Publicity about human immunodeficiency virus (HIV) infection in athletes has focused attention on the potential for transmission of blood-borne pathogens during sports and athletic competitions. Existing information suggests that the potential risk for such transmission is extremely low and that the principal risks athletes have for acquiring HIV and hepatitis B virus are related to off-the-field activities. Therefore, efforts to prevent transmission of blood-borne pathogens among athletes should emphasize prevention in off-the-field settings. We summarize technical and other information about this issue, and provide recommendations for the education of sports participants, for infection control in athletic settings, and for training of coaches and officials.

Publicity about human immunodeficiency virus (HIV) infection in athletes has focused attention on the potential for transmission of blood-borne pathogens—primarily HIV and hepatitis B virus (HBV)—during sports and athletic competitions. This attention has prompted inquiries by health care workers, athletes, coaches, and the families and friends of athletes about the risks for and prevention of transmission of blood-borne pathogens during sports. Because increased interest in this topic provides an opportunity to foster preventive measures, we reviewed available information about such transmission. We summarize technical and other information on this issue and provide a practical approach for addressing concerns about the transmission of blood-borne pathogens during sports.

Transmission of HIV and HBV during Sports

Only one instance of HIV infection thought to be related to sports has been reported in the medical literature; this infection was diagnosed in a recreational soccer player in Italy [1]. However, public health officials in Italy who reviewed the available data could not satisfactorily rule out nonathletic risk factors for this man, who had been working in a drug-dependency rehabilitation center, nor could they definitively establish athletic activity as the source of infection [2]. In this issue of Annals, a study of on-the-field bleeding injuries during professional football competitions in the United States [3] concludes that the potential risk for HIV transmission to each player is extremely low (<1 per 85 million game contacts). Although no episode of HIV transmission during sports has been documented, two reports of transmission during bloody fistfights [4, 5] and two reports of transmission in households in which blood contact occurred [6] have been published. These cases were not sports-related; however, they support the concept that preventing blood contact is prudent.

Hepatitis B virus is more likely than HIV to be transmitted because it is present in higher concentrations in the blood and is more stable in the environment. However, only one episode of documented HBV transmission during sports—an outbreak of hepatitis B among sumo wrestlers in Japan in 1980—has been reported in the medi-cal
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In this outbreak, the putative source for infection was an asymptomatic wrestler who tested positive for both hepatitis B surface antigen (HBsAg) and hepatitis B e antigen (HBeAg). The presence of HBeAg in the serum is associated with high levels of circulating virus and therefore with greater infectivity. This wrestler was reported to have had many scars on his extremities and to have bled often from injuries incurred while wrestling; sumo wrestlers wear uniforms that leave nearly all of their skin exposed. No cases of hepatitis B attributed to sports activities have been reported to the Centers for Disease Control and Prevention in the United States.

Theoretical Considerations

The transmission of blood-borne or other pathogens requires all of the following elements: 1) the presence of a sufficient [usually large] quantity of a viable, infectious pathogen; 2) a mechanism for transport of the pathogen to the host; 3) transmission of the pathogen to the correct portal of entry of the host; and 4) susceptibility of the host to infection by the pathogen. If any one of these elements is missing, transmission will not take place. Using this model, the following conditions must exist for a blood-borne pathogen to be transmitted during a sporting activity: 1) the presence of an infected athlete; 2) the occurrence of a bleeding wound or exudative skin lesion in an infected athlete; 3) the presence in a susceptible athlete of a skin lesion or exposed mucous membrane that could serve as a portal for systemic entry of a blood-borne pathogen; and 4) sustained contact between the portal of entry of the susceptible athlete and the infective material. These conditions are likely to occur together only in a limited range of sports activities. Moreover, existing information indicates that even in settings where these conditions may occur, the potential risk for transmission of blood-borne pathogens is extremely low.

Although at low risk for transmission of blood-borne pathogens during sports, athletes may be at more of a risk for HIV and HBV infection off the field because both HIV and HBV are transmitted through sexual contact. In addition, athletes who inject or allow themselves to be injected with steroids or other drugs are at risk if syringes, needles, or other injection-related paraphernalia are shared.

Preventing Transmission of Blood-Borne Pathogens during Sports

Although sports-related transmission of HIV has not been documented, many public health, medical, and sports organizations have published recommendations or guidelines about prevention of HIV transmission among athletes [8-11]. These recommendations and guidelines have reaffirmed that the risk for HIV transmission during sports is extremely low, have addressed issues related to athletes with HIV infection, and have reviewed basic principles of infection control as they relate to preventing the transmission of HIV and other blood-borne pathogens.

The following measures provide a practical approach for addressing concerns about transmission of blood-borne pathogens among athletes. We have derived these measures from a review of published literature, institutional experience with related issues, and known principles of disease transmission and infection control.

