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Management of Occupational Blood Exposures

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COVER STORY

Use of HIV postexposure prophylaxis by dental health care personnel

An overview and updated recommendations

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In June 2001, the U.S. Public Health Service, or USPHS, consolidated into one set of guidelines all previous USPHS recommendations for the management of health care personnel, or HCP, who have occupational exposure to blood and other body fluids that might contain hepatitis B virus, or

HBV; hepatitis C virus, or HCV; or human immunodeficiency virus, or HIV.¹⁻⁶ The current guidelines reflect the availability of new antiretroviral agents, new information about the use and safety of HIV postexposure prophylaxis, or PEP, and considerations about using HIV PEP when there is known or suspected resistance of the source patient's virus to antiretroviral agents. In addition, the new document provides guidance to clinicians and exposed HCP on deciding when to consider HIV PEP and recommendations for PEP regimens. (See sidebars, pages 1627-1630)

The USPHS document also addresses concerns about unwarranted use of PEP and the use of expanded regimens for exposures that pose a low or negligible risk. For example, data from the Centers for Disease Control and Prevention's, or CDC's, National

Background. The authors conducted a study on the use of postexposure prophylaxis, or PEP, for exposure to human immunodeficiency virus, or HIV, among dental health care personnel, or DHCP, enrolled in a surveillance system established by the Centers for Disease Control and Prevention, or CDC. They also discuss updated U.S. Public Health Service, or USPHS, recommendations for managing occupational exposures to HIV, as well as considerations for dentistry.

Methods. The authors analyzed occupational exposures reported by DHCP to the CDC to describe characteristics of the exposure (for example, type and severity), the source patient's HIV status and use of PEP.

Results. From June 1995 through August 2001, DHCP reported 208 exposures—199 percutaneous injuries, six mucous membrane exposures and three skin exposures—to the CDC. One-third of these percutaneous injuries were caused by small-bore hollow syringe needles, and most (66 percent) were moderate in depth. Nearly half the devices involved (46 percent) were visibly bloody at the time of injury. Per the criteria described in USPHS guidelines, one-half of the injuries were categorized as "less severe." Twenty-four (13 percent) known source patients were HIV-positive; 14 had symptomatic HIV infection or a high viral load. In this study, three in four DHCP exposed to an HIV-positive source warranted a three-drug PEP regimen. Twenty-nine (24 percent) DHCP exposed to a source patient who subsequently was found to be HIV-negative took PEP; six took PEP for five to 29 days. No exposures resulted in HIV infection.

Conclusions. Findings of this study are consistent with earlier reports indicating that the risk of HIV transmission in dental settings is low. Strategies such as rapid HIV testing of source patients and follow-up counseling may reduce unnecessary use of PEP.

Clinical Implications. Dental practices should develop comprehensive, written programs for preventing and managing occupational exposures to blood.



TABLE 1

CHARACTERISTICS USED TO DETERMINE EXPOSURE TYPE.			
EXPOSURE TYPE	CHARACTERISTICS OF THE EXPOSURE		
	Type of Device	Visible Blood	Depth of Injury
Less Severe	Solid instrument or small-bore hollow needle	No	Superficial or moderate
More Severe	Large-bore hollow needle or needle placed in vein or artery	Yes or no	Superficial, moderate or deep
		Any instrument	Deep
	Yes	Superficial, moderate or deep	

Surveillance System for Health Care Workers, or NaSH, indicate that some HCP take a full course of HIV PEP even when the source is HIV-negative.^{7,8} Since 1995, NaSH, a voluntary surveillance system, has collected information on occupational exposures and infections among HCP, including hospital-based dental health care personnel, or DHCP. NaSH monitors routine activities such as immunizations and tuberculosis, or TB, skin testing; occupational exposures to blood, vaccine-preventable diseases and TB; and surveys to evaluate underreporting of exposures. Using a standardized methodology, the CDC can monitor national trends, identify newly emerging hazards for HCP, assess the risk of occupational infection, and evaluate preventive measures. For example, a NaSH study found that more than one-half of exposed HCP took a three-drug PEP regimen when only a two-drug regimen was needed (CDC, unpublished data, 2000).

To date, few data have been published concerning the use of PEP among DHCP.⁹ The objectives of the study whose results are reported in this article were to describe the use of HIV PEP among DHCP included in NaSH. We also discuss the updated USPHS guidelines for managing occupational exposures to HIV and considerations for dentistry.⁴ This article focuses on occupational exposures to HIV specifically, but most exposures also will require evaluation and clinical management for HBV and HCV.⁴

METHODS

The CDC collected data from injury reports among HCP from 52 U.S. hospitals voluntarily enrolled in NaSH. Twenty-two of these hospitals

reported exposures among DHCP. We reviewed exposures to blood among DHCP reported from December 1995 through August 2001 to describe characteristics used as surrogates for the quantity of blood to which the worker was exposed; HIV status of the source patient and, for HIV-positive sources, the stage of disease; and the use of PEP by the exposed person, including the number of drugs taken and the duration of treatment. We char-

acterized the quantity of blood to which the person was exposed based on the type of device that caused the injury, whether the device was visibly contaminated with the patient’s blood at the time of the injury, and the depth of the injury. We also examined the types of procedures most frequently associated with the injuries. For hollow-bore devices, the gauge of the needle and purpose (that is, whether it was used to access a vein or artery or was used for blood collection) were identified. An injury was classified as superficial (such as a scratch), moderate (such as penetration of skin) or deep (as indicated by reports such as “muscle contracted,” “touched bone”).

