CHAPTER

33 Infection Control

Learning Objectives

After completing this chapter, you should be able to:

33.1 Define and spell the terms for this chapter.
33.2 List types of infectious microorganisms.
33.3 Identify conditions required for bacterial growth.
33.4 Explain the cycle of the chain of infection.
33.5 Describe the body's natural barriers to infection.
33.6 Identify government regulations that impact infection control practices in health care.
33.7 List the three categories of transmission-based precautions, as established by the Centers for Disease Control and Prevention (CDC).
33.8 Describe surgical asepsis.
33.9 Identify types of personal protective equipment.
33.10 Describe methods that can be implemented to control the growth of microorganisms.

Case Study

McWalters asks David Dolan, RMA, to perform venipuncture on the 34-year-old female in examination room 4. The physician explains that the patient needs to have routine blood work performed, including a liver function test (LFT), to evaluate the progression of hepatitis B, which the patient was diagnosed with over two years ago.

Terms to Learn

aerobic
airborne precautions
anaerobic
antibodies
antiseptic
asepsis
bactericidal
bloodborne pathogens
contact precautions
direct contact
disinfection
droplet precautions
excreta
immunity
incubation
indirect contact
infectious
medical asepsis
methicillin-resistant *Staphylococcus aureus* (MRSA)
microorganisms
multidrug-resistant organisms (MDROs)
normal flora
opportunistic infections
pathogens
permeable
personal protective equipment (PPE)
phagocytosis
portal of entry
portal of exit
postexposure evaluation
radiation isolation precautions
reservoir host
respiratory hygiene/cough etiquette
safe injection practices
sanitization
standard precautions
sterilization
surgical asepsis
susceptible host
universal precautions
vancomycin-resistant *Enterococci* (VRE)
vancomycin-resistant *Staphylococcus aureus* (VRSA)

Infection control is the process of reducing exposure to pathogens to prevent the spread of disease. **Pathogens**, which are disease-producing organisms, are found everywhere, including on inanimate objects (such as countertops and faucets) and on human skin. In healthy individuals, the immune system provides some measure of resistance to pathogens. However, people who are already suffering from a disease are likely to have a compromised immune system, making them more susceptible to new infections. Therefore, controlling pathogens is especially important in a medical office, where patients with a variety of diseases are constantly coming in and out. These patients can spread pathogens to others, and they are also generally more susceptible to new infections.

As a medical assistant, you must be aware of how easily pathogens can be spread from one person to another or from an inanimate object to a person. **Asepsis** is the state of being free from germs, infection, and any form of microbial life. Medical assistants must know and understand the theory and practice of asepsis to maintain a healthy environment for patients and medical staff members alike.

MICROORGANISMS AND PATHOGENS

Organisms are systems made up of groups of living cells. **Microorganisms** are organisms that are so small they can be seen only with the aid of a microscope. The sizes of microorganisms (also called microbes) can be expressed in micrometers. A micrometer is one-millionth of a meter or one-thousandth of a millimeter.

Not all microorganisms cause disease; those that do, as noted earlier, are called pathogens. There are numerous types of pathogens, including bacteria, fungi, protozoa, viruses, rickettsiae, and parasites (protozoans, helminths, ectoparasites, and the like) (see Figure 33-1).

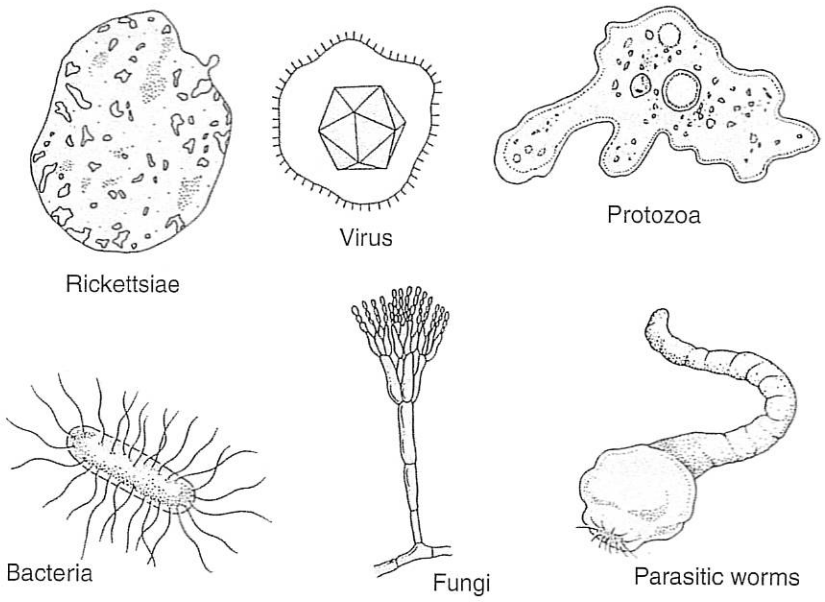


FIGURE 33-1 Examples of pathogens

The four main types of microoganisms are generally considered to be bacteria, fungi, protozoa, and viruses. The study of each of these types is a separate scientific field:

- Bacteriology—the study of bacteria
- Mycology—the study of fungi
- Protozoology—the study of protozoa
- Virology—the study of viruses

As already noted, not all microorganisms are pathogens. Many microorganisms that are not harmful grow and thrive in the human body and may have helpful functions within the body. Microorganisms that are normally found on the skin and in the urinary, gastrointestinal, and respiratory tracts are known as **normal flora**. They do not cause disease under the following conditions:

- If they are not transferred to another part of the body. For example, *Escherichia coli*, a normal bacterium within the colon, aids in food digestion. However, when *E. coli* moves into the bladder or bloodstream, through such poor habits as improper (or lack of) hand hygiene, *E. coli* can cause urinary tract and blood infections.
- If they remain in balance within their environment. For example, when the pH balance of normal flora found within the vagina is altered, a yeast infection may develop.

How Microorganisms Grow

Microorganisms exist everywhere in nature. To grow, they generally require food, moisture, darkness, and a suitable temperature. In addition, some bacteria are **aerobic** (require oxygen to live), and some are **anaerobic** (do not require oxygen to live). Refer to Table 33-1 for the conditions that are necessary for the growth of bacteria. Microorganisms that are capable of producing disease (pathogens) grow best at a body temperature of 98.6°F/37°C, destroy and use human tissue as food, and excrete waste toxins that are absorbed by and may poison the body.

Multidrug-Resistant Microorganisms

One group of microorganisms, **multidrug-resistant organisms (MDROs)**, is of growing concern in health care. These microorganisms are referred to as "super-bugs" because they do not respond to traditional medications and treatments and have developed resistance to antimicrobial drugs. Increased length of hospital stays, increased cost of treatments, and death are associated with these organisms. Common examples include **methicillin-resistant *Staphylococcus aureus* (MRSA)**, **vancomycin-resistant *Staphylococcus aureus* (VRSA)**, and **vancomycin-resistant *Enterococci* (VRE)**.

Methicillin-Resistant Staphylococcus Aureus (MRSA)

Methicillin-resistant *S. aureus*, or MRSA, is an organism that is highly resistant to antibiotics. There are two forms of MRSA: hospital-associated MRSA and community-based MRSA. The first, as the name implies, occurs mostly in health care facilities to individuals with weakened immune

TABLE 33-1 | Conditions Required for Bacterial Growth

Condition	Explanation
Moisture	Bacteria grow best in moist areas: skin, mucous membranes, wet dressings, wounds, dirty instruments.
Temperature	Bacteria thrive at body temperature (98.6°F). Low temperatures (32°F and below) retard, but do not kill, bacterial growth.
Oxygen	Aerobic bacteria require an oxygen supply to live. Anaerobic bacteria can survive without oxygen.
Darkness	Darkness favors the growth of most bacteria. Some bacteria will die if exposed direct sunlight or light.

systems. This organism is one of the most common agents responsible for nosocomial infections (infections acquired while in a medical facility), which are discussed later in this chapter.

S. aureus is the causative agent in boils, acne, some forms of septicemia, and pneumonia. Infection may occur from cuts, sores, and through catheters or breathing tubes. Symptoms of *Staphylococcus* (staph) infection include pus formation, fever, swelling, and tenderness around the area of infection. Individuals with weakened immune systems are more susceptible to this type of infection. Serious staph infections may lead to endocarditis (inflammation of the lining of the heart), cellulitis (inflammation of subcutaneous and connective tissue), pneumonia, and toxic shock syndrome.

Diagnosis of *S. aureus* is established by culture from the infected individual. A sensitivity test determines which antibiotics are most effective in killing the organism. If the organism grows in the presence of methicillin, it is classified as MRSA. The physician then prescribes the medication that most readily kills the microorganism.

The best way to avoid contracting or spreading MRSA infection is through the use of good hygiene practices, including handwashing and wearing gloves and other personal protective equipment (PPE) when treating any patient, especially one known or suspected to have a MRSA infection. Using an antiseptic cream and covering any skin breaks with adhesive bandages also will help prevent the spread of MRSA.

Vancomycin-Resistant Enterococci (VRE)

Enterococci are bacteria normally present in human intestines, the female genital tract, and the environment. Most species of *enterococci* are harmless, but some are capable of causing serious infections, which may be treated with vancomycin, an antibiotic often used as a last line of defense; that is, it is an antibiotic generally used after all other antibiotics have failed. Vancomycin-resistant *enterococci* are a strain of these bacteria that has developed a resistance to vancomycin and no longer responds to this drug.

Signs and symptoms of VRE vary, depending on the source of the infection. Skin or wound VRE infections may be present as well as VRE infections of the urinary and gastrointestinal tracts.

VRE is spread by **direct contact** from human to human, usually by caregivers who have not practiced proper hand hygiene. It can also be spread by touching contaminated inanimate objects. To prevent VRE at home or work, always wash hands after using the bathroom and before preparing food. Wash or use alcohol-based hand rubs after contact with persons with VRE.

INFECTIONS

Scientists have determined that microorganisms are capable of multiplying very quickly. If not controlled, germs may spread infection and diseases rapidly from one person to another. As a medical assistant, you will need to understand how infections are spread—the infection process as well as the types of infections that occur.

The Chain of Infection

The sole presence of a pathogenic organism is not enough to cause an infection. Several factors must be in place for infection to occur. These are referred to as the chain of infection:

1. The **reservoir host** begins the chain of infection. The reservoir host is an organism—usually an animal or human—that harbors and nourishes a pathogen. Often, a reservoir host gives a pathogen a "home" for a long time without suffering any ill effects from it. At other times, the reservoir host may become infected by the pathogen. Either way, the reservoir host is the organism that is the source of a pathogen that can then be transferred to another organism that becomes infected by it. The host provides nourishment and sustenance for the pathogen, allowing it to grow. The host, including a human host, generally is not aware that it is harboring a pathogen.
2. For the pathogen to spread to another animal or person, there must be a **portal of exit** from the reservoir host. The means of exit include the respiratory, gastrointestinal, urinary, and reproductive tracts of the body. An open wound is also an excellent portal of exit.
3. Next, there must be a means of transmission for the pathogen to spread to another person. This may be through direct (human to human) contact, either with the infected person or with the discharge or **excreta** (waste products) of the infected person. The transmission can also occur by **indirect contact** (nonhuman to human). Examples include inhaling infected air droplets from a cough or sneeze, or touching a contaminated object. Other methods of transmission through indirect contact are through contaminated food (possibly meat tainted with the bacterium *salmonella*) or insects (such as the transmission of West Nile virus through infected mosquitos).
4. A **portal of entry** into a new host is required. The portal of entry is the means by which a pathogen enters the body. Similar to the portal of exit, these portals include the respiratory, urinary, and reproductive tracts, skin and mucous membranes, or blood.

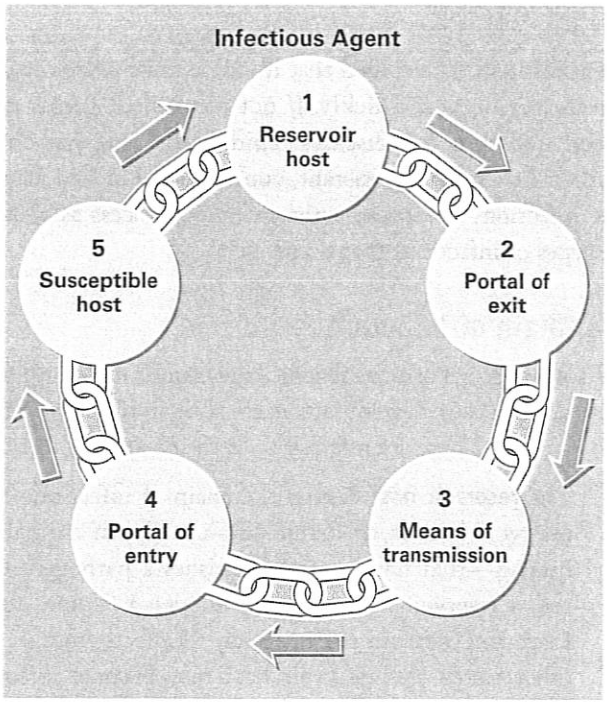


FIGURE 33-2 Chain of infection.

5. A **susceptible host** must be available and capable of being infected by the pathogen. A susceptible host is someone who is unable to fight off the infection. Some situations that lead to susceptibility include poor health, poor hygiene, or poor nutrition. Increased stress levels may also be a factor.

When the susceptible host becomes infected, that person becomes a new reservoir host, and the chain of infection begins again. Figure 33-2 illustrates the chain of infection.

