.g., dehydration, hypovolemia, obesity) also can affect the texture and tone of the skin. In these situations, the skin is more easily irritated by hair removal or the friction of prepping procedures.

Patients with metabolic diseases such as diabetes may have altered wound healing as a result of decreased circulation, and may present preoperatively with unhealed lesions at the surgical site. In addition, steroids will alter a patient's resistance to infection. The perioperative team should take special precautions and give consideration to open wounds and fragile or burned skin.

The perioperative nurse should use gentle friction on fragile skin to prevent tissue damage. Assessment for allergies to skin prep products and soaps can prevent potential problems. Localized reactions can occur with any prep solution. If a patient has had surgery before, the nurse should ask whether he or she knows what prep solution was used prior to surgery and whether any reaction occurred as a result. Patients who are allergic to iodine may react to the use of povidone-iodine. Care should be taken when the prepped area includes mucus membranes. Povidone-iodine is safe to use on mucus membranes; however, if the patient has reacted to povidone-iodine in the past, parachoroxylenol (PCMX) is the only other antiseptic that is labeled safe for use on mucus membranes.

Caution is advised when using PCMX, however, because of the following precautions:

- It is minimally effective in the presence of organic matter.
- The FDA has classified PCMX as a Category III (i.e., data are insufficient to classify it as safe and effective).
- The FDA continues to evaluate PCMX.[6]

Visual inspection of the skin begins with skin color, which may include cyanosis, pallor, or jaundice. These observations provide clues to the resilience or fragility of the skin. The perioperative nurse should note bruises, abrasions, warts, moles, scars, or any lesion that may influence hair removal, choice of prepping agent, or the potential for developing postoperative wound infection. The nurse should also touch the skin to assess temperature, texture, thickness, turgor, and mobility.

Preoperative assessment of all of these factors will help you plan care associated with skin preparation and surgical positioning. Preoperative assessment includes documenting preoperative skin assessment in the patient's medical record. If the assessment is not documented, it becomes impossible to verify that a rash, lesion, or other skin defect was present before skin preparation and surgery. It is equally important to document the condition of the patient's skin at the end of the surgical procedure. Notation of irritation or rashes postoperatively may guide the choice of skin preparation methods for subsequent surgical procedures. If a rash is potentially caused by the prep agent, the patient needs to be informed. If the patient is unable to retain the information, written documentation should be provided, and, if applicable, the patient's representative should be notified.

PREOPERATIVE SKIN ANTISEPSIS

Preoperative skin antisepsis consists of several steps.

Step One: Preoperative Shower

The first step may occur at home. Patients undergoing open, Class 1 surgical procedures may be asked to shower and/or shampoo with Chlorhexidine gluconate (CHG) twice before being admitted to the facility. *Staphylococcus aureus* is the most common organism responsible for SSIs. Many infections are a result of colonization of the surgical site by the patient's own flora. The preoperative shower has been shown to be effective in reducing the number of organisms on the skin, including *Staphylococcus aureus*.

Step Two: Hair Removal

The next step may involve clipping of hair at the surgical site. It is recommended that hair be left in place whenever possible. According to the Centers for Disease Control (CDC) guidelines and AORN's recommended practices for skin preparation of patients, hair should remain at the operative site unless it is so thick that it interferes with the surgical procedure. Research has shown that preoperative shaving of the surgical site increases the risk of SSIs. Clipping or use of a depilatory is recommended if hair removal is necessary.

The necessity for hair removal depends on the amount of hair, the location of the incision, the type of procedure, and the surgeon's preference. The patient should be instructed not to shave or use a depilatory before surgery. Shaving increases the risk of infection caused by abrading of the skin. Depilatory creams may cause skin reactions which could result in cancellation of the surgery.

The traditional practice of preoperative skin shaving is no longer recommended because research[4] has clearly demonstrated that:

1. shaving with a razor causes microabrasions,
2. infection rates increase when the shave is performed hours before surgery, and
3. infection rates are lowest when hair is left in place.[4]

Microabrasions provide an opportunity for microorganisms to colonize in a nutrient-rich environment (ie, blood); therefore, any procedure that causes or increases microabrasions will increase the potential for infection. The areas around warts and moles also are easily nicked. In addition, being shaved can be embarrassing and uncomfortable for patients.