1. Because the principal risks athletes have for acquiring blood-borne pathogens are not directly related to sports activities, efforts to prevent transmission of blood-borne pathogens among athletes should emphasize prevention in off-the-field settings. Schools, professional organizations (for example, those representing physicians, coaches, and trainers), and other institutions have unique opportunities to educate athletes, coaches, trainers, and officials about preventing the transmission of blood-borne pathogens. The following measures may be considered to prevent transmission of blood-borne pathogens among athletes off the field.

   1.1 Athletes should be educated about abstinence, monogamy, the use of condoms, and other approaches to the prevention of sexually transmitted disease.

   1.2 Athletes should be educated about the risks associated with nonmedical uses of injectable steroids and other drugs, and about the importance of not sharing needles, syringes, or other drug-related paraphernalia.
When resources permit, all adolescents and young adults should receive hepatitis B vaccine [12]. In other circumstances, all athletes at increased risk for infection (for example, those who are injecting drug users, have other sexually transmitted diseases, or have a history of sexual activity with more than one partner in the previous 6 months) should receive hepatitis B vaccine [12].

The following measures may be considered to ensure that the risk for transmission of blood-borne pathogens during sports remains extremely low.

1. For athletes participating in sports that involve person-to-person contact, skin wounds (such as scratches, abrasions, and lacerations) and potentially infectious skin lesions (such as vesicular or weeping skin lesions) should be securely covered with bandages or simple wraps to prevent leakage of blood or serous fluid during the sports activity.

2. Whenever a sports participant sustains a laceration or wound with substantial bleeding (more than superficial scratches or small lacerations), the injury should be treated promptly. Blood on the skin of the injured athlete and on that of other participants should be washed off thoroughly with soap and water or with a premoistened towelette. The injured athlete should be permitted to return to the sports activity only after the wound has been securely covered or wrapped.

3. Interruption of a sports activity for a change of equipment or uniform in situations in which an athlete is not actively bleeding is unwarranted. If an athlete's equipment (such as tape or padding) appears wet with blood or if blood has penetrated both sides of a uniform fabric, the equipment or uniform should be changed and blood on the skin should be washed off at the earliest convenient time (for example, when play is stopped for other reasons). Small amounts of dried blood on uniforms or equipment do not constitute a risk for transmission of blood-borne pathogens; therefore, changing a uniform or a piece of equipment in this condition is unwarranted.

4. Although liquid chemical disinfectants with activity against specific blood-borne pathogens and other microorganisms are widely available [13], such disinfectants are not intended for direct contact with the skin, and direct physical contact with such agents may result in skin irritation or other toxic reactions. These disinfectants are not intended for and may not be effective for disinfecting athletic uniforms or equipment while they are being worn by athletes.

5. Disposable toweling or other absorbent cleaning material should be used to clean environmental surfaces if more than a few drops of blood are present [13]. The surface should then be cleaned with soap and water or wiped with a clean paper towel lightly wetted with a germicide registered with the Environmental Protection Agency; this should be done in accordance with label instructions for use on environmental surfaces. An approximate 1/100 dilution of common household bleach (sodium hypochlorite) in tap water (for example, 1 cup bleach to 4 gallons water) is also appropriate in these instances. These measures are useful for most nonabsorbent athletic surfaces. Surfaces should be allowed to dry sufficiently to prevent possible injuries due to slipping during subsequent athletic activity.

6. After each practice or game, any equipment or uniform soiled with blood should be laundered; standard laundry cycles should be used according to the washer and detergent manufacturers' recommendations [13]. Laundry personnel should use appropriate physical barriers, such as reusable utility gloves, to prevent contact with soiled laundry.

7. Athletic trainers should use disposable examination gloves to prevent exposure to blood when treating athletes who are bleeding profusely [13]. In addition, on the basis of Occupational Health and Safety Administration regulations, trainers whose routine responsibilities frequently expose them to blood should be offered preexposure prophylaxis with hepatitis B vaccine [14]. For trainers whose exposure to blood is infrequent, timely prophylaxis after exposure may be preferable to routine vaccination before exposure, unless vaccination is otherwise indicated for these persons [12].
3. There is no medical or public health basis for routine screening of athletes for HIV or HBV infection. Moreover, athletes need not be excluded from participation in a sports activity solely because they are infected with HIV or HBV. Information about a diagnosis of HIV or HBV infection should be maintained in a confidential manner.

4. Prudent hygienic and infection-control strategies to prevent transmission of all infectious diseases should be used in making decisions about the limitation of an athlete's participation in sports activities. The mere presence of HIV or HBV infection should not be used as the basis for such decisions [2]. For example, wrestlers and other athletes participating in sports with extensive skin-to-skin contact should be excluded from matches or practices when skin wounds or other vesicular or weeping skin lesions are present and not securely covered. In addition, disciplinary rules forbidding unsportsmanlike activities (such as biting, scratching, or fighting) that may lead to blood contact during sports activities should be strictly enforced.

5. Coaches, trainers, athletes, and officials should be educated about basic principles of infection control, first aid, and hygiene.

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