Fortunately, if the chain is broken, infection does not occur. The chain can be broken at various points. For instance, the chain may be broken at the reservoir by using medical asepsis, standard precautions (which are discussed later), and proper hand hygiene to prevent transmission of the pathogen. In fact, attaining medical asepsis through proper hand hygiene is the most important method for decreasing the spread of infections.

The Stages and Types of Infections

Once an infection has begun in the host, it proceeds through specific stages. These stages include invasion by the pathogen, multiplication (reproduction) of the pathogen, an **incubation** period, a prodromal period, an acute period, and, finally, the recovery period. The stages of the infection process are described in Table 33-2.

Additionally, it is important to discuss the various types of infections that may be present. The most common types of infections are acute, chronic, latent, opportunistic, and nosocomial.

TABLE 33-2 | **Stages of the Infection Process**

Stage	Description
Invasion	Pathogen enters the body through the portal of entry: respiratory, digestive, reproductive, urinary tracts, and skin.
Multiplication	Reproduction of pathogens.
Incubation	Period may vary from several days to months or years, during which time the disease is developing but no symptoms appear.
Prodromal Period	First, mild signs and symptoms appear; a highly contagious period.
Acute Period	Signs and symptoms are evident and most severe.
Recovery Period	Signs and symptoms begin to subside.

Acute Infections

Many of the common illnesses that afflict the human body are considered acute infections. These may include the common cold and influenza. Acute infections have a rapid transition from invasion of the pathogen to the prodr period. The body is usually able to rid itself of the virus and recover within three to five weeks of onset.

Chronic Infections

Chronic infections are more serious than acute infections because the effects of the disease-causing pathogen can last for a very long time. In fact, some chronic infections are lifelong. The transition of stages from invasion to the prodromal period varies based on the type of infection. Diseases discussed later in this chapter, including HIV and hepatitis B, are examples of chronic infections.

Latent Infections

A latent infection can be very frustrating to patients because this form of infection is characterized by periods of remission and relapse. Remission is when the disease has been treated and there are no longer any signs or symptoms present. Relapse is when the same infection reoccurs. This is common with viral infections such as those that cause cold sores (herpes simplex virus types I and II) as well as the varicella-zoster virus that can cause chickenpox and later erupt as shingles. The main characteristic of a latent infection is that the virus lies dormant within the body for extended pe ; of time (often many years). Then, an external or internal

factor will trigger the virus to become active within the body again.

Opportunistic Infections

Opportunistic infections are those that occur when the host's immune system has already been impaired by another disease-causing pathogen. The immune system has become weakened and more susceptible to other infections. Patients with severely compromised immune systems, such as those who are being treated for cancer or a patient with HIV, are more likely to suffer from other (opportunistic) infections. Oral thrush (candidiasis) and pneumonia are examples of opportunistic infections that might afflict a compromised immune system but not a healthy one.

Nosocomial Infections

Nosocomial infections are infections acquired while in a medical facility, generally the hospital setting. In fact, nosocomial infections are also called hospital-acquired infections. The pathogens were not in the patient's body when the patient came into the facility but rather were introduced into the body because of poor aseptic technique in the facility. The most common types of nosocomial infections include:

- Bloodstream infections (from improper venipuncture or IV line procedures)
- Urinary tract infections (from improper catheter procedures)
- Surgical site infections (from improper wound care)

In all medical settings, there must be a dedicated emphasis on halting the spread of infection.

The Inflammatory Response to Infection

The body may react to the presence of pathogens, such as bacteria or a virus, with an acute inflammatory process. This process results in the dilation of blood vessels to allow increased blood flow, production of watery fluids and materials (exudates such as pus), and invasion of neutrophils and monocytes into the injured tissues. Neutrophils and monocytes are types of leukocytes (white blood cells) that perform phagocytosis, which means that they engulf ("eat") and destroy disease-causing pathogens.

The signs and symptoms of infection and the inflammatory process may be local (an earache) or systemic (an elevated body temperature). The four cardinal signs of acute inflammation are redness, heat, swelling, and pain. Signs and symptoms may vary according to the part of the body is affected. Table 33-3 lists signs and symptoms of infection and inflammation.

TABLE 33-3 | Signs and Symptoms of Infection and Inflammation

Cardinal Signs of Inflammation	Other Signs of Infection
Redness	Abnormal white blood cell counts: high (leukycytosis) or low (leukopenia). High counts are very common with infection.
Heat	Fever
Swelling (edema)	Increased pulse rate
Pain	Increased respiration rate

THE BODY'S NATURAL BARRIERS

The human body can play both beneficial and harmful roles in infection control and the disease process. Some factors, such as advancing age and genetic predisposition, can be detrimental; other factors, such as a healthy diet and plenty of rest, can work in the body's favor. Antibiotics and other drugs are effective infection fighters, but the body itself provides many defenses against infection.

Prevention and Protection

The human body has several natural barriers to infection. The largest natural barrier to infection is intact skin. The acidity of the skin inhibits bacterial action. Mucous membranes lining the body's orifices and its respiratory, digestive, reproductive, and urinary tracts also assist in repelling microorganisms. The gastrointestinal tract contains hydrochloric acid (HCl), which has a **bactericidal** (bacteria-destroying) action. The lymphatic system and the blood also play key preventive and protective roles.

The Lymphatic System and the Blood

The lymphatic system and the blood produce antibodies to identify and neutralize or destroy disease-causing pathogens that enter the body. As noted earlier, leukocytes (white blood cells) actively fight pathogenic microorganisms through **phagocytosis**, the process of engulfing, digesting, and destroying pathogens. The process of phagocytosis is shown in Figure 33-3.

Antigen–Antibody Reaction

Lymphocytes produce antibodies during the antigen–antibody reaction. **Antibodies**—protein substances produced by lymphocytes in the spleen, lymph nodes and tissue, and the bone marrow—react in response to antigens (foreign substances/pathogens). Antibodies have the ability to neutralize

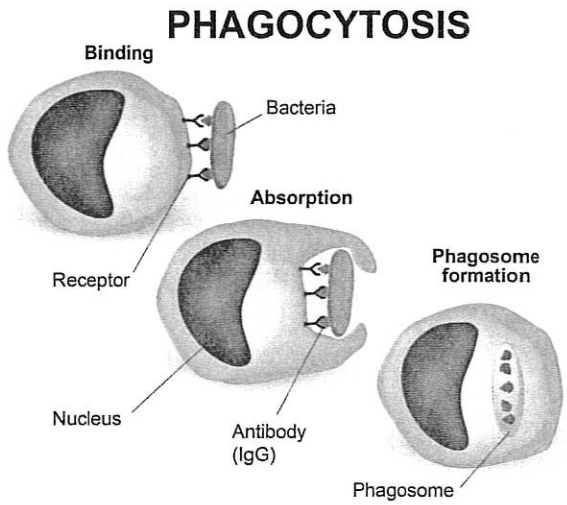


FIGURE 33-3 The process of phagocytosis: a phagocyte engulfing bacteria or other foreign material.

antigens or make them more susceptible to phagocytosis. The antigen–antibody reaction occurs in response to an invasion of antigens.

Immunity

The body has a natural protective mechanism called immunity. **Immunity**, a resistance to disease, is said to have occurred when enough antibodies have been produced to provide protection for weeks, months, or years. Immunity is either innate, active, or passive. Table 33-4 describes the types of immunity.

TABLE 33-4 | **Types of Immunity**

Type	Description
Innate	Sometimes called natural immunity. It is the body's first line of defense against pathogens including skin, mucous membranes, and tears.
Active	Either acquired or artificially acquired: **Acquired active**—a person is immune to a disease because that person has been previously exposed and has developed appropriate antibodies. **Artificially acquired active**—immunity induced through a vaccine.
Passive Immunity	A temporary form of immunity—such as antibodies that are passed from a mother to an infant through breast milk.

INFECTION CONTROL: PRECAUTIONS AND STANDARDS

Several government agencies have developed guidel precautions, and standards to protect patients and health care workers from exposure to pathogens. The guidelines have changed and will continue to evolve as advances are made in what we know about preventing the spread of infection. Although many of these guidelines were first established for health care workers and the care of patients in hospital settings, today these practices are implemented in all medical facilities, including physicians' offices. As a medical assistant, you will need to understand the importance of infection-control guidelines, standards, and precautions as you interact with patients and consistently take the recommended precautions on a daily basis.

Universal Precautions

In the early 1980s, the United States was experiencing an epidemic of the human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS), the disease that HIV causes. At the same time, there was increasing awareness of hepatitis, an infection of the liver, especially the B strain of the hepatitis virus (HBV). Table 33-5 discusses forms of hepatitis and HIV, and Box 33-1 provides considerations for caring for a person with HIV or AIDS.

In 1985, the Centers for Disease Control and Prevention (CDC) established **universal precautions** to protect health care workers and patients from HIV, HBV, and other **bloodborne pathogens**. The theory behind universal precautions was simple—treat all blood and bodily fluids as if they are contaminated. Later, the CDC included the precaution that all moist body secretions should be considered contaminated (except sweat). Practices that surrounded universal precautions included proper hand hygiene and the use of gloves when handling blood or performing invasive procedures, such as venipuncture.

Standard Precautions

Standard precautions have been developed by the CDC, which recommends using these precautions when caring for all patients, whatever their diagnosis. As with universal precautions, the guidelines for standard precautions apply to all blood, body fluid secretions, and excretions except sweat, whether blood is visible or not. The original guidelines had to do with handwashing and use of **personal protective equipment (PPE)** such as gloves, gowns, and masks whenever touching or exposed to patients' body fluids. Box describes bloodborne pathogen training.

TABLE 33-5 | **Hepatitis and HIV/AIDS**

Virus	Means of Transmission	Incubation Period	Signs and Symptoms	Vaccination Available
Hepatitis A (HAV)	• Fecal/oral route—such as food contaminated with fecal material. This is the most common means of transmission. • Sexually transmitted.	• 14–50 days, slow onset of symptoms.	• Fever, loss of appetite, jaundice, nausea, vomiting, malaise, dark urine, and whitish stools.	• Vaccination is available for ages 12 months and up.
Hepatitis B (HBV)	• Contact with contaminated body fluids, including blood, semen, and saliva.	• 60–90 days, rapid onset of symptoms.	• Fever, loss of appetite, jaundice, nausea, vomiting, malaise, dark urine, and whitish stools. • 30 percent of individuals have no signs or symptoms. • Can lead to a lifelong infection, scarring of the liver, liver cancer, or liver failure and death.	• Vaccination is available in a series of shots between the ages of birth and 18 years of age. • High-risk groups such as health care workers and public safety workers generally receive the vaccination.
Hepatitis C (HCV)	• Contact with contaminated blood—particularly through the sharing of needles. • Can be passed from mother to baby during the birth process.	• 6–10 weeks.	• About 80 percent of infected individuals do not develop signs and symptoms. • If symptoms do develop, they mimic HAV and HBV.	No vaccine available.
Human Immunodeficiency Virus and Acquired Immunodeficiency Syndrome (HIV and AIDS)	• Sexual contact. • Can be passed from mother to baby. • Contact with contaminated blood.	Varies by individual; in some, the incubation period can be 6 months up to many years.	• HIV virus may develop into acquired immunodeficiency syndrome (AIDS). • Symptoms before the development of AIDS include loss of appetite, weight loss, diarrhea, skin rash, fatigue, night sweats, swollen lymph glands, poor resistance to infection.	No vaccine.

Hand sanitizing is one of the best means of reducing the spread of microorganisms in a health care facility and at home. Hand hygiene recommendations include not wearing artificial fingernails or extenders when having direct contact with high-risk patients. Natural fingernails should be kept short: less than one-quarter inch long.

In 2007, the CDC issued several new elements to be added in standard precautions. These guidelines involve three areas of practice: respiratory hygiene/cough etiquette,

Professionalism The Life Span

Infants, especially those under 3 months of age, and older adults are more prone to infection. Infants' immune systems are underdeveloped, and the immune systems in older adults are slowing down and decreasing in function. In addition, older adults often do not eat nutritionally sound meals, which further weakens their resistance to infection.

BOX 33-1 | Caring for Someone with HIV or AIDS

To protect themselves from infection, health care workers and caregivers should be reminded to do the following:

- Handle all needles with care. Never recap needles or remove needles from syringes. Dispose of all needles in puncture-proof containers out of the reach of children.
- Wear gloves when in contact with blood, blood-tinged body fluids, urine, feces, or vomit.
- Perform hand hygiene after removing gloves.
- Cover with a bandage any cut, open sore, or breaks on exposed skin of either the patient or the caregiver.
- Flush down the toilet all liquid waste containing blood, using care to avoid splashing during pouring. Nonflushable items such as paper towels, sanitary pads and tampons, wound dressings, or items soiled with blood, semen, or vaginal fluid should be enclosed in a plastic bag and tightly sealed. Check with your local health department or physician to determine trash disposal regulations for your area.
- Use a disinfection solution of 1 part bleach to 10 parts water to disinfect such items as floors, showers, tubs, and sinks. Discard the solution in the toilet after using. The application of heat treatment at 132°F (56°C) for 10 minutes can also be implemented.

To protect the person with AIDS from infection:

- If the caregiver has a cold or flu, and no one else is available to care for the AIDS patient, a surgical-type mask should be worn.
- Hands should be washed before touching the AIDS patient.
- Anyone with boils, fever blisters (herpes simplex), or shingles (herpes zoster) should avoid close contact with the patient.
- Gloves should be worn if the caregiver has a rash or sores on the hands.
- Persons living with or caring for an HIV/AIDS patient should have received all the recommended childhood immunizations and booster shots, including the hepatitis vaccine.
- The AIDS patient should not be in the same room with a person who has, or is recovering from, chickenpox or shingles.