Plastic and craniofacial surgeons frequently perform extracranial surgery using a bicoronal incision without removing the patient's hair. Patients are instructed to shampoo with an antimicrobial soap before surgery. After induction of anesthesia, the hair is thoroughly saturated with an antimicrobial solution and combed away from the incision site. A small strip of hair may be clipped at the incision site.

Some areas of the body should never be shaved because of undesirable patterns of regrowth. Examples include eyebrows and facial hair of women and children.

Under optimal circumstances, hair should rarely be removed. If hair removal is needed, it should be performed as close to the time of surgery as possible in a location outside of the operating or procedure room. This will minimize the dispersal of loose hair and reduce the potential of contaminating the sterile field and surgical wound. Hair removal should be done by a skilled person using an electric clipper or depilatory cream immediately before surgery in an area that affords warmth and privacy. The depilatory cream should be tested on the patient's skin to determine whether they are allergic to the cream. Only hair that will interfere with the surgical procedure should be removed.

Step Three: Application of Antiseptic Agent

PREPPING TECHNIQUES

Selection of the antiseptic agent to be used is based on the patient assessment and surgeon preferences. Antiseptic skin preparation products should be approved by the facility's infection control committee. These products also should be used and stored in accordance with the manufacturer's written guidelines and facility standards. Storage at temperatures outside the recommended range can decrease the effectiveness of the agent.

Any identified patient allergies must be communicated to the perioperative team and considered in determining the agent selected. There are numerous skin preparation products available on the market. The most frequently used include Chlorhexidine gluconate, povidone-iodine, alcohol, Chlorhexidine gluconate with alcohol, iodophor with alcohol, and parachoroxylenol (PCMX) .

ANTIMICROBIALS

Soaps and detergents reduce surface tension on the skin; and, as a result, dirt, oil, and microorganisms are confined into the soap lather and removed through the washing process. The addition of antimicrobial agents to soaps and detergents used for preoperative skin preparation or surgical hand scrubs further reduce microbial counts.

Antimicrobial scrubs should meet the following criteria:

1. Broad spectrum: Effectively kills a wide range of gram-negative and gram-positive organisms.
2. High log-reduction capability: By mechanical removal and chemical killing or inhibition of contaminating and colonizing flora to as low a level as possible.
3. Persistent: Remains effective against microorganisms on the skin for an extended period of time, thereby diminishing regrowth.
4. Nonirritating: Can be safely used without skin irritation or sensitization in most patients.
5. Nontoxic: Some solutions can be absorbed into the blood stream and result in toxic effects; avoid these solutions.
6. Fast-acting: Can be quickly applied and rapidly decreases microbial counts on the skin.

No matter which prepping agent is used, follow manufacturers' and product label directions (e.g., some manufacturers state not to use chlorhexidine in the eye, ear, and genital areas).

COMMONLY USED PREPPING AGENTS

Alcohols:

Alcohols are effective germicidal agents that act by denaturation of proteins. Most vegetative gram-positive and gram-negative organisms are killed by alcohols, including *Staphylococci*. Alcohols do not kill spores, but can destroy many fungi and viruses, including HIV and cytomegalovirus (CMV). Although alcohols do not have a persistent chemical effect on the skin, they initially provide the quickest and greatest reduction in microbial counts. Alcohols must be diluted with water to denature protein. A 70% concentration is used most often because it is less expensive and less drying to the skin than higher concentrations.

Chlorhexidine Gluconate (CHG):
Chlorhexidine Gluconate destroys microbes by disruption of the cell wall and precipitation of cell contents. This product is available in 2% and 4% concentrations. The 2% concentration is considered bacteriostatic, and the 4% concentration is bactericidal, making it the preferred skin prepping agent. 4% CHG is highly effective against gram-positive bacteria, yeasts, molds, and many viruses; however, it is less effective against fungi, gram-negative bacteria, and Mycobacterium tuberculosis. It is persistent over time, rapid-acting, and has high persistence (ie, up to six hours). Microbial regrowth is inhibited for up to 24 hours after application. It is nontoxic for the skin, but should not be instilled into the ears because ototoxicity will result. CHG is designed for topical skin application only. It must NOT be used above the neck because of potential corneal damage and toxicity when introduced into the auditory canal. It is a neurotoxic agent that can cause deafness and corneal damage and should not be used on the head if the patient's tympanic membrane is not intact. It should never come in contact with the brain or meninges because it has been shown to be toxic to nerve tissue. It is not recommended for vaginal or mucous membrane preps. Chlorhexidine gluconate may trigger an allergic reaction in sensitive individuals and must be used with caution on mucus membranes.

