

CHAPTER 9

Recognizing and Preventing the Spread of Infectious Diseases, Blood Borne Pathogens and Wound Care



Objectives

When you finish this chapter you will be able to:

- Discuss how infectious diseases are spread and how they may be prevented.
- Explain what bloodborne pathogens are and how they can infect health care professionals and athletes.
- Describe the transmission, symptoms and signs, and treatment of hepatitis B (HBV).
- Describe the transmission, signs and symptoms, management, and treatment of hepatitis C (HCV).
- Describe the transmission, symptoms, and signs of human immunodeficiency virus (HIV) infection.
- Describe how HIV is most often transmitted.
- List the pros and cons of sports participation of athletes with an HBV or HIV infection.
- Identify universal precautions as mandated by the Occupational Safety and Health Administration and how they apply to the health care provider and the athlete.
- Discuss the various types of skin wounds.
- Explain basic wound care procedures

Key Terms

- infectious diseases
- pathogen
- blood borne pathogens
- hepatitis B virus (HBV)
- hepatitis C virus (HVC)
- human immunodeficiency virus (HIV)
- acquired immune deficiency syndrome (AIDS)
- Occupational Safety and Health Administration (OSHA)
- abrasion
- laceration
- incision
- puncture
- avulsion

It has always been important for any health care provider to be concerned with maintaining an environment that is as clean and sterile as possible.⁵ In today's society, it has become critical for everyone in the population to take measures to prevent the spread of infectious diseases.²⁰ Failure to do so may expose any individual to potentially life-threatening situations.¹⁹

Because of the close physical contact that occurs through athletic participation, the potential for spread of infectious disease among athletes and sports medicine personnel is of major concern. Everyone must be aware of the potential dangers of exposure to blood or other infectious materials and take whatever measures are necessary to prevent contamination (Figure 9-1).¹⁸ There should be a written exposure plan with policies in place for dealing with bloodborne pathogens and infectious diseases that include:

- Communication of potential hazards to employees and training
- Determination of employee exposure
- Implementation of Universal precautions in exposure control
- Hepatitis B vaccination
- Post-exposure evaluation and follow-up
- Procedures for evaluating circumstances surrounding exposure incidents

Infectious Diseases

Infectious diseases are the invasion or infection of a host (person or animal) by microorganisms called pathogens. A **pathogen** causes disease by either disrupting a vital body process or stimulating the immune system to mount a defensive reaction. An immune response against a pathogen, which can include a high fever, inflammation, and other damaging symptoms, can be more devastating than the direct damage caused by the pathogen itself. The most common pathogens are various bacteria, viruses, parasites, and fungi.²⁵

An infectious disease is termed contagious if it is transmitted from one person to another. Transmission can be either direct or indirect. There are three types of direct transmission: contact between body surfaces (touching, sexual intercourse), droplet spread (inhalation of contaminated air droplets from



FIGURE 9-1
Precautions must be taken to prevent exposure and transmission of bloodborne pathogens.

someone who sneezes in close proximity), and fecal-oral spread (feces on the host's hands are brought into contact with the new host's mouth).³⁵

Pathogens can enter the body through the skin, respiratory system, digestive system, or reproductive system. Whether the pathogen will actually infect the new host is determined by factors such as acquired immunity, overall health, and health-related behaviors.¹⁸

Immunizations

Vaccinations against several potentially serious infectious diseases are available and should be given to everyone.⁶ These include the following: coronavirus (COVID-19), diphtheria, pertussis (whooping cough), hepatitis B, influenza (flu), tetanus, rubella (German measles), measles (red measles), polio, mumps, and chickenpox. This immunization process has markedly reduced the incidence of several childhood communicable diseases and minimized the infection rate of hepatitis B, influenza, and tetanus.³⁷

Preventing Spread of Infectious Diseases

The athletic trainer, like other health care professionals, must be diligent in efforts to minimize the chances of transmitting infectious diseases.²⁴ **An essential and effective practice to mitigate the spread of infectious disease is for the athletic trainer to wash his or her hands frequently when treating patients, particularly after caring for a sick person, after using the bathroom, and after blowing the nose and/ or using hands to cover sneezing or coughing. As we have learned with**

the coronavirus, social distancing and wearing facemasks can also be effective in mitigating the transmission of disease particularly in the case of respiratory infections. The athletic trainer should review medical histories of the patients being treated or cared for to make sure that all potential immunizations are up to date. The athletic trainer should also make sure that patients who are sick understand that taking antibiotics is not useful in treating infections caused by viruses and that antibiotics should be taken exactly as prescribed. Taking them unnecessarily will reduce their ability to combat subsequent bacterial infections. All patients should be routinely encouraged to develop healthy lifestyle habits, such as eating well, getting enough sleep, exercising, and avoiding tobacco and substance abuse.