For each injury for which there was adequate information, we identified the appropriate recommendation for PEP by analyzing the data in two steps. First, we classified the exposure type of each injury as “less severe” or “more severe” by examining the three factors (type of device, visible blood on the device and depth of injury) that characterized the quantity of blood to which the person was exposed (Table 1). Second, we matched the exposure type of each injury with the HIV infection status and stage of disease of the source patient, when known: Class 1 (asymptomatic or known low viral load [$\leq 1,500$ RNA copies per milliliter]) or Class 2 (symptomatic, AIDS diagnosis, acute seroconversion or known high viral load [$\geq 1,500$ RNA copies/mL]) (Table 2). HIV status either was known at the time of exposure or was determined subsequently by follow-up testing. All HIV tests of source patients tested after the exposure were performed using a standard enzyme immunoassay, or EIA, for which results are not available for at least six hours;

TABLE 2

RECOMMENDED HUMAN IMMUNODEFICIENCY VIRUS, OR HIV, POSTEXPOSURE PROPHYLAXIS, OR PEP, FOR PERCUTANEOUS INJURIES.*					
EXPOSURE TYPE	RECOMMENDATIONS BASED ON SOURCE PATIENT'S INFECTION STATUS				
	HIV-Positive Class 1†	HIV-Positive Class 2†	HIV Status Unknown‡	Source Unknown§	HIV-Negative
Less Severe¶	Basic two-drug PEP	Expanded three-drug PEP	Generally, no PEP warranted, but consider basic two-drug PEP# for source with HIV risk factors**	Generally, no PEP warranted, but consider basic two-drug PEP# in settings wherein exposure to HIV-infected people is likely	No PEP warranted
More Severe††	Expanded three-drug PEP	Expanded three-drug PEP	Generally, no PEP warranted, but consider basic two-drug PEP# for source with HIV risk factors**	Generally, no PEP warranted, but consider basic two-drug PEP# in settings wherein exposure to HIV-infected people is likely	No PEP warranted

* Adapted from Centers for Disease Control and Prevention.⁴
† HIV-positive, Class 1: Asymptomatic HIV infection or known low viral load ($\leq 1,500$ RNA copies/milliliter). HIV-positive, Class 2: Symptomatic HIV infection, acquired immunodeficiency syndrome, acute seroconversion or known high viral load ($\geq 1,500$ RNA copies/mL). If drug resistance is a concern, obtain expert consultation. Initiation of PEP should not be delayed pending expert consultation and, because expert consultation alone cannot substitute for face-to-face counseling, resources should be available to provide immediate evaluation and follow-up care for all exposures.
‡ Example: a deceased source person with no samples available for HIV testing.
§ Example: a needle from a sharps disposal container.
¶ Examples: a superficial injury or an injury inflicted by a solid needle.
In such cases, PEP is optional and should be based on an individualized decision by the exposed person in consultation with the treating clinician. See sidebar, page 1628, for a description of the basic two-drug and expanded three-drug regimens.
** If PEP is offered and taken and the source is later determined to be HIV-negative, PEP should be discontinued.
†† Examples: injury inflicted by a large-bore hollow needle, a deep puncture, injury inflicted by a visibly bloody device, injury inflicted by a needle used in a patient's artery or vein.

data did not indicate when the test results were reported to exposed DHCP. We compiled descriptive data using the Statistical Analysis System (Version 8.2, SAS Institute Inc., Cary, N.C.).

RESULTS

During the study period, 175 DHCP (dentists, oral surgeons, hygienists, assistants and dental students) reported a total of 208 occupational exposures to blood, including 199 percutaneous injuries, six mucous-membrane exposures and three skin exposures. Because most PEP data for mucous-membrane and skin exposures were missing, our analysis was limited to percutaneous injuries. These events occurred most frequently with small-bore hollow syringe needles (34 percent), followed by burs (13 percent), suture needles (11 percent), surgical scalpels (7 percent), scalers (6 percent), explorers (5 percent) and wires (4 percent); "other sharp objects" accounted for 20 percent (Figure 1). Among injuries with other sharp objects, one involved a large-bore

hollow needle (< 23 gauge) used for blood collection, and another involved a needle used to deliver intravenous fluids.

Most injuries (66 percent) were of moderate depth; 29 percent were superficial; and only 5 percent were described as deep punctures or wounds. Almost half (46 percent) of devices involved were visibly bloody; 35 percent were not visibly contaminated with blood; for 19 percent, this factor was unknown.