Iodine/Iodophors
(PPV-iodine, povidone-iodine):
Iodophors are a combination of free iodine and polyvinylpyrrolidone. They are less irritating to the skin than tincture of iodine, but just as effective. Iodophors act by cell wall penetration, oxidation, and substitution of cell contents with free iodine. They are germicidal against spores, fungi, viruses, and gram-positive and gram-negative bacteria. Persistence is moderate for povidone-iodine. These solutions may be irritating to the skin when contact is prolonged. Additionally, absorption may occur across mucous membranes. Povidone-iodine should be allowed to dry completely and must not be warmed; warming raises the temperature above 108° F. (42° C.).[2]

Povidone-iodine can cause contact dermatitis or irritant reactions, but may not indicate an allergy to iodine. Conversely, there is no correlation between allergies to shellfish and a reaction to povidone-iodine. Neonates can absorb iodine resulting in a condition known as iodism (ie, a condition produced by excessive amounts of iodine in the body. It is characterized by increased lacrimation and salivation, rhinitis, weakness, and skin eruption (Mosby's Medical Dictionary).

Parachlorometaxylenol (PCMX):
Parachlorometaxylenol (PCMX) is used mostly as a hand scrub. It contains emollients to prevent excessive drying of the skin. The related agent that is used as skin prep is a cationic phenolic mixture. The active ingredient is phenol, which acts by cell wall disruption and enzyme inactivation. Absorption does occur via the skin and mucus membranes.

PCMX has broad spectrum antimicrobial activity against gram-negative and gram-positive bacteria, vancomycin-resistant enterococcus (VRE), and methicillin-resistant *Staphylococcus aureus* (MRSA). PCMX has intermediate rapidity of action and is persistence for a few hours. The major benefit of a cationic phenolic mixture is that there are no contraindications for use on mucous membranes, open wounds, or around the eyes. Many facilities are using it as an alternative to iodophors when patients are allergic to iodine.

Concentrations of 5% can be toxic to adults, and weaker solutions can be toxic to children. Prolonged skin contact increases the risk for toxicity.

Table 1 summarizes the ativity and considerations for perioperative skin preparation antiseptics.

Table 1. Activity and Considerations for Perioperative Skin Preparation Antiseptics

Antiseptic agent	Mechanism of action	Gram + bacteria	Gram - bacteria	Viruses	Rapidity of action	Persistent/ residual activity	Use on eye or ear	Use on mucous membranes	Contraindications	Cautions
Alcohol 	Denatures proteins.[1]	Excellent[1]	Excellent[1]	Good[1]	Excellent[1]	None[1]	No. Can cause corneal damage or nerve damage.[1]	No		Flammable.Does not penetrate organic material. Optimum concentration is 60-90%.[1]
Chlorhexidine gluconate	Disrupts cell membrane.[1]	Excellent[1]	Good[1]	Good[1]	Moderate[1]	Excellent[1]	No. Can cause corneal damage. Can cause deafness if in contact with inner ear.[1]	Use with caution[2]	Known hypersensitivity to drug or any other ingredient.[2] Lumbar puncture and use on meninges.[2]	Prolonged skin contact may cause irritation in sensitive individuals. Rare severe hypersensitivity reactions have been reported.[2] Use with caution on mucous membranes.
Povidone-iodine	Oxidation/ substitution with free iodine.[1]	Excellent[1]	Good[1]	Good[1]	Moderate[1]	Minimal[1]	Yes. Moderate oculat irritant.	Yes	Sensitivity to Povidone-iodine. (Shellfish allergies are not a contraindication)[6]	Prolonged skin contact may cause irritation. May cause iodism in susceptible individuals - avoid use in neonates.[3,4] Inactivated by blood.[7,8]

Table 1 *(Continued)*. Activity and Considerations for Perioperative Skin Preparation Antiseptics