What Are Bloodborne Pathogens?

The athletic trainer must possess a sound understanding of how to recognize, minimize and manage the effects of the various **bloodborne pathogens** in an athletic population. Bloodborne pathogens are pathogenic microorganisms which are present in human blood and body fluids that can cause disease in humans.³⁴ They may be present in human blood and other bodily fluids including semen, vaginal secretions, cerebrospinal fluid, synovial fluid, and any other fluid contaminated with blood.² The three most significant bloodborne pathogens include the hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV).² A number of other bloodborne diseases exist, including hepatitis A, hepatitis D, hepatitis E, and syphilis. Although HIV has been more widely addressed in the media, HBV and HCV have a higher possibility for spread.⁷ HBV is stronger and more durable than HIV.⁴⁰ HBV can be

spread more easily via sharp objects, open wounds, or bodily fluids when compared to HIV.

Mode of transmission:

- Human blood
- Semen
- Vaginal secretions
- Cerebrospinal fluid
- Synovial fluid

Hepatitis B Virus

Hepatitis is a disease of the liver. HBV is a major cause of viral infection that results in swelling, soreness, and loss of normal function in the liver.

Signs of HBV The signs in a person infected with HBV include flu-like symptoms such as fatigue, weakness, nausea, abdominal pain, headache, fever, and possibly jaundice. It is possible that an individual infected with HBV will exhibit no signs or symptoms and may go undetected. In these individuals, the HBV antigen will always be present, and thus the disease may be unknowingly transmitted to others through exposure to blood or other bodily fluids or by intimate contact.

An infected person's blood may test positive for the HBV antigen within 2 to 6 weeks after the symptoms develop. Approximately 85 percent of those infected recover within 6 to 8 weeks.¹⁴

Prevention Good personal hygiene and avoiding high-risk activities are the best ways to avoid HBV.¹⁴ HBV can survive for at least a week in dried blood or on contaminated surfaces and may be transmitted through contact with these surfaces. Caution must be taken to avoid contact with any blood or other fluid that potentially contains a bloodborne pathogen.³⁵

Management A vaccine is now available that can prevent contraction of HBV. The vaccine requires a series of three inoculations spread over a 6-month

Bloodborne pathogens:

- Hepatitis B (HBV)
- Hepatitis C (HCV)
- Human immunodeficiency virus (HIV)

OSHA: Occupational Safety and Health Administration

period. The **Occupational Safety and Health Administration (OSHA)** has mandated that vaccination against HBV must be made available by an employer at no cost to any individual who may be exposed to blood or other bodily fluids and may thus be at risk of contracting hepatitis B.³⁰ **Any individual working in an allied health care profession who may potentially come in contact with blood should receive HBV immunization.¹¹**

Hepatitis C

Originally referred to as non-A, non-B hepatitis, hepatitis C is both an acute and chronic form of liver disease caused by the hepatitis C virus (HCV). HCV is the most common chronic bloodborne infection in the United States. Approximately 55 to 85 percent of those infected acutely with HCV become chronically infected, and 15 to 30 percent develop chronic liver disease within 20 years. It is the leading indication for liver transplant. Three percent of those with chronic liver disease die from cirrhosis or liver cancer. As of 2016, it is estimated that 71 million people worldwide and 3.5 million Americans are living with HCV, of whom 2.7 million are chronically infected.¹⁰

Symptoms and Signs Eighty percent of those infected with HCV have no signs or symptoms. Those who are symptomatic may be jaundiced and/or have mild abdominal pain, particularly in the upper right quadrant; loss of appetite; nausea; fatigue; muscle or joint pain; and/or dark urine.

Prevention HCV is not spread by sneezing, hugging, coughing, food or water, sharing eating utensils or drinking glasses, or casual contact. It is rarely spread through sexual contact. It is spread by contact with

the blood of an infected person.²⁹ It is most commonly transmitted by sharing needles or syringes. Therefore, it is a significant risk of getting a tattoo or body piercing. However, it can also be transmitted by sharing personal care items that might have blood on them (razors, toothbrushes). Athletic trainers should always follow routine barrier precautions and safely handle needles and other sharp objects.