Injuries were evenly distributed between less and more severe exposure types. Only 62 (31 percent) injury reports contained information about the type of procedure being performed at the time of exposure. Of these, the most common procedures were oral surgical (39 percent), followed by restorative (21 percent), hygiene (15 percent) and those classified as "other" (25 percent). Of injuries for which procedure information was provided, oral surgical procedures accounted for 53 percent (16 of 30) of those with visibly bloody devices, for 80 percent (four of five) of deep

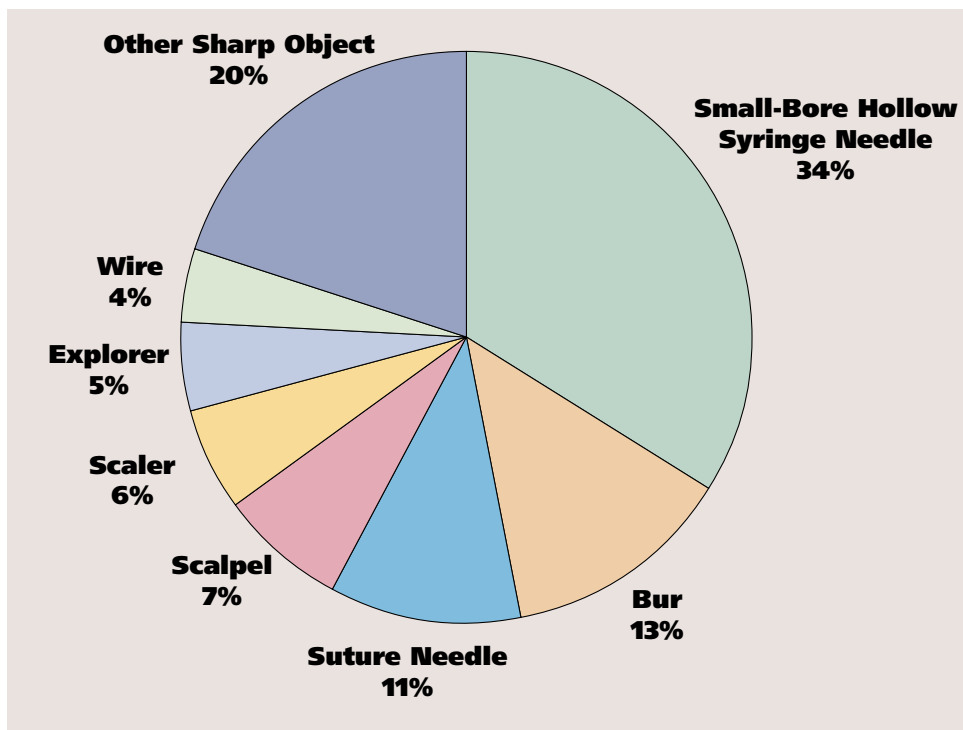


Figure 1. Type of device involved in percutaneous injuries (n = 199) among dental health care personnel included in the Centers for Disease Control and Prevention’s National Surveillance System for Healthcare Workers, June 1995 through August 2001.

injuries and for 53 percent (17 of 32) of injuries categorized as more severe.

One hundred eighty-six source patients were identified. Of these, at follow-up, 24 (13 percent) were HIV-positive, 132 (71 percent) were HIV-negative and 30 (16 percent) had unknown HIV status. About half the injuries in both the HIV-positive group (46 percent) and the HIV-negative and unknown group combined (50 percent) were classified as less severe. Of source patients who were HIV-positive, 25 percent were in Class 1 and 58 percent were in Class 2; this information was not available for 17 percent of these patients (Figure 2). Sixty-three percent of DHCP exposed to an HIV-positive source started PEP, and 33 percent of these people took PEP for 20 or more days. Because of insufficient data, we were unable to determine the actual numbers of PEP drugs used by the exposed DHCP. Of all people exposed to an HIV-positive source, 21 percent warranted use of two drugs and 71 percent warranted use of three drugs, based on the exposure type and the source patient’s stage of disease. (See sidebar, page 1628, for a description of the basic two-drug and expanded three-drug regimens.) Information on the source patient’s stage

of disease was not available for 8 percent of exposures that warranted PEP. Twenty-nine DHCP (24 percent) exposed to a source patient subsequently found to be HIV-negative initiated PEP; of 24 for whom information was available, 18 took it for three days or less; five took it for five to 15 days; and one took it for 29 days. In these data, no exposures resulted in HIV infection of DHCP.

DISCUSSION

It is reassuring that no one in this small group of hospital-based DHCP exposed to HIV-positive sources is known to have been infected with the virus. This finding is consistent with available information indicating that the overall risk of infected patients’ transmitting HIV

to DHCP is very small. For example, as of June 2001, there were no DHCP among the 57 U.S. HCP with documented HIV seroconversion following a specific exposure to a known HIV-infected source patient.¹⁰ Among these 57 workers, 51 had percutaneous injuries. Most (n = 45) of the percutaneous injuries were caused by hollow-bore needles, 22 of which were used in blood collection; of the 30 hollow-bore needles with a known gauge, 27 were large-gauge (< 23 gauge).¹¹ The CDC also has received reports of 137 additional HCP considered to have possible occupational HIV transmission; of these, only six were DHCP. For each of the 137 people, no other risk for infection—such as a sexual or drug behavior or blood transfusion—could be identified during follow-up investigation. Each of the six DHCP reported a history of occupational percutaneous or mucous-membrane exposure to blood or body fluids in the dental setting, but HIV seroconversion could not be linked to a specific exposure. Other evidence supporting the low risk of occupationally acquired HIV infection among DHCP includes HIV seroprevalence studies showing low rates of HIV infection among DHCP, including oral surgeons.¹²⁻¹⁴