Antiseptic agent	Mechanism of action	Gram + bacteria	Gram - bacteria	Viruses	Rapidity of action	Persistent/ residual activity	Use on eye or ear	Use on mucous membranes	Contraindications	Cautions
Chlorhexidine gluconate with alcohol 	Disrupts cell membrane and denatures proteins.[1,2]	Excellent	Excellent	Good	Excellent	Excellent	No. Can cause corneal damage. Can cause deafness if in contact with inner ear.	No	Known hypersensitivity to drug or any ingredient. Lumbar puncture and use on meninges.	Flammable.
Iodophor with alcohol 	Oxidation/ substitution by free iodine/ denatures proteins.[1,3,4]	Excellent [1,3,4]	Excellent	Good	Excellent	Moderate	No. Can cause corneal damage or nerve damage.	No	Sensitivity to Povidone-iodine. (Shellfish allergies are not a contraindication).[6]	Flammable
Parachor-oxylenol (PCMX)	Disrupts cell membrane.[1]	Good[1]	Fair[1]	Fair[1]	Moderate[1]	Moderate[1]	Yes[5]	Yes[5]	Known hypersensitivity to PCMX or any other ingredient.[5]	Minimally effective in the presence of organic matter. The FDA has classified PCMX as a Category III (i.e., data are insufficient to classify it as safe and effective). The FDA continues to evaluate PCMX.[5]

References for Table 1

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The surgical site must be confirmed before skin antisepsis begins. This is included in the time-out process. The surgical site is marked using a marker that will not facilitate microbial growth and that provides a mark that remains visible after the surgical prep is completed.

The efficacy of any antiseptic agent is dependent on the cleanliness of the skin. For this reason, the skin must be free of any soil or debris, exudates and transient microorganisms before application of the antiseptic agent begins. If a preoperative shower was not performed, the area should be washed, either in the preoperative area or immediately before beginning the surgical skin preparation in the operating or procedure room to reduce superficial bioburden at the surgical site.

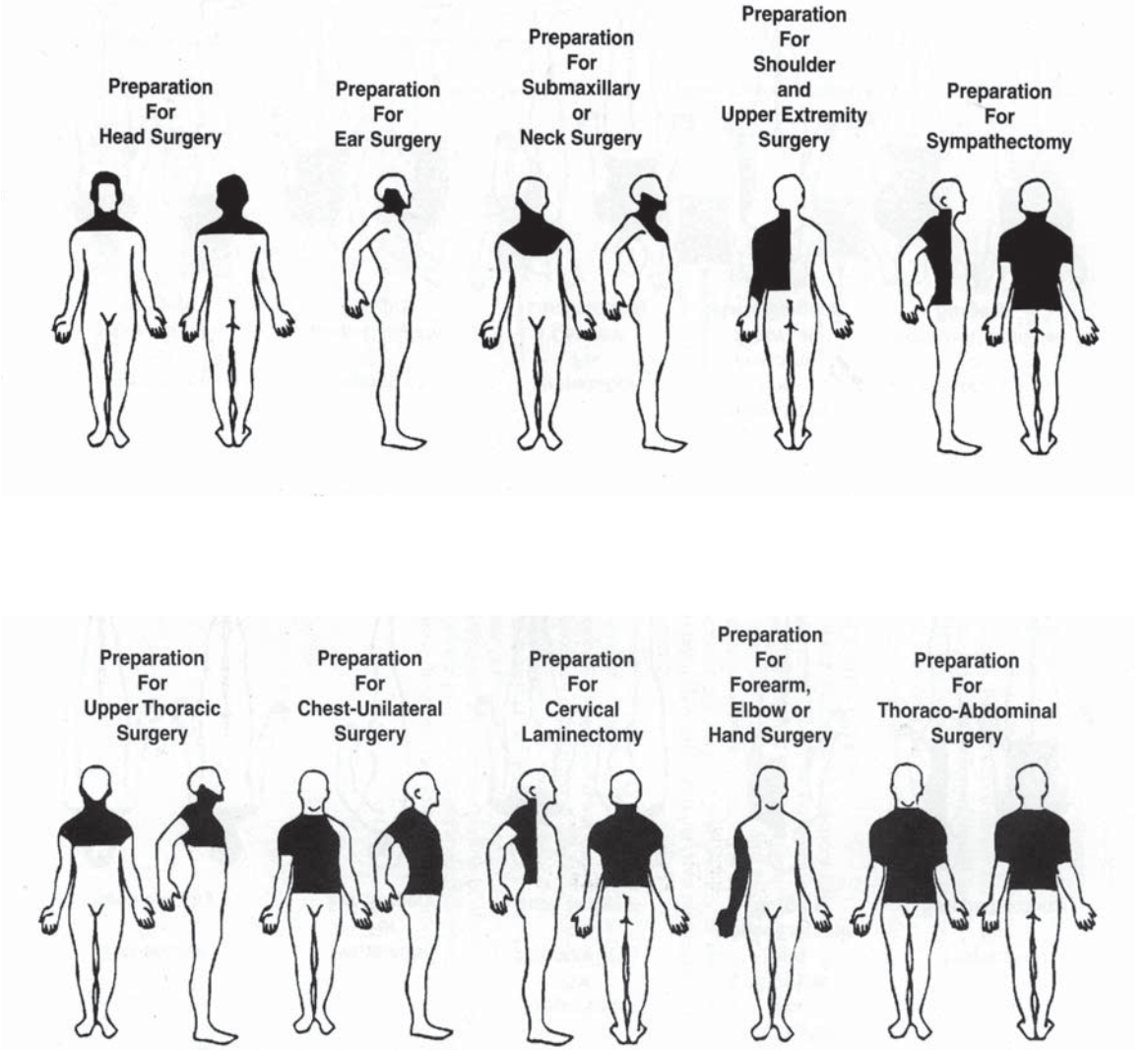
Cosmetics should be removed preoperatively if used on or near the operative site. Abdominal surgery will necessitate the cleaning of the umbilicus before skin preparation begins.