Management Unlike HBV, presently there is no vaccine for preventing HCV transmission.¹¹ Several blood tests can be done to determine whether a person has been infected with HCV. A physician may order just one or a combination of these tests. It is possible to find HCV within 1 to 2 weeks after being infected with the virus. A single positive test after being infected with HCV. However, a single negative test does not prove that a person is not infected. When hepatitis C is suspected, even though an initial test is negative, the test should be repeated.¹

HCV-positive persons should be evaluated by their doctor for liver disease.²³ Direct-acting antiviral drugs are most often used to treat hepatitis C. The best drug depends on the extent of the liver damage! Drinking alcohol can make liver disease worse.

Human Immunodeficiency Virus

HIV infection is caused by a family of complex viruses that invade normal healthy cells, thus decreasing the effectiveness of the host cell in preventing disease.⁹ HIV is a viral infection that has the potential to eventually destroy the immune system. The rapid increase in the number of known individuals who are HIV positive is alarming. As of 2017, an estimated 36.9 million people worldwide were living with HIV/AIDS.³⁸

Symptoms and Signs of HIV As with HBV, HIV is transmitted by exposure to infected blood or other bodily fluids or by intimate sexual contact. In the acute phase of HIV, symptoms may include fatigue, weight loss, muscle or joint pain, painful or swollen glands, night sweats, and fever. Antibodies to HIV can be detected in a blood test within 1 year after exposure. Following the acute phase, people with HIV enter an asymptomatic phase during which they may be unaware that they have contracted the virus and may go for 8 to 10 years before developing any signs or symptoms. It is always a possibility that an individual who tests positive for HIV may develop acquired immunodeficiency syndrome (AIDS) if they do not seek immediate interventional treatments following initial diagnosis. Table 9-1 summarizes information on HBV, HCV, and HIV.

AIDS: Acquired immunodeficiency syndrome

Acquired Immunodeficiency Syndrome AIDS is an acronym for **acquired immunodeficiency syndrome**. A syndrome is a collection of signs and symptoms that are recognized as the effects of an infection. A person who has AIDS has no protection against even the most minor infections and thus is extremely vulnerable to developing a variety of illnesses, opportunistic infections, and/or cancers that cannot be stopped.²² A positive HIV test cannot predict if the individual will show the symptoms of AIDS.⁹ Without treatment, HIV will usually progress to AIDS in about 10 years. HIV typically leads to death in about 3 years.⁸

Management Unlike HBV, there is no vaccine for HIV. Even though some drug therapy may keep HIV patients healthy for many years, there is currently no available treatment to cure patients with HIV. Presently, the most effective treatment seems to be the use of antiretroviral (ART) therapy. ART is recommended for all people living with HIV, regardless of how healthy they are or how long they have been infected.³⁹ Although new treatments have extended the healthy life span of many people with AIDS, HIV prevalence has continued to increase.

Focus Box 9-1

Behaviors That May Lead To Increased Risk of HIV Infection*

If the answer yes to any of the following questions the patient should be tested for HIV.

- Are you a man who has had sex with another man?
- Have you had sex—anal or vaginal—with an HIV-positive partner?
- Have you had more than one sex partner since your last HIV test?
- Have you injected drugs and shared needles or works (for example, water or cotton) with others?
- Have you exchanged sex for drugs or money?
- Have you been diagnosed with or sought treatment for another sexually transmitted disease?
- Have you been diagnosed with or treated for hepatitis or tuberculosis (TB)?
- Have you had sex with someone who could answer yes to any of the above questions or someone whose sexual history you don't know?

*From The Centers for Disease Control and Prevention, <https://www.cdc.gov/hiv/basics/testing.html>

Prevention The best means for prevention is through education.¹³ Athletes should be educated about HIV. Athletes must be made to understand that their greatest risk for contracting HIV is through intimate sexual contact with an infected partner and not through contact that occurs during athletic participation.³² Practicing safe sex is of major importance. (See Focus Box 9-1) The athlete must choose nonpromiscuous sex partners and use

HIV is most often transmitted through intimate sexual contact.

The use of latex condoms can reduce the chances of contracting HIV.