The caregiver should also do the following:

- Call the local HIV/AIDS service organization for support.
- Seek the help of clergy, counselors, and other health care professionals to cope with feelings of frustration and stress.
- Be comfortable touching the person with HIV/AIDS.
- Encourage the patient to become involved in his or her own care, and assist the patient in being active as long as possible.
- Freely discuss the disease with the patient.

For more information on HIV or AIDS, write to the CDC National AIDS Clearinghouse, P.O. Box 6003, Rockville, MD 20849-6003; CDC Control and Prevention, 1600 Clifton Road, N.E., Atlanta, GA 30333; or call 1-800-CDC-INFO (1-800-232-4636).

BOX 33-2 | Bloodborne Pathogen Training

Bloodborne pathogen training is required by the Occupational Safety and Health Administration (OSHA) of all employees and students who have the potential for being exposed to bloodborne pathogens. Training includes discussion of pathogens that include, but are not limited to, hepatitis B (HBV), hepatitis C (HCV), and human immunodeficiency virus (HIV). Ways to prevent sharps-related injuries are also discussed, as these injuries may expose workers to bloodborne pathogens. Courses are sometimes developed by employers or presented by consultants. In these courses, health care personnel—including those who do housekeeping—who are at risk for exposure to bloodborne pathogens learn about the risk factors and ways to prevent exposure. A certificate of completion is usually filed in the employee personnel file as evidence of training. For more information, see www.osha.gov/SLTC/bloodbornepathogens/index.html or by contacting OSHA at 1-800-321-OSHA (6742). Your instructor may require you to get bloodborne pathogen training as part of your education. Save your certificate of training to show potential future employers.

safe injection practices, and the use of masks when there is a risk of splashing.

The current complete set of standard precautions, therefore, concern:

1. Hand hygiene, including handwashing with soap and water or the use of alcohol-based hand rubs.
2. Personal protective equipment to include, as appropriate for the situation, gloves, gowns, face masks or shields, protective eyewear, and respirators.
3. **Respiratory hygiene/cough etiquette**—Respiratory hygiene/cough etiquette is designed to reduce the transmission of pathogens from patients, family members, friends, and any other persons entering a health care facility with signs of illness, cough, congestion, or rhinorrhea (runny nose). The guidelines suggest that signs be posted reminding people to cover their mouth or nose when coughing, to dispose of tissues appropriately, to perform hand hygiene after contact with respiratory secretions, to use a r[illegible] when appropriate, and whenever possible to provide

at least 3 feet of space between persons with respiratory infections.

Safe injection practices—Safe injection practices include the use of aseptic technique and the employment of single-use items (needles, syringes, and whenever possible single-dose vials for parenteral medication). No multidose vials should be kept in the immediate treatment area.

5. The use of masks to cover the face and reduce the risk of splash when inserting catheters or when performing procedures involving lumbar puncture.

While practicing standard precautions, it is important to remember that some patients may be latex-sensitive. Before touching a patient while wearing latex gloves, ask if the patient has a history of latex sensitivity. High-risk patients, such as those with congenital defects and indwelling catheters, must always be assessed for latex sensitivity, which can develop after repeated exposures to latex. Patients with allergies to bananas, chestnuts, kiwi, and avocados may have cross-sensitivity to latex. Therefore, it is prudent to ask about those allergies as well. Symptoms to latex sensitivity include contact dermatitis, swelling, itching, and rhinitis (a runny nose) and may, in some cases, include anaphylaxis (a life-threatening allergic reaction).

Professionalism The Workplace

Wearing excessive jewelry, long fingernails, artificial nails, nail polish, or long hair can harbor microorganisms and cause contamination. Allow your patients and coworkers to view you as someone who maintains immaculate personal hygiene technique and image at all times.

Latex-free gloves, syringes, IV tubing, and solution bags should always be available to meet the needs of the patients and the health care providers.

Standard precautions equipment and examples of situations in which they must be used are found in Box 33-3. Figure 33-4 summarizes standard precautions for all patient care.

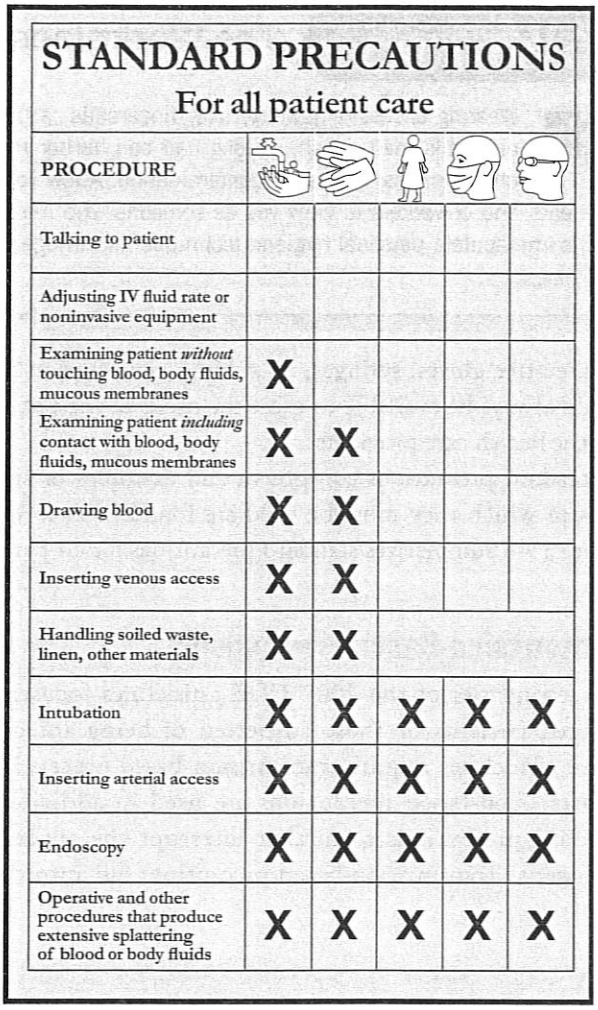
Transmission-Based Precautions

The second tier of the 2007 CDC guidelines focuses on infected patients or those suspected of being infected. These guidelines require transmission-based precautions. Transmission-based precautions are used in addition to standard precautions to further interrupt the spread of pathogens. Transmission-based precautions fall into three

BOX 33-3 | Summary of Standard Precautions

1. Wear gloves when there is potential for exposure to blood or body fluids, secretions, excretions, or contaminated items. This includes performing routine clinical work, touching mucous membranes and the nonintact skin of patients, and handling tissue and clinical specimens (Figure 33-4).
2. Wear gloves when drawing blood, including finger-stick and heel-stick on infants, and during preparation of blood smears.
3. Wear protective barrier equipment (e.g., face mask, eye shield, or goggles) when there is any risk of splashing, splattering, or aerosolization (becoming airborne in small particles) of potentially infectious body fluids.
4. Change gloves after each patient. Perform hand hygiene before putting on gloves and after removing them.
5. Change gloves if they become contaminated with blood or other body fluids, and discard them in a biohazards collection container.
6. Wash hands and other skin surfaces immediately or as soon as possible if they become contaminated with potentially infectious blood or body fluids.
7. Care for linens and equipment that are contaminated with blood, blood products, body fluids, excretions, and secretions in a manner that avoids contact with your skin and mucous membranes or cross-contamination to another person.
8. Wear a mask if the patient has an airborne disease. A special mask is recommended if a patient has an active case of tuberculosis.
9. Use care with needles, scalpels, and other sharp instruments to avoid unintentional injury.
10. Dispose of needles and other sharp items in a rigid, puncture-proof sharps container.
11. Do not recap or handle used needles.
12. Store reusable sharp instruments and needles in a puncture-proof container.
13. Avoid the direct mouth-to-mouth resuscitation technique in all but life-threatening situations. Use a mechanical device or mask barrier instead.
14. Use a solution of household bleach (1:10 dilution) to disinfect surfaces (countertops and exam tables) and reusable equipment.
15. Use hazardous waste containers for contaminated materials.

Note: Adapted from Guidelines for Isolation Precaution in Hospitals, developed by the Centers for Disease Control and Prevention and the Hospital Infection Control Practices Advisory Committee, January 2002.



STANDARD PRECAUTIONS
For all patient care

PROCEDURE					
Talking to patient					
Adjusting IV fluid rate or noninvasive equipment					
Examining patient *without* touching blood, body fluids, mucous membranes	X				
Examining patient *including* contact with blood, body fluids, mucous membranes	X	X			
Drawing blood	X	X			
Inserting venous access	X	X			
Handling soiled waste, linen, other materials	X	X			
Intubation	X	X	X	X	X
Inserting arterial access	X	X	X	X	X
Endoscopy	X	X	X	X	X
Operative and other procedures that produce extensive splattering of blood or body fluids	X	X	X	X	X

FIGURE 33-4 Standard precautions.

categories: airborne precautions, droplet precautions, and contact precautions.

- **Airborne precautions** are designed to reduce the transmission of certain diseases, such as TB, measles, or chickenpox. Airborne precautions are used when patients are infected with pathogens that are transmitted via airborne droplet nuclei (smaller than 5 microns), pathogens that can remain suspended in air and can be widely dispersed throughout a room by air currents. Airborne precautions often involve patient isolation (in a private room if hospitalized) and require use of mask and gown by all health care personnel who come in contact with the patient. When these precautions are used, the risk of transmitting diseases such as TB and chickenpox is reduced. Handwashing and gloves are required as well. Patient transport should be limited, with the patient wearing a mask during transport. All reusable patient care equipment should be cleaned and disinfected before use on another patient. Disposable items should always be used if available. Special masks (N95 and TB masks) may be used to protect a caregiver from those who have certain microbes that are small enough to enter regular surgical masks. Masks should be changed if they become wet. Check the CDC website (www.cdc.gov) for information about what personal protective equipment (PPE) should be used with patients.
- **Droplet precautions** are used for patients suspected of being infected with organisms spread by droplets during sneezing, coughing, and talking. Some examples are *Haemophilus influenzae* type b, meningitis, pneumonia, pertussis, and streptococcal pneumonia. A mask should be worn if the health care worker is within 3 feet of an infected patient. Gown and gloves are worn if there is a chance of coming into contact with blood or body fluids of suspected patients. Transport of the patient should be limited. All reusable equipment should be cleaned and disinfected.
- **Contact precautions** are specialized precautions used when infections are both difficult to treat and the likelihood of microorganism transmission among patients and health care providers is high. These precautions include isolating patients and wearing gowns and gloves. If there is a chance of coming in contact with body fluids, a mask and protective eyewear should be worn. Health care providers should be aware that some diseases are transmitted by several routes, and all precautions should be taken. Conditions such as intestinal infections, hepatitis, open wounds, respiratory infections, herpes, scabies, and pediculosis are all treated using contact precautions.
- **Radiation isolation precautions**, although not done specifically for infection control, isolate a patient who has received radiation from other people who radioactivity might harm through distance. Those caring for these individuals will usually spend very little time with the patient, stay as far away from the patient as possible, and wear a dosimeter to measure their radiation exposure from the patient.

Bloodborne Pathogen Standard

The Occupational Safety and Health Administration (OSHA) is the main federal agency that enforces safety and health legislation. Much as the CDC developed guidelines regarding the epidemic of HIV and HBV, as well as other bloodborne pathogens such as *Staphylococcus* (staph) and *Streptococcus* (strep), OSHA developed the Bloodborne Pathogen Standard in 1991. The standard was aimed at minimizing exposure of health care workers to harmful bloodborne

pathogens. In 2000, the United States Congress passed the Needlestick Safety and Prevention Act, which was created in response to the overwhelming number of exposure incidents each year. In turn, OSHA updated its Bloodborne Pathogen Standard to reflect necessary changes brought about by this new act. Engineered controls like sharps containers must be available to protect health care professionals from accidental sticks from used needles, but fundamentally health care workers must have safe practices with sharps that include using equipment that automatically recaps or retracts, never breaking a needle, and always immediately disposing of used needles in a sharps container like the one shown in Figure 33-5. The OSHA guidelines apply to facilities in which the employees could be "reasonably anticipated" to come into contact with potentially **infectious** materials (materials that can spread infection). An exposure control plan must be implemented in each facility and evaluated yearly, and must include the following:

- An exposure control plan that would reduce occupational exposure that details employee protection measures.
- Use of engineering controls such as availability of gloves (sterile and nonsterile of various sizes), safety needles, disposable cannula, sharps containers, sinks and running water, and biohazard containers. These control measures should be routinely updated for newer and safer devices.
- Employment of work practice controls such as the use of PPE and clothing, proper training, availability of hepatitis B vaccinations, and proper signage and labels.
- Exposure determination indicating job classifications and the possibility of exposure.
- Methods of compliance that document safety measures that would decrease the risk of exposure.
- **Postexposure evaluation**—procedures that would follow in the event of an exposure.

FIGURE 33-5 Sharps containers.

In addition to the exposure control plan, the Bloodborne Pathogen Standard also requires that strict record keeping be enforced including a log of sharps containers and a log of incidents of occupational exposure or illnesses. Routine and documented employee input must also be recorded. The employees (nonmanagerial) are able to provide ideas and recommendations regarding the practices of the office including safety measures, engineering controls, and safer medical devices. Safe housekeeping practices including the use of appropriate containers, bags, and procedures are also a component of the Bloodborne Pathogen Standard. See Procedure 33-1, Disposing of Biohazardous Material.