Jewelry, including body piercing ornaments, should be removed. Not only can jewelry harbor microorganisms, but jewelry also can increase the risk of injury related to positioning and proximity to the incision site or the active electrode of the electrosurgical unit.

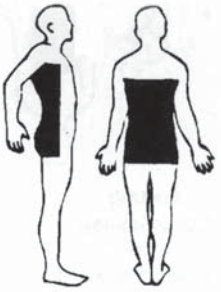
The area of the prep must be wide enough to prevent contamination and to allow for extension of the incision. In addition, drains may need to be placed or additional incisions made. In the case of laparoscopic surgery, the prepped area should be large enough to accommodate an incision for conversion to open surgery.

Figure 2 illustrates standard prep areas.

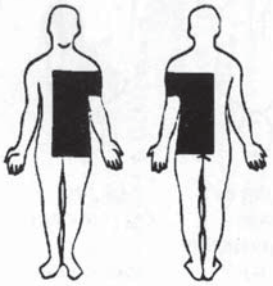
Figure 2.


Preparation For Head Surgery
Preparation For Ear Surgery
Preparation For Submaxillary or Neck Surgery
Preparation For Shoulder and Upper Extremity Surgery
Preparation For Sympathectomy
Preparation For Upper Thoracic Surgery
Preparation For Chest-Unilateral Surgery
Preparation For Cervical Laminectomy
Preparation For Forearm, Elbow or Hand Surgery
Preparation For Thoraco-Abdominal Surgery

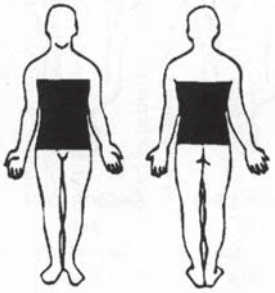
Preparation For Lumbar Laminectomy



Preparation For Unilateral Surgery at Posterior Lumbar Region

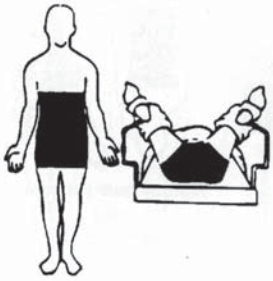


Preparation For Renal and Upper Ureteral Surgery



Preparation For Abdominal Surgery

Preparation For Gynecological and Genito-Urinary Surgery



Preparation For Unilateral Hip Surgery

Preparation For Unilateral Thigh and Leg Surgery

Preparation For Lower Leg and Foot Surgery

Preparation For Ankle, Foot or Toe Surgery

Preparation For Ano-Rectal Surgery

Special care should be taken when prepping in and around mucous membranes because some antiseptic agents are neurotoxic or ototoxic. Application of the antiseptic agent must be performed in a way that minimizes contamination. The skin prep should be applied by non-scrubbed personnel to avoid contamination to the sterile gown and gloves. Hand hygiene should be performed before performing the prep.