TABLE 9-1 TRANSMISSION OF HEPATITIS B AND C VIRUSES AND HUMAN IMMUNODEFICIENCY VIRUS

Disease	Symptoms and Signs	Mode of Transmission	Infectious Materials
Hepatitis B virus	Flulike symptoms, jaundice	Direct and indirect contact	Blood, saliva, semen, feces, food, water, and other products
Hepatitis C virus	Jaundice, upper right quadrant pain, loss of appetite, nausea, fatigue, dark urine	Direct and indirect contact with blood	Blood
Human immunodeficiency virus/acquired immunodeficiency syndrome	Fever, night sweats, weight loss, diarrhea, severe fatigue, swollen lymph nodes, lesions	Direct and indirect contact	Blood, semen, vaginal fluid

condoms for vaginal or anal intercourse. Latex condoms provide a barrier against both HBV and HIV. Male condoms should have reservoir tips to reduce the chance of ejaculate being released from the sides of the condom. Condoms that are prelubricated are less likely to tear. Water-based, greaseless spermicides or lubricants should be avoided. If the condom tears, a vaginal spermicide should be used immediately. The condom should carefully be removed and discarded.⁷

Dealing With Bloodborne Pathogens In Athletics

In general, the chances of transmitting bloodborne pathogens among athletes is low. There is minimal risk of on-field transmission from one player to another in sports.¹⁷ It should be stressed that at this time, there have been no validated reports of HIV transmission in sports in the professional literature.¹²

Some sports may have a higher potential risk of transmission because of close contact and the possibility of passing blood on to another person.¹⁶ Combat sports such as the martial arts, wrestling, and boxing have the greatest potential for transmission. (See *Focus Box 9–2*.)

Policy Regulation

Athletes participating in organized sports are subject to procedures and policies relative to transmission of bloodborne pathogens.²⁶ The United States Olympic Committee (USOC), the National Collegiate Athletic Association (NCAA), the National Federation of State High School Associations (NFHS), the National Basketball Association (NBA), the National Hockey League (NHL), the National Football League (NFL), and Major League Baseball (MLB) have established policies to help prevent the transmission of bloodborne pathogens.^{12,26} They have also initiated programs to help educate athletes under their control.

All institutions should take the responsibility for educating their student-athletes about how bloodborne pathogens are transmitted.²⁶ Efforts should also be made to educate the parents of secondary and middle-school athletes as well.²⁷ Professional, collegiate, and Secondary-school athletes should be made to understand that the real risk of contracting HBV or HIV is through their

Focus Box 9–2

Bloodborne pathogen risk categories for sports^{12,16}

- Greatest risk: Boxing, taekwon do, wrestling, rugby hockey, judo, soccer, team handball
- Moderate risk: Basketball, field hockey, football, ice canoeing/kayaking, cycling, diving, equestrian sports, fencing, figure skating, gymnastics, modern pentathlon, racquetball, rhythmic gymnastics, roller skating, rowing, shooting, softball, speed skating, skiing, swimming, synchronized swimming, table tennis, volleyball, water polo, weightlifting, yachting

off-the-field activities, which may include unsafe sexual practices and sharing needles, particularly in the use of steroids.²² Athletes, perhaps more than other individuals in the population, tend to think that they are immune and that infection will always happen to someone else.

9–1 Critical Thinking Exercise

A wrestler is concerned about the possibility of contracting HIV from wrestling with a sweaty partner.

What can this athlete be told to help him ease his fear?

Each institution should implement policies and procedures concerning bloodborne pathogens.²⁶ In a sports medicine or other health care setting, following these universal precautions protects the athlete, the coach, and the health care providers.²⁶

Universal Precautions in an Athletic Environment

The guidelines instituted by OSHA were developed to protect the health care provider and the patient against bloodborne pathogens.³⁰ It is essential that every sports program develop and carry out a bloodborne pathogen exposure control plan.³⁰ This plan should include counseling, education, volunteer testing, and the management of bodily fluids.²⁶

OSHA's guidelines should be followed by anyone coming in contact with blood or other bodily fluids.³⁰ Following are considerations specific to the sports arena.

Preparing the Athlete

Before an athlete participates in practice or competition, all open skin wounds or lesions must be covered with a dressing that is fixed in place and does not allow for transmission to or from an athlete.⁴¹ An occlusive dressing lessens the chances of cross-contamination and also reduces chances of the wound reopening, by keeping it moist and pliable.