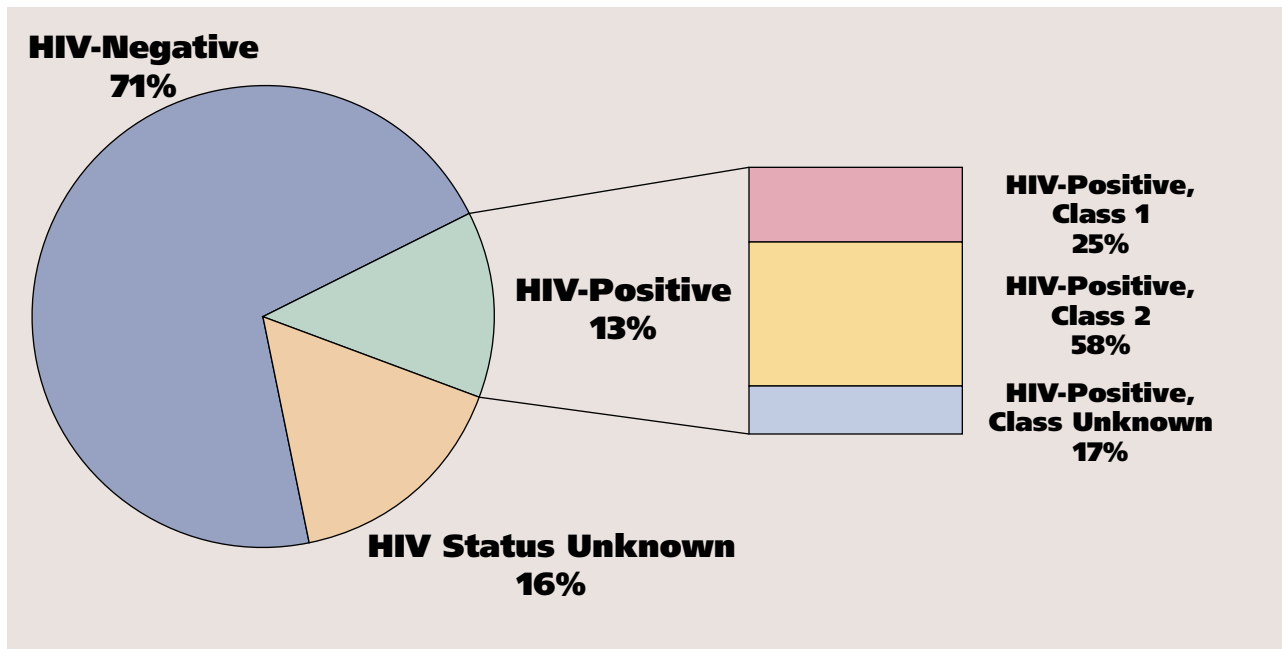


Figure 2. Human immunodeficiency virus, or HIV, status of known source patients (n = 186) for exposures experienced by dental health care personnel included in the Centers for Disease Control and Prevention's National Surveillance System for Healthcare Workers, June 1995 through August 2001. HIV-positive, Class 1: Asymptomatic HIV infection or known low viral load ($\leq 1,500$ RNA copies/milliliter). HIV-positive, Class 2: Symptomatic HIV infection, AIDS, acute sero-conversion or known high viral load ($\geq 1,500$ RNA copies/mL).

Although 50 percent of the injuries in our study were classified as more severe exposures, few were deep injuries or involved large-bore hollow needles or devices used in an artery or a vein. These findings suggest that DHCP were exposed to relatively small volumes of blood and are consistent with the documented low risk of HIV transmission in dental settings. Published reports evaluating percutaneous injuries among DHCP and factors related to the severity of the injury lend further support to the low level of this risk.^{13,15-19} For example, cross-sectional and prospective studies conducted by the American Dental Association have found that small-gauge syringe needles and solid instruments caused most (> 96 percent) injuries among dentists; according to current guidelines, these injuries would be classified as less severe.^{13,17} In a study examining 428 reports of percutaneous injuries in dental teaching settings, small-bore hollow syringe needles caused 33 percent of injuries, burs 17 percent and explorers 12 percent; only 5 percent were deep exposures.²⁰ In 1995, the circumstances of exposures to HIV-infected blood among 19 dental workers voluntarily enrolled in a national surveillance project commonly known as CDC's needlestick study were examined.¹⁵ Findings of that study, the first to collect information

about factors representative of the amount of blood to which DHCP were exposed, suggested that most of these DHCP were exposed to small volumes. About one-third of the instruments were reported as being visibly bloody at the time of injury, most injuries with hollow-bore syringe needles involved smaller-gauge needles and none of the exposures was described as a deep puncture wound.