Sterile supplies should be used to apply the antiseptic agent. Supplies for prepping can be prepared and sterilized in the hospital central processing unit or purchased as a sterile disposable tray. The skin prep should be accomplished using sterile gloves unless sufficient length of the antiseptic prep applicator prevents the antiseptic agent and patient's skin from coming in contact with the unsterile glove.

Whenever possible, highly contaminated sites (e.g., anus, colostomy site) should be isolated from the area that will be prepped using an adhesive, fluid resistant, or plastic drape.

The person performing the prep should use the principles of aseptic technique. Towels should be used to define the area to be prepped, and to prevent pooling of the prep solution under the patient. Pooled prep solutions can result in chemical injury.

The guiding principle for the scrubbing and painting portions of the skin prep is to "prep from clean to dirty." The site of the surgical incision should be the cleanest area of the prep; therefore, the prep should begin at the incision site and continue outward. After the periphery of the area to be prepped is reached, the person performing the prep should discard the contaminated sponge. A clean sponge should be used to begin again at the incision site. The same circumferential pattern should be used with an applicator, moving from clean to dirty and never going back over the area already prepped. Mechanical friction when prepping aids in the removal of microorganisms. The nurse should always refer to the manufacturer's written directions and facility policy to determine prepping times. The application will be different, however, if the surgical site includes a highly contaminated area. In this instance, the area with the lower bacterial count is prepped first, followed by the area with the higher contamination.

Consistent with the principle of prepping from clean to dirty, allowing prep solution to run or drip from the periphery of a prepped area toward the incision site will reintroduce bacteria into the cleaner area of the prep and should be avoided. Positioning the patient so that the incision site is less prone to dripping can decrease this possibility.

Special considerations also exist when prepping the anus, vagina, stoma, sinus, ulcer, or open wound. In these situations, the sponge must be applied once only and then discarded. Placing an antiseptic-soaked sponge to the contaminated area

while prepping the surrounding skin (eg, stoma site) is recommended. Vaginal preps for procedures that include the abdomen are performed in a manner that prevents splashing of antiseptic agents that may be expelled from the vagina onto the prepped abdomen. Stomas contained within the surgical field should be cleansed gently and separately from the rest of the prepped area.

Special attention should be paid to the nails if hand or foot surgery is to be performed. Open, traumatic orthopedic wounds can be cleaned using pulse lavage, high-pressure parallel waterjet, or brush-suction irrigation. Sterile 0.9% saline solution should be used and caution exercised to prevent aerosolization of wound contaminants onto the sterile field during irrigation.

When both a perineal and abdominal prep are necessary, as in the case of a laparoscopy, the abdomen should remain the cleanest area. This is an exception to the principle of prepping clean to dirty. To avoid potential contamination by splashing or aerosolization from the perineal prep, the perineum is prepped first. If urethral catheterization is desired, a new pair of sterile gloves should be used to place the catheter following the perineal prep.

The abdomen is prepped second using a new prep set. If painting with antimicrobial solution is a part of the prepping procedure, remove the antimicrobial soap by blotting with a sterile towel before painting. Take care to apply and remove the towel using aseptic technique. When applying the solution, the nurse should follow the same circumferential pattern used for the antimicrobial soap solution. It is recommended that the antimicrobial solution be allowed to dry before making the skin incision.

If a flammable prep solution is used, special precautions must be observed. Following are precautions developed by The National Fire Protection Association (NFPA) that have been incorporated into the Joint Commission's National Patient Safety Goals.

1. Ensure personnel are familiar with any flammable agents which are used.
2. Check that the agents are packaged in small, single-application quantities or prepackaged in a unit dose.
3. Prevent the solution from coming in contact with fabric or pooling on or under body parts.
4. Remove any solution-soaked materials from the procedure room.
5. Allow prep agents to dry thoroughly and vapors to dissipate before applying any draping materials.
6. Identify the use of a flammable prep agent being used during the surgical time out.
7. Be sure to never heat any flammable skin preparation agents.

In general, skin preparation should be accomplished in as short a period of time with the least amount of tissue irritation as possible, using the manufacturer's recommendations for contact and drying times.