INFECTION CONTROL: PHYSICAL AND CHEMICAL BARRIERS

Effective physical and chemical barriers can be used to maintain infection control. The development of a nosocomial infection, or health care–associated infection (HAI), is prevented when careful medical and surgical asepsis (sterile equipment and procedures) are maintained.

Medical Asepsis

Medical asepsis refers to the destruction of organisms after they leave the body. (By contrast, surgical asepsis, which we discuss next, refers to the destruction of organisms before they enter the body.) Techniques such as hand hygiene (one of the most effective means of reducing pathogen transmission), using disposable equipment, and wearing gloves can help reduce the transfer of pathogens. Aseptic techniques are the fundamental means of providing a safe environment in medical facilities.

Ordinary hygiene habits of everyday life, such as covering your mouth during a cough or sneeze, are forms of medical asepsis. These ordinary hygiene habits include handwashing when handling food or after using the bathroom. Hand hygiene is considered the first step in infection control because the hands are a primary means of transferring

PROCEDURE 33-1

Disposing of Biohazardous Material

Objective *Properly dispose of biohazardous material.*

EQUIPMENT AND SUPPLIES

Infectious waste container with lid marked appropriately with universal biohazard symbol and label; red disposable plastic liners; gloves

METHOD

1. Check to ensure that the infectious waste container is lined with a red disposal plastic bag.
2. Discard any infectious waste into the infectious waste container.
3. Make sure that all liquid waste is already contained in a closable device or container before putting it into the infectious waste container.
4. Do not put contaminated glass or glass of any kind into the infectious waste bag. Instead, all glass should be placed into a puncture-proof or very highly puncture resistant container for disposal; small glass items can be deposited into a sharps container for disposal.
   a. Needles and syringes should never be recapped and always placed immediately into an appropriately labeled, puncture-proof sharps container after activating the safety device mechanism on the needle or syringe.
5. When the infectious waste container becomes full, close the red trash bag by tying with a securing knot, twist-tying, or otherwise securing it (Figure A).
6. Make sure that the contents of the red bag are completely contained inside the closed bag.
7. Make sure the red bag is not overstuffed so that it cannot be closed, ruptured when handled or lifted, opened, or leak.
   a. If necessary, double-bag the infectious waste bag if there is a small rupture or tear; or when office protocol dictates. Two people should always perform this task to ensure contamination does not occur (Figure B).
8. Do not mix noninfectious trash in the same large bin, container, or dumpster with infectious waste or trash. (Figure C).
9. Closed red bags should be transported from the point of waste generation to a dirty utility room or area and stored in a designated holding area that cannot be accessed by other than authorized staff until they are transported away from the facility. Never store trash in hallways, entrances, corridors, or other areas accessible to and used by the public (Figure D).

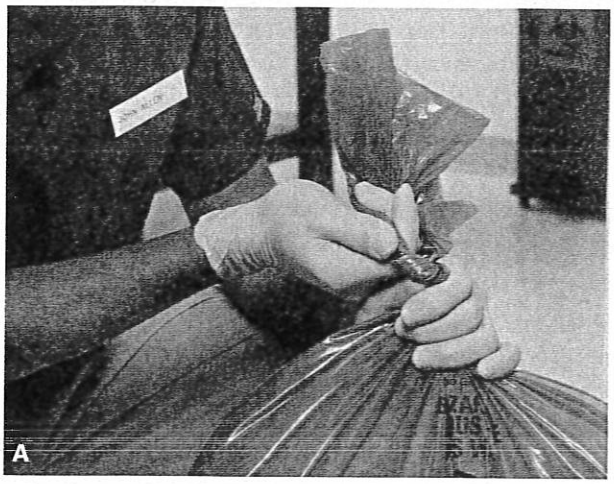
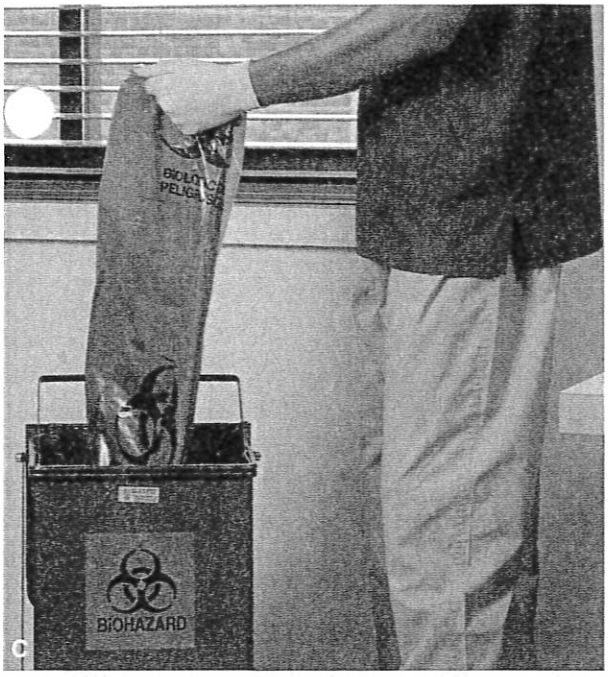


FIGURE A–B **(A)** Always secure the bag by tying a sturdy knot. **(B)** With a coworker, double bag the infectious waste if necessary.



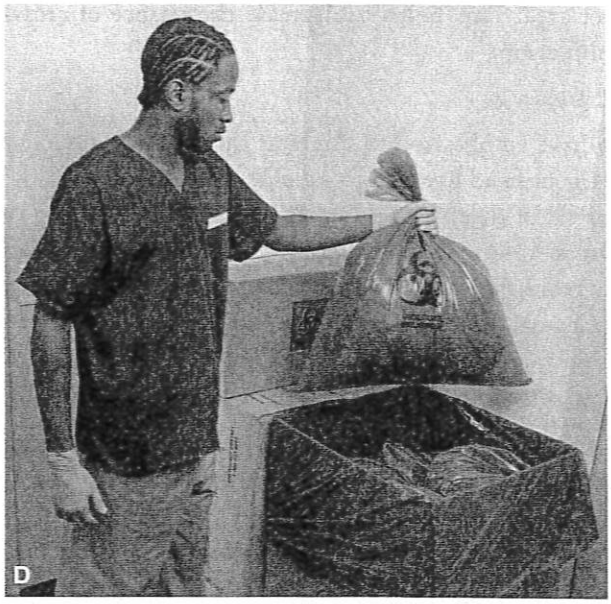


FIGURE C–D (C) Place a new biohazard bag in the empty biohazard container. **(D)** Place the properly secured red biohazard bag in the specified area for proper disposal.

infection from the host to the receiver. To keep the skin free of harmful organisms, frequent hand hygiene is necessary—either with soap, friction, and warm running water or with alcohol-based hand sanitizers. Jewelry should be removed before performing hand hygiene or applying gloves.

Situations that should involve medical asepsis include but are not limited to taking oral, aural, and rectal temperatures; obtaining throat or vaginal cultures or smears; performing venipuncture; obtaining urine, stool, or sputum specimens; administering medications; and cleaning treatment rooms.

Preventing infection and causing a break in the chain of infection can be achieved by practicing the following suggested forms of medical asepsis:

- Wash hands before and after any contact with patients or equipment.
- Handle all specimens and materials as though they contain pathogens.
- Use gloves for protection when handling contaminated articles or materials, such as specimens or instruments that have been used during a procedure.
- Do not wear jewelry that can attract and harbor bacteria.
- Use disposable equipment whenever possible, and dispose of all equipment properly after use.
- Clean all nondisposable equipment as soon as possible after patient use, using an approved disinfectant and while wearing appropriate gloves.
- Use only clean or sterile supplies for each patient.
- Use a protective covering over clothes if there is any danger of contaminated materials or supplies coming into contact with them.
- Discard items that fall on the floor if they cannot be cleaned. Any item dropped on the floor must be resterilized or redisinfected before use. All floors are considered contaminated. If in doubt, throw it out!
- Place all wet or damp dressings and bandages in a waterproof bag to protect the persons handling the waste removal.

Medical asepsis relates not only to equipment and instruments but also to other aspects of the facility. Having proper ventilation in all areas of the medical office will assist in decreasing the transfer of microorganisms. All examination rooms, including table surfaces, should be cleaned with an approved disinfectant after each patient contact. Checking and emptying trash cans, replacing sharps containers in a timely manner, and observing for any insect infestation are also means of maintaining medical asepsis.

Some medical offices have one reception area for well patients and another for sick patients. For example, a patient

who is returning for a follow-up visit is seated in one area, and a patient with symptoms of the flu is seated in another area. This helps to decrease the chance of cross-contamination.

Hand Hygiene

As we have emphasized throughout this chapter, frequent and diligent hand hygiene provides the first defense against the spread of disease and should be done often. Refer to Procedure 33-2 and Figures A–D for a demonstration of proper handwashing procedure and technique. It is also important to moisturize your hands to prevent cracking or breaks in the skin. Breaks in the skin provide a means of entry for pathogens.

Alcohol-Based Hand Rubs. The CDC has presented some new guidelines concerning the use of alcohol-based (waterless) hand rubs. These rubs have the advantage of not requiring rinsing, and many contain emollients that moisturize and prevent drying of the skin. A disadvantage, however, is that they may be more expensive than hand soaps and may cause stinging if there is an abrasion on the skin.

The CDC guidelines suggest that the alcohol-based hand rubs can be used at the times usually required for handwashing. However, the hands should always be washed with soap and water:

- Every third time hand hygiene is performed
- If they are visibly soiled with dirt or body fluids
- Before eating
- After using the restroom

As with regular handwashing, jewelry should be removed before using the hand rubs. Approximately 2 to 3 ml of the gel should be placed in the palm of the hand and thoroughly spread over the surface of both hands up to ½ inch above the wrist (Figure 33-6). Continue to rub the hands together until dry, approximately 15 to 30 seconds. Waterless hand sanitizers kill 99.9 percent of common microorganisms in 15 seconds. Recent studies indicate, however, that waterless hand sanitizers may not be effective against certain microorganisms, including the norovirus and *Clostridium difficile*, or *C-diff*. Manufacturers' instructions regarding the use of alcohol-based hand rubs should be followed exactly.

Performing Handwashing

Objective ◆ *Perform handwashing procedure without error.*

EQUIPMENT AND SUPPLIES

Soap in liquid soap dispenser; nail cleaner (brush or orange cuticle stick); warm running water; paper towels; waste container

METHOD

1. Remove any jewelry (includes rings with the exception of a plain wedding band). Artificial nails must be removed to maintain infection control practices.
2. Stand at the sink without allowing clothing to touch the sink. Turn on the faucet while holding a paper towel to prevent contamination. Or, if it is available, turn on the water with the foot or knee pedal. Adjust the running water to a moderately warm temperature (Figure A).
3. Wet hands under running water and place liquid soap (1 teaspoon, or about the size of a nickel) into the palm of hand. Work soap into a lather by moving it over the palms, sides, and backs—the entire surface—of both hands for 20 to 30 seconds. Use a circular motion and friction. Interlace the fingers and move soapy water between them.
4. Keep the hands pointed down with hands and forearms below elbow level during the entire handwashing procedure. Water should always flow from the forearms down, never from the hands up. This also prevents contamination (Figure B).
5. Use nail cleaner (brush or orange cuticle stick) to clean under fingernails at the start of each day and if hands are heavily soiled (Figure C).
6. Rinse hands under running water with fingers pointed down, using care not to touch the sink or faucets.
7. If hands are heavily soiled, reapply soap and wash them again.
8. Rinse hands under running water.
9. Dry hands thoroughly with a paper towel without touching the paper towel dispenser. Discard the paper towel into a trash can that can be opened with a foot pedal.
10. Use a dry paper towel to turn off the faucet if the foot or knee pedal is not available (Figure D).
11. Apply an antibacterial hand lotion to prevent chapping skin.