In our review of percutaneous injuries to hospital-based DHCP as reported in NaSH, we found that almost half of the devices were visibly contaminated with blood. Where there was information on procedures, we found that slightly more than one-half of the injuries involving a visibly bloody device occurred during oral surgery. We believe, however, that DHCP preferentially reported exposures they believed were more likely to result in HIV infection (those with bloody devices or an HIV-positive source) or for which they wanted PEP or both. This would be consistent with other studies indicating that most percutaneous injuries to HCP go unreported because the person believes the injury carries a low risk.²⁰

The risk of HIV transmission varies with the type and severity of exposure as well as with the source's HIV status. According to current criteria for recommending PEP, almost three-quarters of

percutaneous injuries among NaSH DHCP exposed to an HIV-positive source patient warranted use of the expanded three-drug regimen. This finding was based in large measure on the fact that 58 percent of the HIV-positive source patients were in Class 2 (in which case three-drug PEP always is recommended), and 54 percent of the exposures were considered more severe (again, in which case three-drug PEP always is recommended). We should note that CDC recommendations for PEP are based on the risk of developing HIV infection after different types of exposures, as well as on limited information about the efficacy and toxicity of PEP. Given the low frequency of injuries that were deep punctures or involved large-bore hollow needles or devices used in an artery or a vein, the risk for DHCP in NaSH could well be lower than that for other types of medical HCP, who are more likely to sustain more severe injuries (for example, during blood collection). Understanding the common characteristics of dental injuries as well as the factors associated with the risk of HIV transmission (such as the amount of blood involved) can help the evaluating health care professional balance the risk of HIV infection with the effects of PEP.

Of concern is that some DHCP exposed to source patients who ultimately were determined to be HIV-negative took PEP. Two plausible reasons may explain these findings. First, exposed DHCP may have started PEP pending test results of the source patient. If test results had been delayed for some reason, the exposed person may have continued PEP although it was not necessary. This underscores the importance of using the rapid HIV antibody assays and re-evaluating the exposed person within 72 hours so that regimens can be discontinued or altered as additional information becomes available. The use of rapid HIV antibody assays can prevent the unnecessary use of PEP and associated adverse symptoms when results are provided to exposed HCP as soon as they are available.⁸ In addition, the use of rapid HIV test results could result in economic savings.^{21,22} In a 1999 study, HCP whose sources were tested using the standard EIA took PEP for a median of four days, with an average cost per person for testing

and drugs of \$123.²² In comparison, for people whose sources were tested with the rapid HIV test, the duration of PEP was one day, at an average cost of \$69 per person for testing and drugs.

A second reason for prolonged PEP use might have been because of concerns that the source was in the “window period” of HIV infection. USPHS guidance, however, indicates that if the source person is HIV-negative and has no clinical evidence of AIDS or symptoms of HIV infection, the likelihood of the person’s being in the “window period” of HIV infection is extremely small. Thus, if PEP is started and the source is found to be HIV-negative, PEP should be discontinued.⁴

Of concern is that some dental health care personnel exposed to source patients who ultimately were determined to be HIV-negative took postexposure prophylaxis.

Avoiding occupational blood exposures is the primary way to prevent transmission of bloodborne pathogens in health care settings. Reducing percutaneous injuries can be accomplished through engineering controls, such as using safer devices (for example, those with engineered sharps injury prevention features), and by modifying work practices. Personal protective equipment—such as gloves, masks, protective eyewear and gowns—is used to prevent skin and mucous-membrane exposures.

Changes to the bloodborne pathogens standard of the Occupational Safety and Health Administration, or OSHA, mandated by the Needlestick Safety and Prevention Act,²³ were published Jan. 18, 2001, and became effective April 18, 2001.²⁴ The revisions clarified the need for employers to select safer needle devices as they become available and to involve employees in identifying and choosing the devices. Many safer versions of sharp devices used in hospital settings have become available and their impact on reducing injuries has been studied.^{25,26} In dentistry, aspirating anesthetic syringes have been developed to incorporate safety features; however, low injury rates in dentistry limit assessment of their effect on reducing injuries among DHCP. Nonetheless, injuries with small-bore hollow needles accounted for the largest percentage of injuries in our study. Furthermore, the impact of safer medical devices in other settings suggests that devices with engineered safety features would reduce percutaneous

injuries in dental settings as well. A sharps injury prevention program that includes a process for identifying, screening and evaluating safer dental devices should be developed by all dental practices and integrated into existing infection control and safety programs.

This study has several limitations. It is a retrospective review of self-reported data from less than one-half of the 52 hospitals voluntarily enrolled in NaSH. Thus, the findings may not be generalizable to other hospital-based or private-practice DHCP.

In addition, reporting bias may have affected the accuracy of some information, such as the depth of the injury, or it may have resulted in missing data (for example, presence of visible blood on the device, type of procedure during which the injury occurred). Furthermore, loss to follow-up resulted in missing PEP data, which, in many cases, precluded an evaluation of the number of PEP drugs taken. These limitations notwithstanding, however, three important characteristics of the injuries in our study (type of device, depth of injury and presence of visible blood on the device) were similar to those described in several other studies of DHCP.^{13,15,17} Finally, these data may represent only a fraction of injuries among DHCP in these facilities, because many injuries go unreported.

SUMMARY

In this analysis, we examined factors associated with the risk of HIV transmission following occupational exposures to blood and examined the use of PEP among hospital-based DHCP enrolled in NaSH. In general, findings of this study are consistent with those of earlier reports indicating that the risk of HIV transmission in dental settings is low. Even so, of the small group of DHCP who were exposed to HIV-positive source patients, close to three-fourths would have warranted the three-drug regimen, based on the severity of the injury and the source patient's stage of disease. In addition, findings suggest that strategies such as rapid HIV testing of the source patient and follow-up counseling would have decreased the use of PEP among exposed DHCP.