When Bleeding Occurs

As mandated by the NCAA and the USOC, open wounds or other skin lesions considered a risk for disease transmission should be treated aggressively.²⁸ This means that athletes with active bleeding must be removed from participation as soon as possible and returned only when it is deemed safe by the medical staff.²⁸ Uniforms containing blood must be evaluated for infectivity. When blood is present on a uniform (unless the uniform is saturated), it can sometimes be removed with hydrogen peroxide, without having to remove the entire uniform. A uniform that is saturated with blood must be removed and changed before the athlete can return to competition.²⁸ All personnel managing potential infective wound exposures must follow universal precautions.³⁰

Personal Precautions

Health care personnel working directly with bodily fluids on the field must make use of the appropriate protective equipment in all cases in which there is potential contact with bloodborne pathogens.³⁰ Protective equipment includes disposable nonlatex gloves, gowns, or aprons; masks and shields; eye protection; nonabsorbent gowns; and disposable mouthpieces for resuscitation devices. **One-time-use nonlatex gloves such as those made of vinyl or nitrile rubber should be used in treating the athlete.** Gloves are always carefully removed following their use (see *Focus Box 9–3*). In cases of emergency, heavy towelings may be used until gloves can be obtained.

9–2 Critical Thinking Exercise

A soccer player jumps to win a head ball, and an opponent's head smashes the right eyebrow, creating a significant laceration. The athlete is conscious but is bleeding profusely from the wound.

What techniques are most effective to control the bleeding, and what should be done to close the wound?

Focus Box 9–3

Glove removal and use (Figure 9–2)

1. Avoid touching personal items when wearing contaminated gloves.
2. Remove first glove by using the other gloved hand, and turn it inside out, beginning at the wrist and peeling it off without touching skin.
3. Remove second glove while trapping the other glove inside, making sure not to touch ungloved hand to soiled surfaces.
4. Discard gloves that have been used, discolored, torn, or punctured in white biohazard bags.
5. Wash hands immediately after glove removal.

Hands and all skin surfaces that come in contact with blood or other bodily fluids should be washed immediately with soap and water or other antiseptics.

First-aid kits must have protection for hands, face, and eyes as well as resuscitation mouthpieces. Kits should also make towlettes available for cleaning skin surfaces.

Nonlatex gloves should be worn when dealing with blood or other bodily fluids.

Availability of Supplies and Equipment

In keeping with universal precautions, the sports program must have available chlorine bleach, antiseptics, proper receptacles for soiled equipment and uniforms, wound care bandages, and a designated container for disposal of sharps such as needles, syringes, or scalpels.³⁰

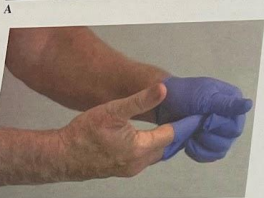
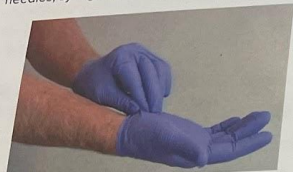


FIGURE 9-2

Technique for removing nontex gloves. (A) Grasp one gloved hand at the wrist with the opposite hand and peel that glove off. (B) Ball up the removed glove and hold it in the opposite gloved hand. (C) Then peel off the second glove trapping the first glove inside.

Universal precautions minimize the risk of exposure and transmission.

9-3 Critical Thinking Exercise

All institutions sponsoring athletic programs must initiate and carry out a bloodborne pathogen exposure control plan.

What is the policy on universal precautions in an athletic environment, as proposed by OSHA?

Biohazard warning labels should be fixed to regulated wastes, refrigerators containing blood, and other containers used to store or ship potentially infectious materials (Figure 9-3). The labels are fluorescent orange or red and should be affixed to containers. White bags should be used for disposal of potentially infected materials such as contaminated gloves and bandages (Figure 9-4). Sealed white bags can be placed in regular trash containers for disposal. If you are not sure whether any substance qualifies as biohazardous waste, the best practice is to use a biohazard bag to dispose of it.



FIGURE 9-3

Biohazard warning labels should be fixed to regulated waste disposal bags or containers that contain potentially infectious materials.



FIGURE 9-4

Soiled linens should be placed in a leakproof bag marked as a biohazard.