PROTECTIVE MEASURES

Protective measures should be used to prevent skin and tissue injury that can occur with prolonged contact with skin prep agents. Skin irritation and chemical injury are likely to occur if the solutions are not allowed to dry and remain in contact with the skin for long periods of time. This is especially troublesome with iodine preparations where the iodine remains "free" until it has dried. While in the "free" state, the iodine can irritate and even macerate skin. The use of adhesive drapes and forced-air warming can increase this risk to the patient. To reduce the risk of skin injury, the following preventative steps should be taken.

- Sheets, padding, adhesive tape, positioning devices, electrocardiograph and electrosurgical unit dispersive electrodes should be protected from dripping or pooling prepping agents.

- If a tourniquet is used, the cuff, padding, and skin under the cuff must be protected from contact with prep solutions. Consider using an impervious tourniquet cuff protector or plastic drape with and adhesive strip.

- Barriers should be removed at the conclusion of the prep. The barriers around tourniquets should remain.

TYPES OF PREPS

The application of skin antiseptics may occur in a few different ways. In general, there are two-step preps, and one-step paint applications and gel preps.

Two-Step:

Many skin antiseptic products use a two-step process; a scrub with an antiseptic solution containing a detergent, and then an antiseptic paint. The scrub (ie, detergent) solution should be applied beginning at the incision site, exerting gentle friction and using circular strokes toward the periphery. A fresh sponge should be used, starting once again at the incision site and continuing toward the periphery. This process may be repeated as necessary. The period of time needed for skin preparation is based on the manufacturer's written directions and facility policy. When this step is completed, the nurse should place a sterile prep towel over the prepped site and gently blot. Next, the towel should be carefully removed, observing aseptic technique.

The next step involves application of the "paint" solution, which is accomplished in the same manner, working from clean to dirty. The paint also may be blotted or left to dry. If the paint contains alcohol, sufficient drying and evaporation time should be allowed before using electrosurgical or laser equipment.

One-Step:
Some antiseptic preparations consist of either a gel or a one-step paint method. Iodophors often come as a thick viscous gel which may be applied as a single coat. This preparation is frequently used on extremity preps.

There are several one-step, film-forming iodophor preparations that contain alcohol. These preparations are flammable and appropriate care must be taken to ensure adequate drying time.

DOCUMENTATION

AORN's recommended practices state that preoperative skin preparation should be documented in the patient record. Documentation is an essential component of all perioperative nursing care. Complete and accurate charting is the perioperative nurse's best legal defense. Documentation related to the surgical prep occurs in the preoperative, intraoperative, and post-operative phases.

Preoperatively, it is important to document that the skin was checked for the presence of allergies and the skin condition at the site of the proposed surgical incision was assessed. If hair was removed, documentation should include the time, method, and who removed it.

Intraoperatively, documentation should include the area prepped, the name of the person performing the prep, and all scrubs and solutions used. Postoperatively, documentation should indicate the skin condition. This is essential to evaluate the expected PNDS outcomes for all surgical patients.

1. The patient is free from signs and symptoms of nosocomial surgical site infection such as pain, induration, foul odor, purulent drainage, and/or fever through 30 days following the perioperative procedures.[2]
2. The patient remains free from signs or symptoms of injury related to chemical hazards.

SUMMARY

The three goals of preoperative skin preparation are to reduce the risk of postoperative wound infections; to reduce the resident microbial count to subpathogenic levels; and to inhibit the rapid, rebound growth of microorganisms. The first goal is primarily accomplished by removing soil and transient microbes from the skin. The second goal is accomplished in a short period of time and with the least amount of tissue irritation. The third goal is attained by using microbial agents approved or cleared by the FDA for use in the health care facility.

Antimicrobial skin antisepsis products should be broad spectrum, persistent, non-irritating, nontoxic, fast-acting, and have a high log reduction capability. The area of the prep must be wide enough to prevent contamination and to allow for extension of the incision.

Protective measures should be used to prevent skin and tissue injury that can occur with prolonged contact with skin prep agents. Skin irritation and chemical injury are likely to occur if the solutions are not allowed to dry and remain in contact with the skin for long periods of time.

Surgical skin antisepsis must meet two desired outcomes for the surgical patient: freedom from injury, and freedom from infection. Careful attention during the application and subsequent draping of the surgical site is critical in preventing injury. Thorough preoperative skin preparation allows the surgical incision to be made with minimal danger of infection from transient and resident microbes on the skin.

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POST-TEST

Multiple Choice: Please choose the one answer that best completes the following statements.