Since the first guidelines for managing occupa-



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tional blood exposures to HIV were published in 1990, additional information about the use and safety of PEP has become available. Studies have identified factors associated with the risk of HIV transmission, further describing exposures that may benefit most from PEP.²⁷ Improved methodologies for animal and human studies have continued to show beneficial results from PEP in reducing transmission of HIV. Overall, these studies have provided additional support for recommending PEP following certain occupational exposures. With the advent of new antiretroviral agents, however, PEP regimens have become more complex, serious side effects more frequent, and development of resistant strains more common.

Health care professionals who will evaluate exposed DHCP should be selected before DHCP are placed at risk of exposure, should have expertise in antiretroviral therapy and should be familiar with the unique nature of dental injuries so that they can provide appropriate follow-up. ■

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The complete Centers for Disease Control and Prevention, or CDC, guideline, "Management of Occupational Exposures to Hepatitis B, Hepatitis C and HIV, and Recommendations for Postexposure Prophylaxis," can be found online at "www.cdc.gov/ncidod/hip/Guide/phspep.htm". CDC's sample screening and evaluation forms for safer dental devices can be found at "www.cdc.gov/OralHealth/infection_control/forms.htm". More information about CDC's National System for Health Care Workers is available at "www.cdc.gov/ncidod/hip/nash".

1. Centers for Disease Control and Prevention. Public Health Service statement on management of occupational exposure to human immunodeficiency virus, including considerations regarding zidovudine postexposure use. *MMWR Recomm Rep* 1990;39(RR-1):1-14.

2. Centers for Disease Control and Prevention. Update: provisional Public Health Service recommendations for chemoprophylaxis after occupational exposure to HIV. *MMWR Morb Mortal Wkly Rep* 1996;45:468-72.

3. Centers for Disease Control and Prevention. Public Health Service guidelines for the management of health-care worker exposures to HIV and recommendations for postexposure prophylaxis. *MMWR Recomm Rep* 1998;47(RR-7):1-33.

4. Centers for Disease Control and Prevention. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. *MMWR Recomm Rep* 2001;50(RR-11):1-52.

5. Centers for Disease Control and Prevention. Recommendations for prevention and control of hepatitis C virus (HCV) infection and HCV-related chronic disease. *MMWR Recomm Rep* 1998;47(RR-19):1-39.

6. Hepatitis B virus: a comprehensive strategy for eliminating trans-

mission in the United States through universal childhood vaccination. Recommendations of the Immunization Practices Advisory Committee (ACIP). *MMWR Recomm Rep* 1991;40(RR-13):1-25.

7. Jochimsen EM, Srivastava PU, Campbell SR, Cardo DM, NaSH Surveillance Group. Postexposure prophylaxis (PEP) use among health care workers (HCWs) after occupational exposures to blood (abstract W6-F). Paper presented at: Fourth ICOH International Conference on Occupational Health for Health Care Workers, Montreal, Canada, Sept. 29-Oct. 1, 1999.

8. Critchley SE, Srivastava PU, Campbell SR, Cardo DM, NaSH Surveillance Group. Postexposure prophylaxis use among health care workers who were exposed to HIV-negative source persons (abstract P-S2-64). Paper presented at: Fourth Decennial International Conference on Nosocomial and Healthcare-Associated Infections, Centers for Disease Control and Prevention; March 5-9, 2000; Atlanta.

9. Cleveland J, Barker L, Campbell S, Cardo D, NaSH Surveillance Group. Postexposure prophylaxis (PEP) among dental workers after occupational HIV exposures (abstract 3412). *J Dent Res* 2000;79:570.

10. Centers for Disease Control and Prevention. Preventing occupational HIV transmission to health care personnel. Available at: "<http://www.cdc.gov/hiv/pubs/facts/hcwprev.htm>". Accessed May 21, 2002.

11. Do A, Li J, Fleming P. Occupational HIV infection in health care workers in the U.S.: possible lessons for developing countries? (abstract ThPpC1454). Paper presented at: XIII International AIDS Conference; July 2000; Durban, South Africa.

12. Klein RS, Phelan JA, Freeman K, et al. Low occupational risk of human immunodeficiency virus infection among dental professionals. *N Engl J Med* 1988;318(2):86-90.

13. Gruninger SE, Siew C, Chang SB, et al. Human immunodeficiency virus type I. Infection among dentists. *JADA* 1992;123(3):57-64.

14. Gooch BF, Siew C, Cleveland JL, Gruninger SE, Lockwood SA, Joy ED. Occupational blood exposure and HIV infection among oral and maxillofacial surgeons. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1998;85(2):128-34.

15. Gooch BF, Cardo DM, Marcus R, et al. Percutaneous exposures to HIV-infected blood among dental workers enrolled in the CDC Needlestick Study. *JADA* 1995;126:1237-42.

16. Siew C, Chang SB, Gruninger SE, Verrusio AC, Neidle EA. Self-reported percutaneous injuries in dentists: implications for HBV, HIV,

transmission risk. *JADA* 1992;123(7):37-44.

17. Siew C, Gruninger SE, Miaw CL, Neidle EA. Percutaneous injuries in practicing dentists: a prospective study using a 20-day diary. *JADA* 1995;126:1227-34.

18. Cleveland JL, Lockwood SA, Gooch BF, et al. Percutaneous injuries in dentistry: an observational study. *JADA* 1995;126:745-51.