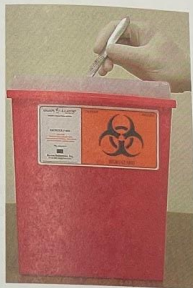


FIGURE 9-5

Sharps should be disposed of in a red, puncture-resistant, plastic container marked as a biohazard.

Contaminated surfaces should be cleaned with a 10 percent bleach solution.

transported in red or orange containers or bags that prevent soaking or leaking and are labeled with the biohazard warning labels (refer to Figure 9-4). Contaminated laundry should be washed in hot water (160°F for 25 minutes) using a detergent that deactivates the virus.³⁰ Laundry done outside the institution should be taken to a facility that follows OSHA standards. Gloves must be worn during bagging and cleaning of contaminated laundry.

Sharps Sharps refers to sharp objects such as needles, razor blades, and scalpels. Extreme care should be taken when handling and disposing of sharps, to minimize risk of puncturing or cutting the skin. OSHA mandates that sharps be disposed of in a leakproof and puncture-resistant container.³⁰ The container should be red or orange and labeled as a biohazard (Figure 9-5).

Protecting the Caregiver

It must be pointed out that OSHA guidelines for bloodborne pathogens are intended to protect health care employees and not the athlete.³⁰ Staff other than sports medicine personnel and occasionally coaches do not normally come in contact with blood or other bodily fluids from an injured athlete, so their risk is considerably reduced. It is the responsibility of the high school, college, professional team, or clinic to ensure the safety of all staff members as potential health care providers by instituting and annually updating policies for education on the prevention of transmission of bloodborne pathogens through contact with athletes. The institution must provide the necessary supplies and equipment to carry out these recommendations. All staff members have the personal responsibility of adhering to these policies and guidelines and enforcing them.

Protecting the Athlete from Exposure

Several additional recommendations may further help protect the athlete. For example, the USOC supports the required use of mouthpieces in those high-risk sports listed in Focus Box 9-2. All athletes should

Disinfectants All contaminated surfaces, such as the field or court, should be cleaned immediately with a solution consisting of one part bleach to ten parts water (1:10) or with a disinfectant approved by the Environmental Protection Agency.¹⁵ Disinfectants should inactivate the virus. Towels or other linens that have been contaminated should be bagged and separated from other laundry. Soiled linen is to be



FIGURE 9-6
Skin wounds.
(A) Abrasion on forearm.
(B) Laceration of the eyebrow with sutures.
(C) Incision on finger.
(D) Puncture on sole of foot. (E) Avulsion on ankle.

shower immediately after practice or competition. Athletes who may be exposed to HIV or HBV should be evaluated for immunization against HBV.

Postexposure Procedures

Following a report of an exposure incident, the exposed individual should have a confidential medical evaluation that includes documentation of the exposure route, identification of the source individual, a blood test, counseling, and an evaluation of reported illness. Again, the laws that pertain to reporting and notification of the test results relative to confidentiality vary from state to state.³⁰

Caring For Skin Wounds



Skin wounds are extremely common in sports. A wound is defined as trauma to tissues that causes a break in the continuity of that tissue.²³ The skin consists of two layers, the epidermis

and the dermis. Because of the soft, pliable nature of skin, it can be easily traumatized. Numerous mechanical forces can injure soft tissue. These forces produce friction or rubbing, scraping, compression or pressure, tearing, cutting, and penetration, each of which can adversely affect the skin's integrity.³ Wounds are classified according to the mechanical force that caused them.

Types of Wounds

Various types of wounds may be classified as follows (Figure 9-6):

Abrasions are common conditions in which the skin is scraped against a rough surface such as grass, artificial playing surface, floor, or mat. The top layer of skin wears away, exposing numerous blood capillaries. This exposure, with dirt and foreign materials scraping and penetrating the skin, increases the probability of infection unless the wound is properly debrided and cleansed. When large areas are abraded, the wound tends to be quite painful.

Lacerations, also common in sports, occur when a blunt force has been delivered over a sharp bone or a bone that is poorly padded, giving a wound the appearance of a jagged-edge cavity. As with abrasions, lacerations present an environment conducive to infections.³¹ The same mechanism that causes a laceration also can lead to a skin avulsion, in which a piece of skin is ripped off.