1. Using mechanical friction when prepping will NOT aid in
   a. removal of resident bacteria.
   b. removal of dirt and oil.
   c. the effectiveness of antimicrobials.
   d. removal of transient bacteria.

2. Reduction in resident bacteria is aided by
   a. use of a degreaser.
   b. use of antimicrobials.
   c. prepping clean to dirty.
   d. mechanical friction.

3. Pooling of prep solution is NOT reduced by
   a. using gel preps.
   b. using towels to collect solution.
   c. placement of grounding and EKG pads.
   d. prepping clean to dirty.

4. Which one of the following statements is TRUE?
   a. Povidone-iodine's mechanism of action is to disrupt the cell membrane.
   b. Povidone-iodine is non-irritating to the skin.
   c. Povidone-iodine cannot be used on mucous membranes.
   d. Heating povidone-iodine may decrease its effectiveness.

5. Documentation of the preoperative skin prep includes all of the following EXCEPT
   a. hair removal.
   b. manufacturer of solutions used.
   c. allergies.
   d. the name of the person who performed the prep.

6. When prepping an extremity, which one of the following is ALWAYS required?
   a. Positioning the extremity to prevent prep solution from running toward the incision site.
   b. Assistance in holding the limb
   c. Scrubbing nails with a brush before the formal prep
   d. Prepping so that the entire limb can be draped

7. Surgical wound infections can result in decreased
   a. hospitalization time.
   b. intraoperative time.
   c. income for hospitals.
   d. workload for perioperative nurses.

8. Preoperative skin preparation is accomplished by
   a. removing soil and transient microbes.
   b. reducing resident microbes.
   c. using antimicrobial agents that inhibit growth of microbes.
   d. all of the above.

9. According to AORN's recommended practices for skin preparation of patients, hair at the operative site is
   a. allowed to remain unless it interferes with the surgical procedures.
   b. always removed with a depilatory.
   c. removed at least two hours before surgery.
   d. dry shaved as opposed to wet shaved.

10. The concept of prepping from clean to dirty means
    a. cleaning all stomas or open wounds first.
    b. beginning at the incision site and using circular strokes toward the periphery.
    c. prep solution is changed after cleaning contaminated areas.
    d. surgical scrub solutions used first and then surgical paint.

11. Common resident bacteria include all EXCEPT
    a. *Staphylococcus epidermidis*.
    b. *Staphylococcus aureus*.
    c. diphtheroid bacillus.
    d. pseudomonas aeruginosa.

12. Which one of the following statements about the final skin prep is FALSE?
    a. Povidone-iodine should not be allowed to dry.
    b. Manufacturers' guidelines should be followed.
    c. Final skin prep is performed after the patient has been positioned.
    d. The name of the person performing the prep should be documented.

13. Objectives of the surgical prep include all EXCEPT
    a. removal of dirt, skin oil, and microbes from the skin.
    b. sterilization of skin.
    c. reduction of bacterial count.
    d. prevention of regrowth of microbes for several hours.

14. The generally recognized length of time required for contact of antimicrobial agents to be effective is
    a. 1 to 3 minutes
    b. 2 to 5 minutes
    c. 3 to 5 minutes
    d. according to manufacturers' directions

15. The principles of preoperative skin preparation include all of the following EXCEPT
    e. prep from clean to dirty.
    a. use aseptic technique.
    b. prep stomas first.
    c. prevent pooling.

16. Which one of the following topical antimicrobial agents is neurotoxic?
    a. Povidone-iodine
    b. Alcohol
    c. PCMX (parachlorometaxylenol)
    d. Chlorhexidine gluconate

17. Which of the following topical antimicrobial agents is ototoxic?
    a. CHG
    b. PCMX
    c. Alcohol
    d. Povidone-iodine

18. Which statement is TRUE about iodophor with alcohol?
    a. It provides rapid reduction in microbial counts of skin.
    b. Persistence or residual activity is excellent.
    c. It has been shown to be nontoxic and nonirritating.
    d. Percutaneous absorption may occur across mucous membranes.

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PREOPERATIVE SKIN ANTISEPSIS OF THE SURGICAL PATIENT

POST-TEST ANSWER KEY

1. A
2. B
3. D
4. D
5. B
6. A
7. C
8. D
9. A
10. B
11. D
12. A
13. B
14. D
15. C
16. D
17. A
18. A

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