19. Cleveland JL, Gooch BF, Lockwood SA. Occupational blood exposure in dentistry: a decade in review. *Infect Control Hosp Epidemiol* 1997;18:717-21.

20. Ramos-Gomez F, Ellison J, Greenspan D, Bird W, Lowe S, Gerberding JL. Accidental exposures to blood and body fluids among health care workers in dental teaching clinics: a prospective study. *JADA* 1997;128:1253-61.

21. Kallenborn JC, Price TG, Carrico R, Davidson AB. Emergency department management of occupational exposures: cost analysis of rapid HIV test. *Infect Control Hosp Epidemiol* 2001;22:289-93.

22. Veeder AV, McErlean M, Putnam K, Caldwell WC, Venezia RA. The impact of a rapid HIV test to limit unnecessary postexposure prophylaxis following occupational exposures (abstract P-S2-66). Paper presented at: Fourth Decennial International Conference on Nosocomial and Healthcare-Associated Infections in conjunction with the 10th Annual Meeting of the Society for Healthcare Epidemiology of America, Inc.; March 5-9, 2000; Atlanta.

23. Pub. L. No. 106-430, 114 Stat. 1901.

24. U.S. Department of Labor, Occupational Health and Safety Administration. Occupational exposure to bloodborne pathogens; needlestick and other sharps injuries; final rule. 29 CFR Part 1910, Docket No. H370A RIN 1218-AB85. *Fed Reg* 2001;66(12):5317-25.

25. Centers for Disease Control and Prevention. Evaluation of blunt suture needles in preventing percutaneous injuries among health-care workers during gynecologic surgical procedures: New York City, March 1993-June 1994. *MMWR Morb Mortal Wkly Rep* 1997;46(2):25-9.

26. Centers for Disease Control and Prevention. Evaluation of safety devices for preventing percutaneous injuries among health-care workers during phlebotomy procedures: Minneapolis, St. Paul, New York City, and San Francisco, 1993-1995. *MMWR Morb Mortal Wkly Rep* 1997;46(2):21-5.

27. Cardo DM, Culver DH, Ciesielski CA, et al. A case-control study of HIV seroconversion in health care workers after percutaneous exposure. Centers for Disease Control and Prevention Needlestick Surveillance Group. *N Engl J Med* 1997;337:1485-90.

Updated USPHS Guidelines for Managing Occupational Exposures to HBV, HCV, and HIV and Considerations for Dentistry*

Postexposure management is an integral component of a complete program to prevent infection after an occupational exposure to blood.¹ An exposure that might place health care personnel, or HCP, at risk of experiencing infection with a bloodborne pathogen is defined as a percutaneous injury (e.g., needle stick or a cut with a sharp object) or contact of mucous membrane or nonintact skin (e.g., exposed skin that is chapped, abraded, or afflicted with dermatitis) with blood, tissue or other body fluids that are potentially infectious (such as blood, body fluids containing visible blood, semen and vaginal secretions).

RISK OF HIV INFECTION AFTER OCCUPATIONAL EXPOSURE AMONG HEALTH CARE PERSONNEL

In prospective studies of HCP, the average risk of HIV transmission after a percutaneous exposure to HIV-infected blood has been estimated to be 0.3 percent (range: 0.2 percent-0.5 percent)² and after a mucous membrane exposure, approximately 0.1 percent.³ The precise risk of transmission after skin exposures is unknown, but it is estimated to be less than the risk for mucous membrane exposures.

Several factors affect the risk of HIV transmission after an occupational exposure. Laboratory studies have found that during an exposure, needles that pass through latex gloves, are solid rather than hollow-bore, or are of small gauge, such as those commonly used in dentistry, transfer less blood.⁴ In a retrospective case-control study of HCP, an increased risk for HIV infection was associated with exposures to a relatively large volume of blood as indicated by a deep injury, injury with a device that was visibly contaminated with the patient's blood, or a procedure that involved a needle placed in the patient's vein or artery.⁵ The risk was also increased if the exposure was to blood from patients with terminal illness, possibly

reflecting the higher titer of HIV in late-stage AIDS.

RATIONALE FOR PEP AFTER AN OCCUPATIONAL EXPOSURE TO HIV

The ideal study to evaluate the efficacy of PEP after occupational exposure—prospective, randomized, placebo-controlled—is impractical because of the large sample of HCP needed to detect a significant benefit from PEP. Thus, the rationale and recommendations to establish HIV PEP as a standard of care following an exposure to HIV-infected blood are based on indirect evidence of PEP efficacy, including data on HIV pathogenesis and human and animal studies on PEP.

Current information suggests that systemic infection does not occur immediately after an exposure. Thus, PEP can be considered biologically plausible, as there is a short window of opportunity in which it may limit or prevent viral replication. Data from animal studies have found that PEP prevented retroviral infection altogether or decreased its rate in some cases; delaying time to treatment, shortening its duration, or decreasing the dose of treatment all decreased efficacy. The extent to which data from animal studies can be extrapolated to humans is largely unknown, however.