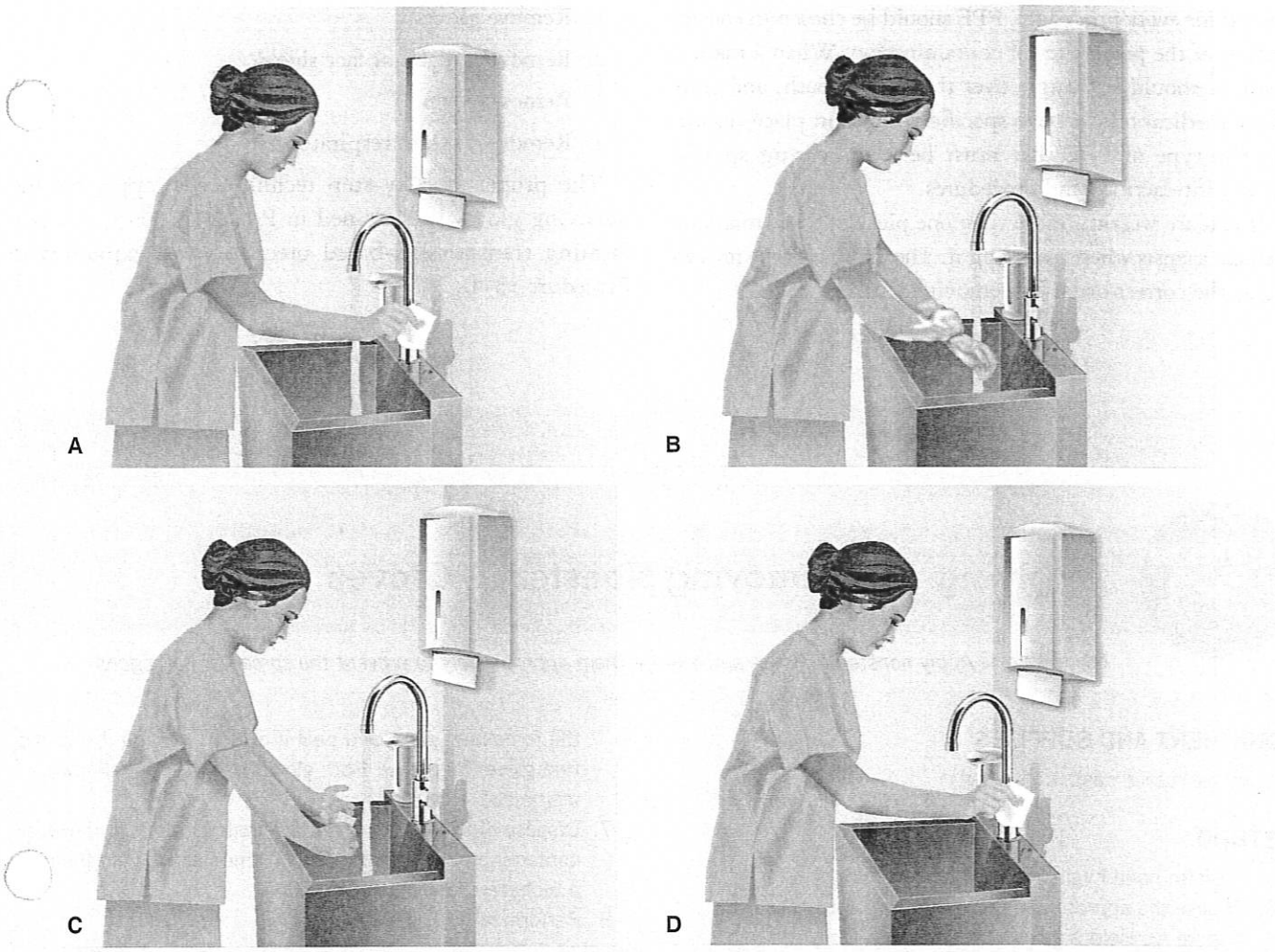


FIGURE A–D (A) Turn on the faucet with a paper towel and stand away from the sink so that your clothing is not touching the sink. **(B)** Hands and forearms should always face down below the elbow. **(C)** Use a nail brush or cuticle stick to clean under the fingernails. **(D)** Using a paper towel, turn off the faucet.

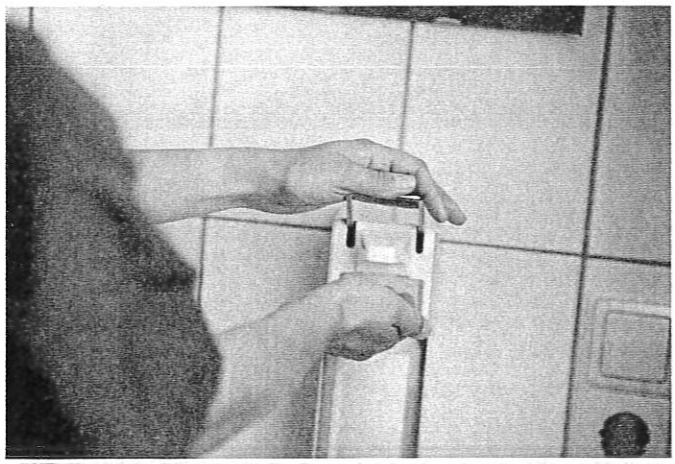


FIGURE 33-6 Dispense 2–3 ml of hand sanitizer into the palm of the

Protective Clothing and Personal Protective Equipment

Protective clothing and equipment, such as gowns, gloves, and masks, are worn for two reasons:

1. To protect the patient from any microorganisms that might be present on the health care worker's uniform
2. To protect the health care worker from carrying microorganisms away from the patient

In addition, protective devices, such as gloves and masks, assist in protecting the health care worker from contamination with bloodborne pathogens. Nonsterile gloving technique is used for procedures such as drawing blood and specimen collection. Wearing each piece of PPE will not be

needed for every procedure. PPE should be chosen in consideration of the possibility of contamination. When a mask is worn, it should fit snugly over the nose, mouth, and chin. Many medical offices have specific policies in place regarding the type of PPE that must be worn during specific patient interactions and procedures.

If you are wearing more than one piece of PPE, maintain medical asepsis when removing it. The CDC lists the following as the correct order for removing PPE:

1. Remove gloves.
2. Remove goggles or face shield.
3. Remove gown.
4. Remove mask or respirator.

The proper step-by-step technique for applying and removing gloves is explained in Procedure 33-3, and performing transmission-based precautions is explained in Procedure 33-4.

PROCEDURE 33-3

Applying and Removing Nonsterile Gloves

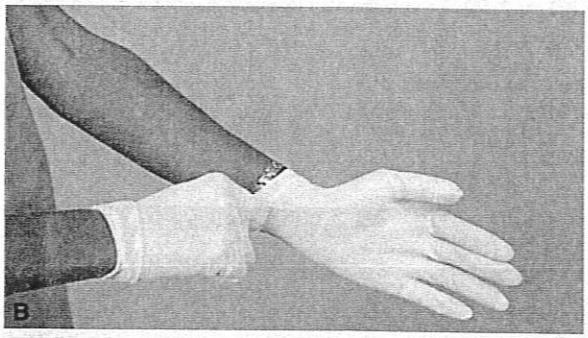
Objective *Apply nonsterile gloves and remove them appropriately to prevent the spread of pathogens.*

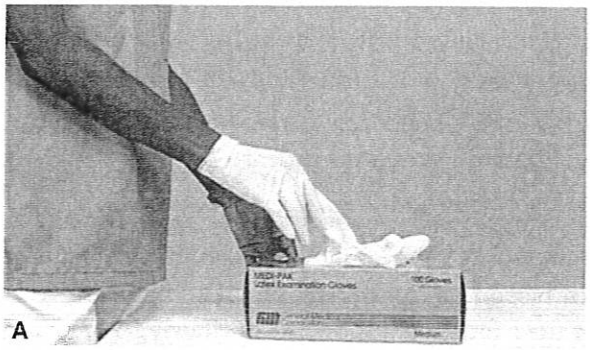
EQUIPMENT AND SUPPLIES

Gloves; biohazard waste container

METHOD

1. Perform hand hygiene (see Procedure 33-2).
2. Choose the appropriate size gloves for your hands (Figure A). Hold a glove at the wrist opening and insert fingers, pulling the glove up to wrist.
3. Apply the second glove in the same manner, checking for holes and other flaws (Figure B). If any flaws are found, discard the gloves and obtain new gloves.
4. To remove gloves, grasp the glove covering your nondominant hand at the palm and pull it away (Figure C).
5. Pull the glove off, and hold it in the palm of the gloved dominant hand (Figure D).
6. While holding the soiled glove in your gloved hand, slide the index finger of the ungloved hand below the cuff of the remaining glove and peel it down, inverting it over the first glove (Figure E). Both gloves will be in a ball and inside out.
7. Dispose of the gloves in a trash container unless they are contaminated by biohazards, in which case place them a biohazard container.
8. Perform hand hygiene.





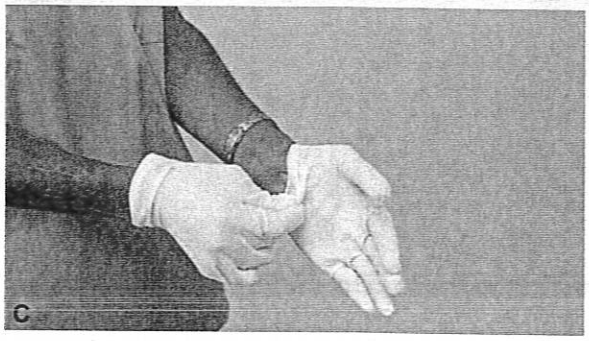
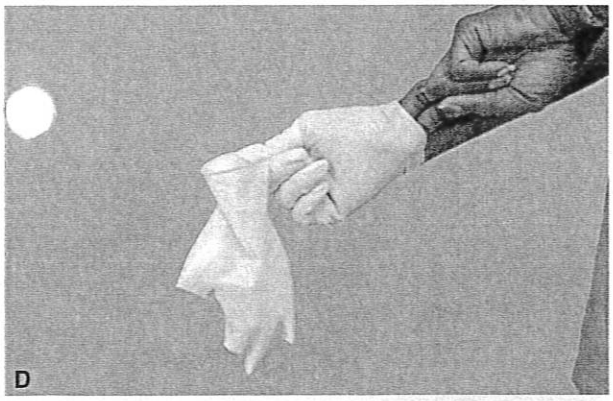


FIGURE A–C **(A)** Use a clean pair of gloves for each patient contact. **(B)** Grasp the glove just below the cuff. **(C)** Pull glove over the hand while turning the glove inside out.



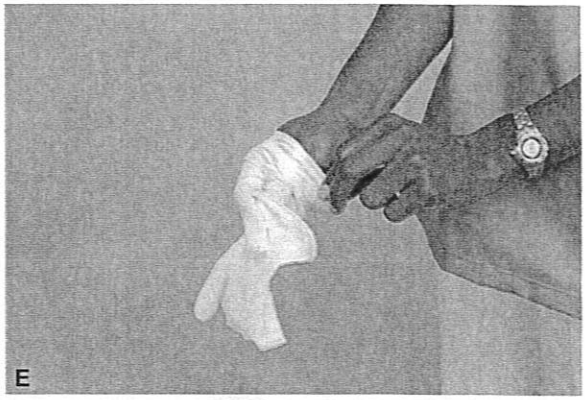


FIGURE D–E (D) Place the ungloved index and middle fingers inside the cuff of the glove, running the cuff downward. **(E)** Pull down the cuff and turn the glove inside out as you remove your hand.

PROCEDURE 33-4

Selecting and Using Personal Protective Equipment (PPE)

Objective ◆ *Select appropriate barrier/personal protective equipment (PPE).*

IIPMENT AND SUPPLIES

Disposable gowns, masks, caps, nonsterile gloves, and sterile gloves; sink and running water; paper towels

METHOD

1. Review orders and agency protocols regarding isolation procedures. (Orders depend on whether patient requires isolation for TB, MRSA, radiation, or others.)

Note: Office-based medical assistants may not use transmission-based precautions often, but they should be familiar with the necessary PPE and how to put them on appropriately. Figure A shows examples of four types of PPE.

2. Assemble the necessary protective equipment that is appropriate for the level of isolation necessary based on the patient's diagnosis, signs, or symptoms.
3. Remove lab coat and jewelry.
4. Perform hand hygiene (see Procedure 33-2).
5. Apply the appropriate disposable apparel in the following order:
   a. Apply the cap to cover hair and ears completely.
   b. Apply the gown over uniform or clothing as follows: Hold the gown in front of the body, and place arms through the sleeves. Pull the sleeves on, covering the wrists. Tie the gown securely at the neck and waist.
   c. Apply the mask by placing the top of the mask over the bridge of the nose and pinching the metal strip to secure a snug fit on the nose, tying it if needed. Apply protective eyewear.
   d. Apply nonsterile gloves, pulling the cuffs of the glove up and over the cuffs of the gown, covering them completely.
6. Enter the isolation room, and perform patient tasks as needed.
7. Exit the isolation room, and immediately remove barrier protections in the following order:
   a. Untie waist of the gown.
   b. Remove gloves (see Procedure 33-3).
   c. Wash hands (see Procedure 33-2).
   d. Untie the neck of the gown. Remove the gown by pulling it down from the shoulders. Turn the gown inside out, and remove arms from the sleeves. The inside of the gown is not contaminated (Figures B and C).
   e. Holding the gown away from the body with contaminated area on the inside, fold and place it in a biohazard container (Figure D).

Note: Most isolation rooms have designated areas and appropriate receptacles near the doorway for immediate removal of protective barriers.

8. Remove protective eyewear.
9. Remove mask and discard in biohazard container.
10. Perform hand hygiene for the final time.

In Figure 33-7, the medical assistant is wearing a mask and other PPE to prevent exposure to airborne droplets from the patient who is coughing.