Incisions are wounds with smooth edges that often appear where a sharp or pointed object such as a knife or piece of glass tears the skin. Because the torn edges are smooth and can be easily cleaned and pulled together by either sterile strips or sutures, they are not as serious as the other types of exposed wounds.

Puncture wounds can easily occur during physical activities and can be fatal. Direct penetration of tissues by a pointed object such as a track shoe spike can introduce the tetanus bacillus into the bloodstream, possibly making the athlete a victim of lockjaw. All puncture wounds and severe lacerations should be referred immediately to a physician.

Avulsion wounds occur when skin is torn from the body, and they are frequently associated with major bleeding. The avulsed tissue should be wrapped in saline-soaked gauze and placed in a watertight bag. The bag is immersed in ice water or placed on top of an ice bag. The tissue and bag are sent to the physician for further evaluation and possible reattachment.

Immediate Care

All open wounds should be cared for immediately.³ (Table 9-2) Traumatic skin lesions must initially be considered contaminated and receive appropriate cleansing, debridement, and dressing as soon as possible. Although most traumatic skin lesions heal without consequence, appropriate management can lessen the risk of adverse reactions and infection and create an environment conducive to healing (i.e., moist, clean, warm). To minimize the chances of infection, it is critical that the wound be cleaned as thoroughly as possible.³ It is recommended that the wound initially be cleaned using copious amounts of soap and water or sterile saline. Neither bacterial solutions nor hydrogen peroxide should be used to clean the wound initially. Dressing wounds requires a sterile environment to prevent infections. Focus Box 9-4 describes how to help reduce wound infections.

Focus Box 9-4

Suggested practices in wound care

The following are suggested procedures to reduce the possibility of wound infections.

1. Make sure all instruments used, such as scissors, tweezers, and swabs, are sterilized.
2. Wash hands thoroughly, and put on nonlatex gloves.
3. Clean a skin lesion using soap and water.
4. Place a nonmedicated dressing on a lesion if the athlete is to be sent for medical attention.
5. Avoid touching any parts of a sterile dressing that will come in contact with a wound.
6. Place medication on a pad rather than directly on a lesion.
7. Secure the dressing with tape or a wrap.
8. If necessary, follow the procedures described in this chapter for control of bleeding.

Dressings

Sterile dressings should be applied to keep a fresh wound clean. Sterile dressings come in various sizes, from simple gauze pads to adhesive bandages. Occlusive dressings provide a complete barrier around and over a wound and are air-tight and watertight. They prevent any kind of bacteria or other contaminants from getting into the wound. Occlusive dressings appear to be extremely effective in minimizing scarring.³ If a wound is discharging fluid (serum), the dressing should be changed often to minimize bacterial growth. After drainage has stopped, there is no need for a dressing. Antibacterial ointments may be applied to limit surface bacterial growth and prevent the dressing from sticking to the wound. Topical antibiotics are recommended. Wounds may be cleansed with hydrogen peroxide initially. After this, saline solution is recommended for cleaning repeatedly, followed by the application of an antibiotic ointment to keep the wound moist. Good wound care will minimize the inflammatory response, speed healing, and minimize scarring.

Are Sutures Necessary?

Deeper lacerations, incisions, or occasionally puncture wounds may require some sort of manual closure using