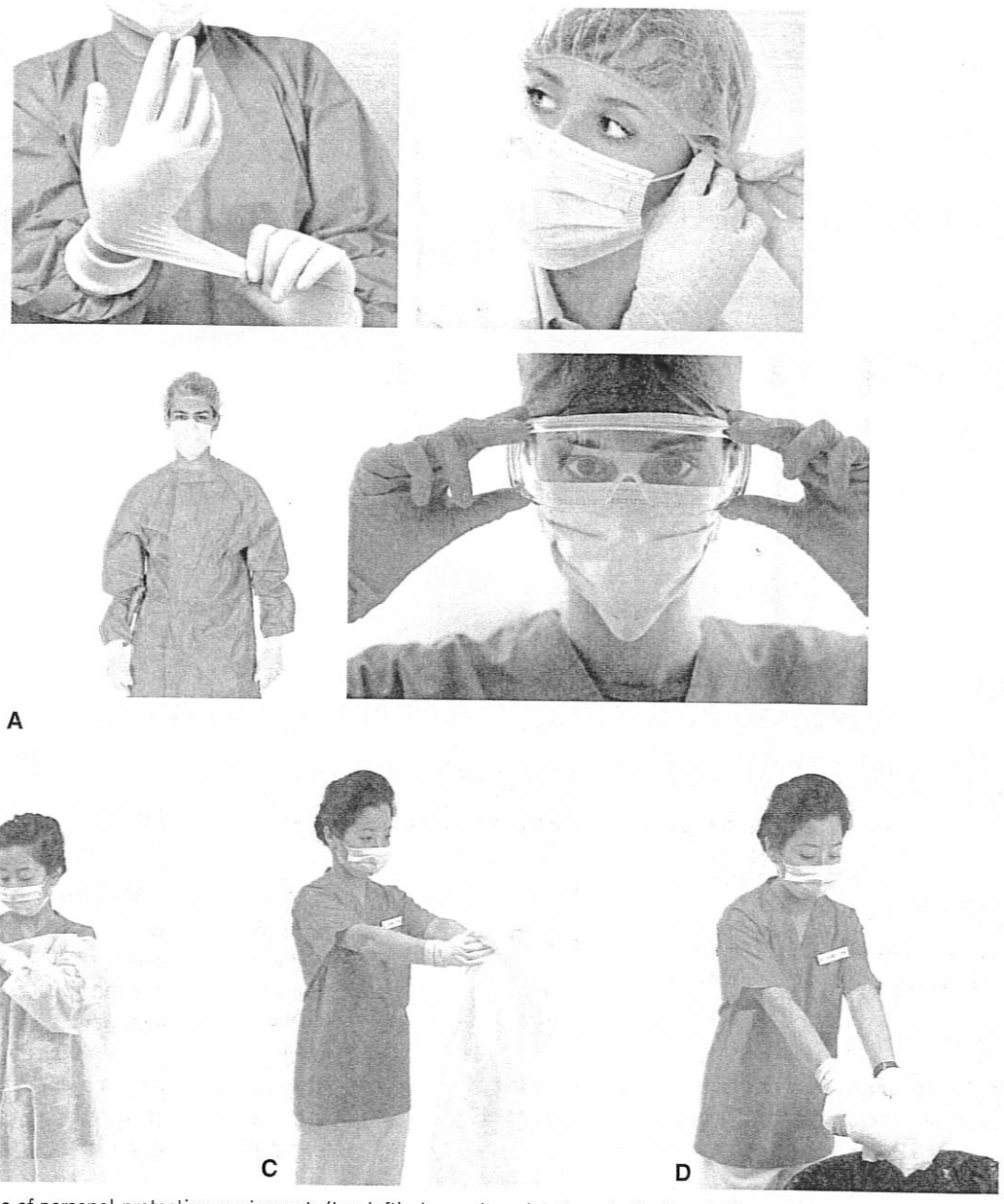


FIGURE A–D **(A)** Examples of personal protective equipment: (top left) gloves; (top right) mask; (bottom left) gown; and (bottom right) face shield (Source: StockPhotoPro). **(B)** Remove gown by pulling it down from the shoulders. **(C)** Turn the gown inside out, and remove arms from sleeves (inside of gown is not contaminated). **(D)** Holding the gown away from the body with contaminated area on the inside, fold and place the gown in a biohazard container.

In Figure 33-7, the medical assistant is wearing a mask and other PPE to prevent exposure to airborne droplets from the patient, who is coughing.

Surgical Asepsis

Surgical asepsis refers to the techniques practiced to maintain a sterile environment. As noted earlier, it involves the destruction of organisms before they enter the body. Surgical asepsis is the practices that are used to control the growth of microorganism and prevention transmission and infection. Three important methods are used to achieve sterility (the absence of microorganisms). These methods for preventing the spread of infectious pathogens in the medical facility include sanitization, disinfection, and sterilization.

Sanitization

Sanitization is a cleaning process that inhibits or inactivates pathogens through the careful cleaning of equipment and instruments to remove debris. This is accomplished by rinsing and scrubbing the instruments with a brush and a detergent with a neutral pH, such as a low-sudsing soap. After the debris has been removed, the items are rinsed in hot

FIGURE 33-7 The mask covers both the mouth and nose to prevent exposure to body fluid and airborne droplets.
(*Source:* FotoliaXIV)

water and air dried. During this process you should protect yourself by wearing thick utility gloves. Instruments and supplies should be separated so that items with sharp or pointy edges (tweezers or scissors) are kept away from other items. Hinged items should be opened completely, and the hinges should be carefully scrubbed with a smaller brush. (Many times a firm toothbrush is sufficient.) After instruments are scrubbed and rinsed in hot water, they are placed on a clean towel for air-drying. The items may also be hand dried to prevent spotting.

Although sanitization cleans items, it does not destroy microorganisms and bacteria. This process can be used for supplies and equipment that do not come into direct contact with the patient or that touch only the skin surface. If a contaminated material cannot be sanitized immediately, then it should be soaked in detergent and water according to the manufacturer's instructions. See Procedure 33-5 for one method of sanitizing instruments.

Ultrasonic Sanitization. Another means of sanitizing equipment is by using ultrasonic technology. In this case, the instruments and equipment are placed into a bath tank in which sound waves vibrate to break up the contamination. The articles are then rinsed thoroughly. Always follow the instructions of the facility procedure manual regarding the proper procedure for sanitizing instruments.

Disinfection

Disinfection destroys or inhibits the activity of disease-causing organisms, although it does not always kill spores or certain viruses. The process of disinfection involves soaking items and/or wiping items. Disinfecting agents used include chemical germicides, flowing steam, and boiling water.

Chemical germicides are often used in the medical office for disinfection. A 1:10 bleach solution is also commonly used and is very cost effective. The chemical disinfection process is referred to as a "cold" process, because

PROCEDURE 33-5

Sanitizing Instruments

Objective *Clean and sanitize instruments to eliminate any remaining visible contamination.*

EQUIPMENT AND SUPPLIES

Disposable gloves; rubber (utility) gloves; face shield or mask and goggles; plastic brushes (large and small), preferably disposable; disposable towels; sink; running water; container to hold all the instruments; low-sudsing (low-pH) detergent or germicidal agent; biohazard container

Note: Instruments should be rinsed under warm running water immediately after surgery to remove blood, body fluids, and tissue. If it is not possible to clean them immediately, instruments should be submerged in water containing a low-pH detergent.

METHOD

1. Apply both disposable and rubber gloves.
   a. If there is potential of splashing of infectious materials, don face shield or goggles and mask as necessary.
2. Place a low-sudsing (low-pH) detergent or germicidal agent in a large basin with water following manufacturer's instructions.
3. Initially rinse instruments in clear cold water in a sink or other container. Delicate and sharp instruments should be separated from general instruments (Figure A).

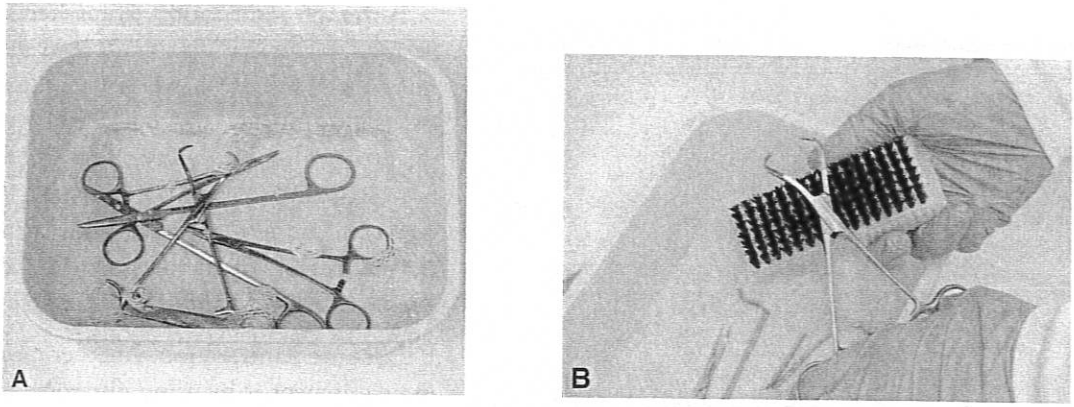


FIGURE A–B (A) Delicate and sharp instruments should be kept separated from others. **(B)** Take extra care to scrub the hinges and screws of equipment as necessary.

4. Scrub each instrument individually with a brush and detergent under running water. Open instruments to thoroughly scrub all serrated edges, crevices, and hinge areas (Figure B).
5. Rinse instruments thoroughly under hot water.
6. After thoroughly rinsing cleaned instruments, roll them in a towel and hand dry them.
7. Check the condition of all instruments for defects or any remaining soil. Take appropriate action, if required.
8. Discard disposable towels and any disposable instruments in the biohazard waste container.
9. Remove utility gloves and disposable gloves (Procedure 33-3), and perform hand hygiene (Procedure 33-2).
10. Place sanitized instruments in the appropriate area for storage, or wrap instrument(s) for sterilization, or place them in an ultrasonic cleaner.
11. If necessary, perform quality assurance reporting in necessary log books regarding sanitization practices.

heat is neither used nor generated. Chemical disinfectants used for soaking and wiping include soap, alcohol, phenol, acid, alkalines (such as bleach), and formaldehyde (Table 33-6).

When performing chemical disinfection, completely immerse contaminated instruments and equipment in a germicidal solution for the period of time stated in the manufacturer's instructions (1 to 10 hours, based on the solution).

TABLE 33-6 | **Disinfection Methods**

Method	Description and Use
Alcohol (70% Isopropyl)	Used for skin surfaces, equipment such as stethoscopes and thermometers, and table surfaces. Causes damage to rubber products, lenses, and plastic. Flammable.
Chlorine (Sodium Hypochlorite or Bleach)	Use in dilution of 1:10 (1 part bleach to 10 parts water). Used to eliminate a broad spectrum of microorganisms. Has a corrosive effect on instruments, rubber, and plastic products. Can cause skin irritation. Inexpensive.
Formaldehyde	Used to disinfect and sterilize. Dangerous product that is regulated by OSHA—must have clearly marked labels.
Hydrogen Peroxide	Effective disinfectant for use only on nonhuman surfaces and products. May damage rubber, plastics, and metals.
Glutaraldehyde	Effective against viruses, bacteria, fungi, and some spores. Regulated by OSHA—must have clearly marked labels and be used only in well-ventilated area. Must wear gloves and masks when using.

Then rinse in water and dry them. (Instruments are rinsed in distilled water to prevent rust and corrosion.)

Objects that come into contact with mucous membranes, such as vaginal speculums, laryngoscopes, or thermometers, must be disinfected; however, it is ideal if these instruments are sterilized. Instruments and equipment that cannot be soaked, such as scopes, computers, and electrical instruments, should be wiped thoroughly with a germicidal solution. Germicidal solutions must be changed frequently according to the manufacturer's instructions.

Although it is not effective for viruses (such as hepatitis) or for destroying spores, boiling water can be used as a means of disinfection. Stainless steel, glassware, and instruments can be boiled without damage. The articles are submerged in a container filled with cold water. (Distilled water should be used when boiling instruments or stainless steel to prevent sediment or deposits from forming.) The water must completely cover the articles to be disinfected. It is then brought to the boiling point. The water must continue to boil for 20 to 30 minutes for disinfection. When the boiling time has elapsed, the disinfected materials are allowed to cool. To maintain disinfection, they must be touched only with sterile forceps. Using boiling water is generally impractical, so this method is not often used for disinfection.

Antiseptics. It is also necessary to disinfectant a patient's skin before performing invasive procedures, including venipuncture, surgical procedures, and injections. This is accomplished through the use of antiseptics. **Antiseptics** inhibit the growth of microorganisms on skin surfaces. The most commonly used antiseptic is 70 percent isopropyl alcohol. However, it has been found that other antiseptics, such as povidone-iodine solution (Betadine), are safe and are more effective methods of inhibiting microorganisms.

Sterilization

Sterilization is a process that kills all microorganisms, both pathogenic and nonpathogenic. Heat sterilization (produced by an autoclave under steam pressure) can kill spores, bacteria, and other microorganisms. Dry heat is used for sterilizing dense ointments, such as petroleum jelly.

All supplies—including dressings, needles, and instruments that come into contact with internal body tissue or an open wound—must be sterile. Once a sterile article is touched by hands or another unsterile object, it is considered contaminated. Sterile gloves must be used when touching sterilized items. The procedure for applying sterile gloves (as well as nonsterile gloves) is sometimes referred to as donning.

Autoclave. The methods used for sterilization include the autoclave (steam and pressure) and chemical (cold) sterilization. Most medical offices use the autoclave for sterilization. Types of autoclaving include steam under pressure, dry heat (320°F for 1 hour), dry gas, and radiation.

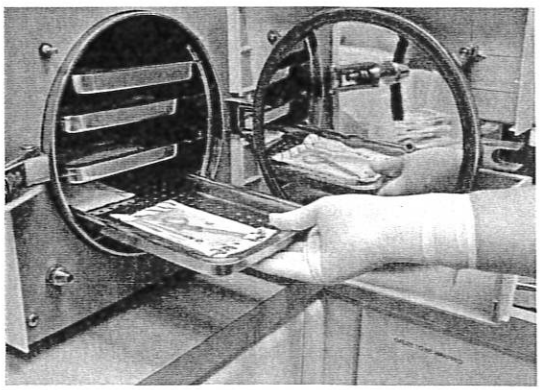


FIGURE 33-8 An autoclave.

The high heat and moisture caused by the steam, which settles on the instruments during the autoclave cycle, causes the cells of the microorganisms to explode, thus killing the microorganisms. This method of sterilization requires 15 pounds of pressure per square inch (PSI) and a temperature of 250°F to 270°F, depending on the manufacturer's recommendations. Heat is actually transferred to the items by way of the steam condensation through the use of distilled water. Steam sterilization of surgical packs is not effective if air pockets are present within them. The autoclave consists of an outer chamber (jacket) that creates a buildup of steam that is forced into an inner chamber. Items that are to be sterilized are placed inside the inner chamber. (Figure 33-8 is an example of an autoclave.)

Depending on the model, an autoclave may have three gauges (some have only one):

1. A jacket pressure gauge to indicate pressure in the outer chamber
2. A chamber pressure gauge to indicate the steam pressure in the inner chamber
3. A temperature gauge to indicate the temperature in the inner chamber in which items are placed

A pump within the autoclave will first remove air from the outer chamber. Once the air is removed from the outer chamber, the pressure level and temperature levels within the autoclave chamber can begin to rise. Therefore, the gauges indicating pressure and temperature must be monitored by the medical assistant. Table 33-7 describes autoclave sterilization time requirements.

Autoclave Maintenance. Always read and follow the manufacturer's instructions for use and maintenance before using any piece of electrical medical equipment. The autoclave

TABLE 33-7 | **Sterilization Time Requirements**

Time	Article
15 minutes	Glassware
	Metal instruments—open tray or individual wrapping with hinges open
	Syringes (unassembled)
	Needles
20 minutes	Instruments—partial metal in double-thickness wrapper or covered tray
	Rubber products: gloves, tubing, catheters wrapped or unwrapped
	Solutions in a flask (50–100 ml)
30 minutes	Dressings—small packs in paper or muslin
	Solutions in a flask (500–1,000 ml)
	Syringes—unassembled, individually wrapped in gauze
	Syringes—unassembled, individually wrapped in glass tubes
	Needles—individually packaged in paper or glass tubes
	Sutures—wrapped in paper or muslin
	Instrument and treatment trays—wrapped in paper or muslin
	Gauze—loosely packed
60 minutes	Petroleum jelly, 1 oz jar—in dry heat

should be cleansed on a regular basis so that it is free of any materials or lint. The air exhaust valve must also be cleaned and free of lint before each use. It is especially important to follow all manufacturer's instructions regarding how and what items should be used to clean the autoclave.

At various intervals, an outside, independent company should perform regulated checks on the autoclave to ensure proper functioning. The medical office can continue to autoclave items as usual, but usually one item is chosen to be sent to an outside lab where it is checked for sterility. These quality assurance checks are necessary to determine that proper sterilization practices are being upheld.

Autoclave Wrapping Materials and Loading the Autoclave. The wrappings in which the instruments and materials are sterilized must be both **permeable** (allowing steam to pass through) and strong enough to hold together during the steam process. Wrapping materials that are commonly used include heavy paper, muslin, plastic, and stainless steel containers. The wrapping generally consists of two layers of permeable materials. All items must be completely covered with the wrapping material and fastened with autoclave tape, which looks similar to masking tape. Autoclave indicator tape is used to fasten the autoclave package securely. The lines on the tape change color during the autoclaving process and indicate that exposure to the high temperature has occurred (Figure 33-9). However, this is not necessa

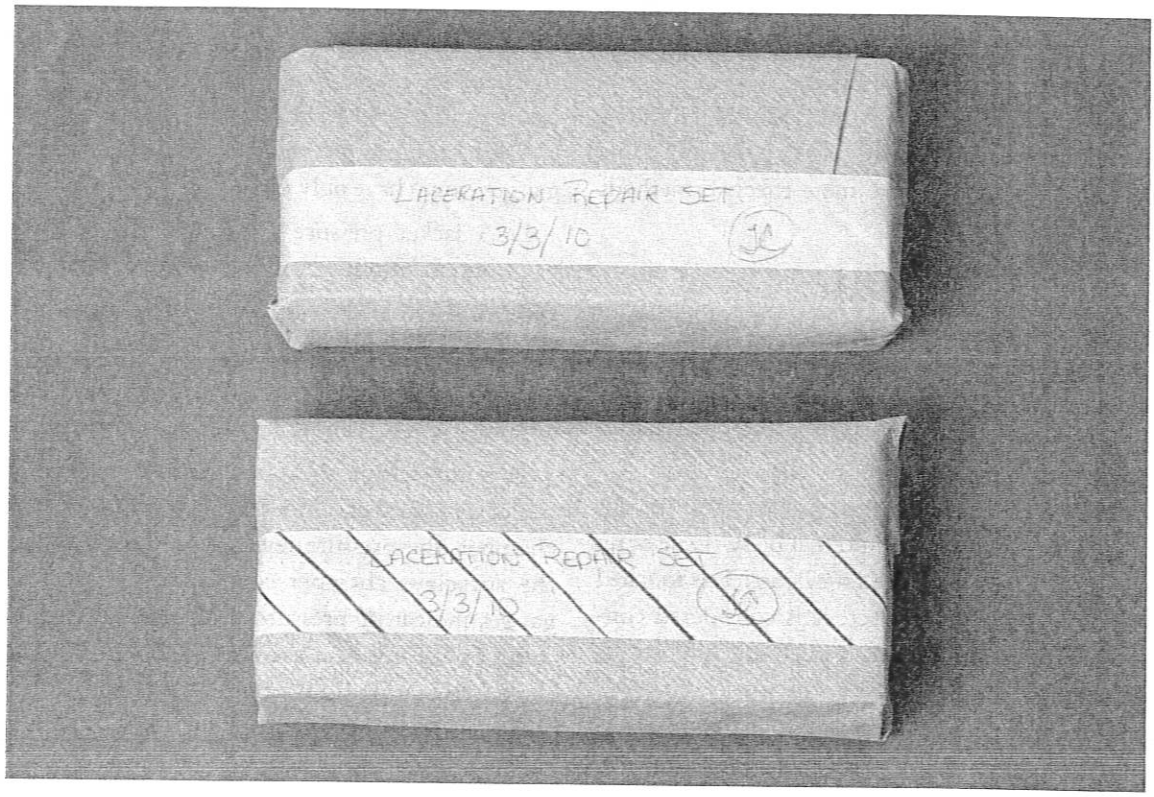


FIGURE 33-9 Top: Autoclave tape before sterilization. Bottom: Autoclave tape after sterilization.

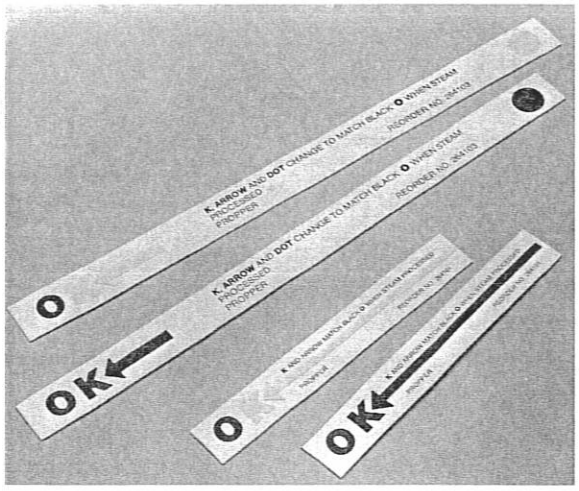


FIGURE 33-10 Sterility check strips.

an indication that the proper time and temperature for sterilization have been reached.

Sterilization indicators are used to signify proper and complete sterilization. Indicators come in a variety of types, including strips (Figure 33-10). The strip is placed inside the wrapper of packages or in the chamber when using open trays. The color changes or dots that appear on an indicator denote that the inner contents have been exposed to the required conditions necessary for sterility: correct temperature, correct time, and exposure to moisture.

Sterilization pouches or bags are often used to hold individual instruments. Small, lightweight instruments are suitable for these pouches. Careful inspection must be made to make sure the bag has not ruptured or been punctured during the autoclave process. The pouches have sterilization indicators both inside and outside the bag.

Each package (whether wrapped or a pouch) should be labeled with the date of sterilization, the items within the packet, and the initials of the individual who prepared the pack. Instruments with hinges should be in the open position, any tubing should be free of any kinks, and syringes should be unassembled before wrapping.

Record Keeping and Quality Control. For quality control, sterilization record keeping should include sterilization logs as well as equipment maintenance and cleaning records. These records would include dates of purchase of equipment, maintenance, cleaning, and quality control checks. Further, biological culture capsules (a special kit that includes a stable vacutainer holder with sterile pack and everything you would need for gathering a sterile culture except the sterile needle) can be purchased to assure sterility in gathering specimens. Indicator strips demonstrate whether the equipment is too old, and date labeling locally shows the length of time the specimen took to be processed.

(Refer to Procedure 33-6 and Figures A–D for how to wrap and label instruments for the autoclave.)

PROCEDURE 33-6

Preparing Items for Autoclaving

Objective *Wrap and label instruments properly.*

EQUIPMENT AND SUPPLIES

Wrapping material; instrument(s) for autoclaving; sterilization indicator strips; autoclave tape; permanent pen; gloves

Note: Before wrapping instruments for sterilization in the autoclave, it is recommended that instruments be properly sanitized as in Procedure 33-5.

METHOD

1. Wash your hands and don gloves.
2. Place a square of wrapping material on a clean flat surface. Arrange the material so that it appears as a "diamond" shape when you look at it. Be sure the wrapping material is large enough to cover the entire article being wrapped.
   a. According to office policy, it might be necessary to use an additional piece of wrapping material if the material is only single layered.
3. Place the items in the center of the wrapping material.
   a. If hinged items are included, be sure the instrument is in the open position.
   b. If sharp instruments are being autoclaved, place the tip in a piece of gauze to prevent puncture through the material.
4. Place the sterilization indicator strip in the center of the packet.
5. Fold the bottom point of the wrapping material up and over the instruments. Fold a small portion of the point back over so that it can be used to pull back the paper when it is unwrapped (Figure A).

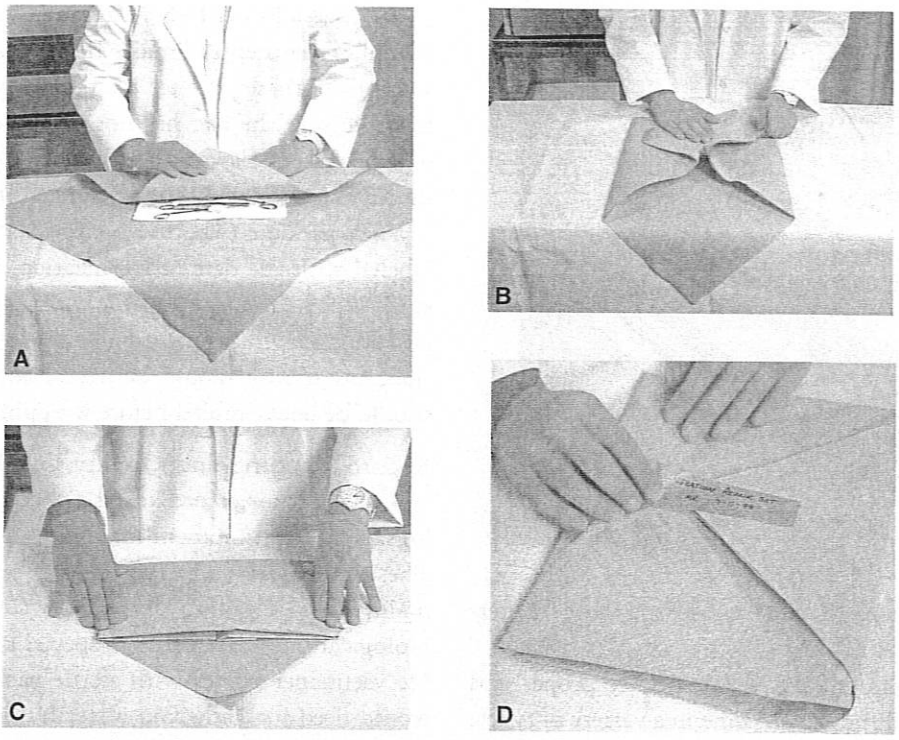


FIGURE A–D **(A)** Place items (with hinges open) in the center of wrapping material. Fold the bottom up and over the instruments. **(B)** Fold the right side of the paper until it covers the item, and make a small flap. Proceed in the same way with the left side. **(C)** Fold the bottom of the package up toward the top until the top corner remains. **(D)** Use a piece of autoclave tape to secure the package.

6. Fold the right side of the wrapping paper over until it covers the instrument(s). Fold a small portion of the point back over as in the previous step.
7. Fold the left side of the wrapping paper over until it covers the instrument(s). Fold a small portion of the point back over as in the previous step (Figure B).
8. Now fold up the bottom of the package upward until you have reached the top point of the wrapping square (Figure C).
9. Be sure the pack is folded snugly and air pockets are not present.
10. Secure the final point of the package with a piece of autoclave tape (Figure D).
11. Label the package with the name of the item(s) inside, your initials, and the date.
12. If bags are used for the autoclaving procedure, place the item and an indicator strip inside the bag. (If the item has a sharp point, wrap the point in a piece of gauze.)
13. Seal the bag. Label the bag with the name of the item(s) inside, your initials, and the date.

Instruments that will be used immediately can be placed in open perforated trays and left unwrapped. The lid for the tray is placed next to the open tray of instruments inside the autoclave. The lid is immediately placed over the instruments after sterilization. A towel is usually placed under the instruments to absorb moisture during autoclaving.

Containers and jars of supplies should be placed on their sides in order for full sterilization to occur. Solutions should be autoclaved separately, generally in glass containers, because they may boil over during autoclaving.

It is important not to overload or cram items inside the autoclave chamber. Consistent spacing of packages and instruments is vital to allow the steam to properly circulate and penetrate the packages, ensuring complete sterilization.