TABLE 9-2 CARE OF SKIN WOUNDS

Type of Wound	Action of Athletic Trainer	Initial Care	Follow-up Care
Abrasion	Cleanse, debride, and dress wound.	Cleanse and debride wound bed with normal saline or tap water irrigation. Cleanse periwound tissues with saline or tap water irrigation or scrubbing with sterile gauze soaked with saline, tap water, or antiseptic. Dry the periwound tissues. Dress the wound with a nonocclusive or occlusive dressing based on wound depth and amount of exudate. Apply secondary dressing if needed.	Change dressing based on type; visually inspect daily for adverse reactions and infection.
Laceration /Incision	Cleanse around the wound. Avoid wiping more contaminating agents into the area; refer to a physician.	Cleanse and debride wound with saline or tap water irrigation. Avoid using tap water if bone or tendon is exposed. Cleanse periwound tissues with irrigation or scrubbing. Dry the periwound tissues. Tissue approximation and closure will depend on wound length, width, depth, and location.	Change dressing based on type; visually inspect daily for adverse reactions and infection.
Puncture	Visually inspect wound and possible embedded object; cleanse, debride, and dress wound; refer to physician if necessary.	Remove small and visible objects with sterile instruments. Avoid pushing the object deeper into the cavity. Allow bleeding to occur to self-cleanse the wound. Control venous or arterial bleeding. Cleanse the wound and periwound tissues with saline or tap water irrigation. Use gentle irrigation to prevent pushing debris and bacteria into the cavity. Dress wound with a nonocclusive or occlusive dressing based on wound depth and amount of exudate.	Closely monitor patient and wound area daily for adverse reactions and infection; change dressing based on type; check tetanus immunization
Avulsion	Cleanse, debride, and dress wound; refer to physician if necessary.	Cleanse and debride wound with saline or tap water irrigation. Avoid using tap water if exposed bone or tendon is present. Apply saline-soaked gauze over the wound and cover with additional gauze. Gently irrigate completely avulsed tissue with saline. Wrap the avulsed tissue in saline-soaked gauze and place in a watertight bag. Place the bag in ice water or on top of an ice bag. Avoid direct contact of the tissue with the ice. Refer to a physician for further cleansing and evaluation.	Closely monitor patient and wound area daily for adverse reactions and infection; change dressing based on type; check tetanus immunization.

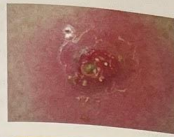


FIGURE 9-7
MRSA infection.

sutures.³¹ **If an athlete has a wound that appears to be severe, he or she should be sent to a physician, who will make a decision as to whether it is necessary to use sutures to close the wound.**¹³ Sutures should be put in as soon as possible but there is no strict timeline as to when a wound may or may not be sutured. In relatively simple wounds, the edges may be brought in close approximation by the use of sutures to minimize scar formation. Before closing a wound with a suture, the physician will usually anesthetize the local area with a short-acting medication. Fine suture material and minimal tightening limit any additional tissue damage, inflammation, and scarring. Wounds in areas that heal more slowly (areas that are less vascularized) or are in high-stress areas require larger suture material and that the stitches be left in longer. Sometimes sutures may be removed after only a few days, to minimize scarring.¹²

The physician may decide that the wound does not require sutures and that the torn tissues may be approximated using adhesive steri-strips, butterfly bandages, or absorbable staples. The most recent alternative is to use a topical pliable waterproof

adhesive (glue) that forms a strong flexible bond across apposed wound edges, allowing normal healing to occur beneath. The advantages to using tissue adhesives are that they provide faster wound closure than sutures, staples or adhesive strips, they are less painful and there is no need for suture removal.⁴

Signs of Wound Infection

The classic signs of infection are the same as those for inflammation, including pain, heat, redness, swelling, and disordered function. In addition, pus may form due to an accumulation of white blood cells, and a fever may occur as the immune system fights the bacterial infection.⁴¹ Most wound infections can be treated with antibiotic drugs. However, in recent years some strains of a bacterium found on the skin called *staphylococcus aureus* have become resistant to some antibiotics. The bacteria are referred to as methicillin-resistant *staphylococcus aureus* (MRSA) (Figure 9-7). MRSA strains are much more difficult to treat because many antibiotics do not work.⁴¹ Therefore, infections tend to become more severe than they may otherwise have been if the cause of the infection is not diagnosed early, and antibiotics that are given at first may not work. Infections that start in the skin may spread to cause more serious infections.³³

Tetanus Tetanus is a bacterial infection that causes fever and convulsions. A tetanus infection occurs most often with a puncture wound. Tonic spasm of skeletal muscles is always a possibility for any nonimmunized athlete. After initial childhood immunization with a tetanus vaccine, boosters should be given every 10 years.

Athletic Trainers Checklist

The following is a checklist for practicing universal precautions in dealing with bloodborne pathogens.

- Wash hands thoroughly after taking universal precautions and frequently throughout the day.
- Make sure all open wounds or skin lesions are covered before practice or competition.
- Routinely use nlonatex gloves when dealing with bleeding or wound care.
- Remove athletes with active bleeding from competition.
- When blood is present on a uniform, it can sometimes be removed with hydrogen peroxide instead of removing the whole uniform.
- Ensure that a uniform saturated with blood is removed and changed.
- Clean up blood spills with a disinfecting solution.
- Use the appropriate technique when removing gloves.
- Dispose of all soiled materials in a biohazard bag.
- Dispose of sharps in a biohazard container.
- Report all exposure incidents.