After the autoclave process is complete, the drying process takes place. This process is almost as important as achieving the correct temperature and pressure during autoclaving. Wetness on items ("wet packs") can cause a break in sterility because moisture will allow bacteria to grow and be transmitted into the inside of the package. Wet packs can be avoided by allowing for a drying period at the end of autoclaving. To do this, open the door of the autoclave ¾ inch (but no more) just before the drying cycle on the autoclave. Run the dry cycle according to the manufacturer's directions.

Autoclaved packages are stored in dry and dust-free shelves or drawers. For easy access, autoclave packs are organ according to the date and type of item(s) visible. The oldest

dated packs are placed in front of the stack so that they can be used first. Instruments are considered sterile for 21 to 30 days (7 days in plastic bags, 30 days in muslin). Individual manufacturer's guidelines should be followed concerning when to resanitize and resterilize items. Autoclaved items cannot be reautoclaved in the same packages without washing, rinsing, drying, and rewrapping each item. See Procedure 33-7 for the steps when using an office-size autoclave.

Chemical Gas Sterilization. Gas sterilization removes or kills life through the use of gasses. The most common gas used for sterilization is ethylene oxide (EtO) at low

PROCEDURE 33-7

Sterilizing Instruments in an Autoclave

Objective *Sterilize instruments in an autoclave to prevent the spread of pathogens.*

EQUIPMENT AND SUPPLIES

Autoclave; instruments sanitized and wrapped for autoclaving; distilled water; autoclave directions

METHOD

1. Check the level of water in the autoclave reservoir. Add distilled water as needed to the fill line (Figure A).
2. Load the autoclave:
   a. Trays and packs should be loaded on their sides.
   b. Containers should be loaded on their sides with lids off or ajar.
   c. Mixed loads are loaded with hard objects on bottom racks and softer items on top racks.
   d. Keep large packs 2 to 4 inches apart and smaller packets 1 to 2 inches apart.
3. Read the manufacturer's instructions and follow them exactly. Most autoclaves follow similar protocols.
   a. Turn the control knob to FILL and observe carefully with the door open until the water reaches the chamber fill line.
   b. Turn the knob to autoclave position (Figure B). This shuts off the water. Do not allow the water to overflow.
   c. Close and lock the door.
4. When pressure reaches 15 to 17 pounds per square inch and the temperature reaches 250°F to 270°F, set the timer for the required time. Typical timing is 30 minutes for wrapped trays and packages and 15 minutes for unwrapped items. Always check the manufacturer's suggested times and facility protocol.
5. When timing is complete, turn the control knob to VENT.
6. When the pressure reaches zero, open the chamber door about ¾ inch and allow items in the autoclave to dry completely before removing them (about 30 to 45 minutes).
7. Turn the autoclave knob to OFF.
8. Remove the wrapped items, and check the autoclave tape on the outside for indicated color change. Store in a dry closed cabinet for future use. Unwrapped items must be removed using sterile transfer forceps and must be placed on a sterile field or in a sterile storage area (Figure C).
9. Perform quality assurance measures by recording the activity in the proper log book. Record date, time, and types of items autoclaved in log and initial.

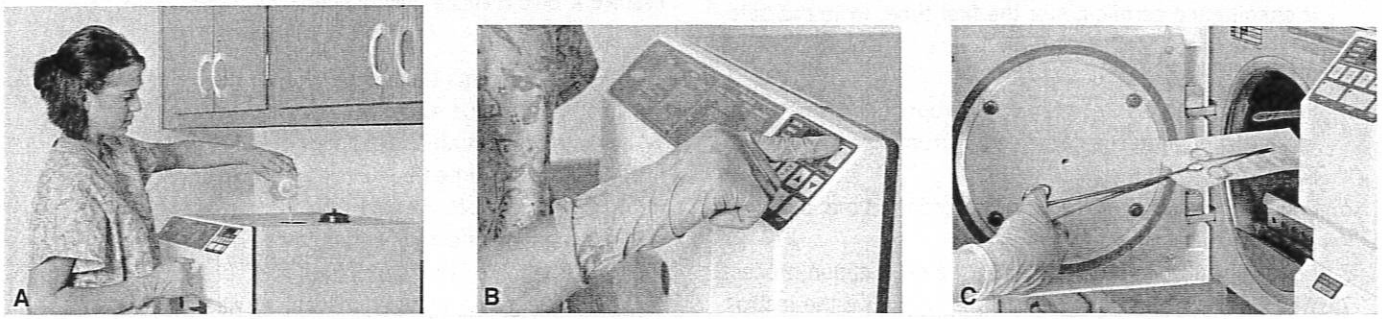


FIGURE A–C **(A)** Check the water level in the autoclave, and add distilled water as necessary. **(B)** Properly set the autoclave controls according to manufacturer's instructions. **(C)** Remove instruments and packages to a clean container using sterile transfer forceps.

temperature. It can be used as an ingredient in a mixed gas or as 100 percent EtO. Since the 1950s when chlorofluorocarbon (CFC0) was phased out, alternative technologies that have been used and are cleared by the U.S. Food and Drug Administration (FDA) for medical equipment include 100 percent ETO; ETO with a different stabilizing gas such as carbon dioxide or hydrochlorofluorocarbons (HCFC); immersion in peracetic acid; hydrogen peroxide gas plasma; and ozone. Technologies under development for use in health care facilities, but not cleared by the FDA, include vaporized hydrogen peroxide, vapor phase peracetic acid, gaseous chlorine dioxide, ionizing radiation, or pulsed light.

Chemical Liquid Sterilization. Chemical sterilization uses a chemical that is toxic to the microbes to sterilize objects. The medical assistant may submerge instruments, for example, in liquid chemicals instead of gasses to perform this procedure. Liquid sterilants require much more time to work than dry heat, ultraviolet, or steam sterilization needs. Proper sterilization by chemical liquid can take hours to days to work effectively, as some microbial species form structures called spores, which are very tough and resist killing in a short period of time. Typically, the equipment, such as surgical instruments, must be completely submerged in the liquid sterilant. See Procedure 33-8 for how to perform chemical liquid sterilization.

PROCEDURE 33-8

Sterilizing Instruments Chemically

Objective *Sterilize heat-sensitive instruments chemically to prevent the spread of pathogens.*

EQUIPMENT AND SUPPLIES

Chemical disinfectant; goggles, disposable gloves, and utility (rubber) gloves; sink; glass or stainless steel container with cover; sterile towels; sterile transfer forceps; sterile basin; sanitized articles

Note: Before anything can be chemically sterilized, it must be sanitized properly as described in Procedure 33-5. Always read and follow the manufacturer's directions on the original container of the chemical agent.

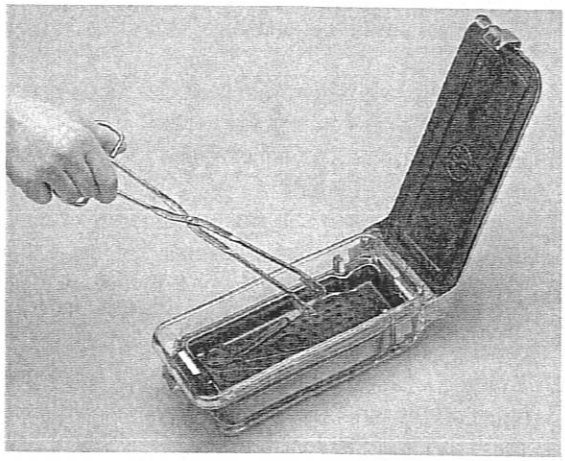


FIGURE A Cold chemical sterilization.

METHOD

1. Sanitize instruments appropriately.
2. Select the type of chemical needed to sterilize the instruments.
3. Read the directions on the original germicidal agent label. If opening the germicide for the first time, write the date on the container and follow directions to properly prepare the chemical agent for initial use.
4. Place the chemical agent in an appropriate container that is large enough to submerge the instrument completely. See Figure A.
5. Cover the container tightly, and record the time, date, and your initials.
6. Do not open the container during the sterilization process.
7. When sterilization timing is complete, remove the instrument from the container using sterile gloves or sterile transfer forceps.
8. Rinse the items thoroughly with sterile water over a sterile basin. Hold the instruments over the basin for a few moments to drain excess sterile water.
9. Dry the instruments thoroughly with a sterile towel, and place onto a sterile field for use.
10. Change the chemical agent every 7 to 14 days, or as recommended by the manufacturer.
11. Remove gloves and perform hand hygiene.
12. Perform quality assurance by recording appropriate information in the appropriate log book.

Professionalism The Law

Isolation precautions and quarantining can be legally mandated to prevent an individual who has been exposed to a communicable disease but is not even yet ill to prevent that person from exposing others to the disease. Isolation is the separation of ill persons who have, or may potentially have, a communicable disease from those who are healthy and restriction of their movement to stop the spread of that disease or illness, according to the CDC. Public health officials have the authority to separate individuals with communicable diseases, such as tuberculosis (TB), from the general population, because they may pose a threat to public health. When a local health official determines that an individual poses a risk to others, an isolation order may be issued that specifies the location and time of isolation. The order may include a requirement for medical supervision. See the CDC website (www.cdc.gov/tb/programs/Laws/menu/isolation.htm) for more information.

SUMMARY

Infection control is important not only to health care workers, but to patients as well. The medical assistant is often the first line of defense against the spread of infection in the medical office. A thorough understanding of standard precautions and isolation techniques is important to maintain a safe patient environment. The meticulous attention given to sterilization of all reusable materials and equipment is often the full responsibility of the medical assistant and is a serious responsibility. All who handle bodily fluids and waste products must be trained in safety measures such as standard precautions and the Bloodborne Pathogen Standard. Fines may be imposed for not adhering to OSHA regulations about these precautions. When practicing an aseptic technique, the medical assistant should learn the correct method and then never deviate from it.

33 CHAPTER REVIEW

COMPETENCY REVIEW

1. Define and spell the terms for this chapter.
2. How does the age of a person affect susceptibility to infections?
3. List three natural barriers to infection.
4. List the four cardinal signs of infection.
5. List three examples of body fluids included in standard precautions.
6. A sterilized package has reached its expiration date. What should you do?
7. What solution of household bleach has been found to be effective in destroying HIV?
8. Explain the difference between sanitization and sterilization.
9. List three examples of PPE.
10. Define multidrug-resistant organism (MDRO), and give an example.

PREPARING FOR THE CERTIFICATION EXAM

1. The term *asepsis* means
   a. contaminated.
   b. needs oxygen.
   c. free of pathogens.
   d. soap.
   e. needs sanitizing.

2. Most sterilization indicators operate on what principle?
   a. Color change will revert back when an item is contaminated.
   b. Original color reappears after six weeks.
   c. Color change indicates the package has been properly sealed.
   d. Color change indicates sterilization is complete.
   e. Color change occurs at the beginning of the process.

3. An organism that is infected with a pathogen and is a source of infection to others is
   a. a reservoir host.
   b. a carrier.
   c. an anaerobe.
   d. not an infectious risk to others.
   e. an inanimate object.

4. During which stage of infection are signs and symptoms both evident and severe?
   a. prodromal stage
   b. acute stage
   c. incubation stage
   d. invasion stage
   e. multiplication stage

5. All bacteria require which of the following to grow best?
   a. oxygen
   b. cool temperature
   c. light
   d. sugar
   e. moisture

6. MRSA is a(n)
   a. disinfectant.
   b. type of microorganism.
   c. oxygen source.
   d. physician's credential.
   e. drug.

7. How long is it necessary to wash hands before assisting a new patient?
   a. 1 minute
   b. 6 minutes
   c. 2 to 3 minutes
   d. 20 to 30 seconds
   e. 10 seconds

8. "Treat all bodily fluids as if they were contaminated with harmful pathogens" summarizes which concept?
   a. standard precautions
   b. Bloodborne Pathogen Standard
   c. isolation techniques
   d. universal precautions
   e. none of the above

9. Which of the following PPE and/or protective barrier items would be removed first?
   a. gloves
   b. respirator
   c. gown
   d. goggles
   e. face shield

10. Which process involves the destruction of organisms before they enter the body?
    a. disinfection
    b. sterilization
    c. sanitization
    d. medical asepsis
    e. surgical asepsis

CRITICAL THINKING

Refer to the case study at the beginning of the chapter and use what you have learned to answer the following questions.

1. What type of PPE would David need to wear when performing venipuncture on this patient?
2. Why would the physician include a liver function test as part of the patient's routine blood work?
3. Which particular groups of individuals are encouraged to receive the vaccination to guard against HBV?

ON THE JOB

Emma Brown, 70 years old, is caring for her 78-year-old husband, George Brown. Mr. Brown, a diabetic, has been hospitalized with a recurring infection that may lead to amputation of his right leg. Mr. Brown's physical condition may not be able to withstand another massive leg infection. He has been placed on antibiotics, and his leg is now healing. Mrs. Brown will require instructions on irrigating the leg wound and changing her husband's dressing. When the leg wound was cultured, *E. coli* was present. Mrs. Brown mentioned to the medical assistant that she is concerned about her own health because she has a colostomy.

1. What patient education is required for Mrs. Brown regarding the procedure to be used in caring for her husband?
2. Is it possible that the *E. coli* was transmitted from Mrs. Brown's colostomy site to her husband's leg wound? Explain.

INTERNET ACTIVITY

Conduct an Internet search of published studies detailing infection control rates of health care facilities in your area—research hospitals, nursing homes, urgent care facilities, and health clinics—to determine how well infection control is maintained.