In the retrospective case-control study among HCP, PEP was associated with an 81 percent decrease in the risk of HIV seroconversion after percutaneous exposure to HIV-infected blood.⁵ Although the results of this study suggest PEP efficacy, it was limited by relatively few cases and by the use of cases and controls from different sources. Trials of zidovudine (ZDV) and other antiretroviral drugs to prevent perinatal HIV transmission have shown a significant decrease in transmission.⁶ Only part of the protective effect of ZDV was explained by reduction of the HIV viral load in the maternal blood, however, suggesting that other mechanisms were involved. Recent studies have also shown a

reduction, although small, in transmission when the antiretroviral drug was given only to the newborn within 48-72 hours after birth, highlighting the role of PEP.⁷⁻¹⁰

Although these studies tend to support the use of PEP for occupational exposures, this protection is not absolute. Failure of PEP to prevent HIV infection in HCP has been reported in at least 21 instances.^{1,11} Possible contributing factors have included exposure to a resistant strain, high titer or large inoculum, delayed initiation or short duration of the regimen, and possible host factors such as diminished cellular immune response.

PEP FOR OCCUPATIONAL HIV EXPOSURES

Because most occupational HIV exposures do not result in the transmission of HIV, the decision to recommend PEP must carefully balance the risk of HIV infection (represented by the exposure and information about the exposure source) and the efficacy and adverse side effects of PEP. First, the exposure should be evaluated for potential to transmit HIV based on the type of body substance involved and the route and severity of the exposure (Table 2). For example, exposure to a blood-filled, large-bore hollow needle or visibly bloody device suggests a higher risk for transmission than exposure to a needle used for an injection.¹ A basic regimen using two nucleoside analogs (e.g., ZDV and 3TC, or 3TC and d4T) is recommended if the source is Class 1 (asymptomatic or has a known low viral load [$\leq 1,500$ RNA copies/mL]) and the exposure was "less severe" (e.g., solid needle and superficial injury). An expanded PEP regimen, which adds a protease inhibitor, is recommended for "more severe" injuries (large-bore hollow needle, deep puncture, visible blood on the device, or needle used in a patient's artery or vein) or if the source is Class 2 (symptomatic, has AIDS, or has a known high viral load [$\geq 1,500$ RNA copies/mL]), regardless of the severity of the exposure. In most cases, if the HIV status is unknown, no PEP is warranted. PEP may be considered, however, for source patients with HIV risk factors or in settings where patients are likely to be HIV-positive. Because drug regimens for PEP are subject to change (based on the availability of new drugs and the development of resistant strains), a previously identified physician or

occupational health specialist with expertise in antiretroviral therapy should be consulted when the decision is being made whether to begin PEP and should decide which drugs to prescribe. If PEP is indicated, it should be started as soon as possible (within hours rather than days). The exposed person should be reevaluated within 72 hours so that regimens can be altered as additional information becomes available. If a source patient is determined to be HIV-negative, PEP should be discontinued.

TREATMENT OF EXPOSURE SITE, EXPOSURE REPORT AND EVALUATION OF THE EXPOSURE

After an occupational blood exposure, first aid should be administered as necessary. Puncture wounds and other injuries to the skin should be washed with soap and water; mucous membranes should be flushed with water.¹ Exposed personnel should immediately report the exposure to the infection control coordinator, who should initiate referral to the qualified health care professional and complete necessary reports. Because many factors contribute to the risk of infection after an occupational exposure to blood, the following information should be included in the exposure report, provided to the evaluating health care professional and recorded in the exposed person's confidential medical record:

- date and time of exposure;
- details of the procedure being performed, including where and how the exposure occurred and whether the exposure involved a sharp device, the type and brand of device and how and when during its handling the exposure occurred;
- details of the exposure, including the type and amount of fluid or material and the severity of the exposure. For a percutaneous injury, this would include the depth of the wound, gauge of the needle, and whether fluid was injected; for a skin or mucous membrane exposure, the estimated volume of material, duration of contact, and the condition of the skin (e.g., chapped, abraded, or intact);
- details about the exposure source—whether the source material contained HIV or other bloodborne pathogens and, if the source was infected with HIV, the stage of disease, history of antiretroviral therapy, and viral load, if known;

- details about the exposed person (e.g., hepatitis B vaccination and immune status at follow-up, and
- details about counseling, postexposure management, and follow-up.

Each occupational exposure should be evaluated individually for the potential to transmit a bloodborne pathogen. This evaluation is based on the following: 1) the type and amount of body substance involved, 2) the type of exposure (e.g., percutaneous injury, mucous membrane or non-intact skin exposure, bites resulting in blood exposure to either person involved), 3) the infectious status of the source, and 4) the susceptibility of the exposed person.¹ All of these factors should be considered in assessing the risk of infection and the need for further follow-up (e.g., PEP).

CONSIDERATIONS FOR DENTISTRY

During dental procedures, saliva will predictably be contaminated with blood.^{12,13} If blood is not visible, however, it is likely that only very small quantities of blood are present, and the risk for transmission of hepatitis B virus, or HBV; hepatitis C virus, or HCV; and HIV is extremely small.⁴ Despite this small risk of transmission, a qualified health care professional should evaluate any occupational exposure to saliva, regardless of the presence of visible blood.

Dental practices should make available to their personnel a written, comprehensive program that includes HBV immunization and post-exposure management protocols that: 1) describe the types of blood contact that may place DHCP at risk for infection; 2) describe procedures for promptly reporting and evaluating such exposures; and of particular importance to outpatient dental settings 3) identify a health care professional who is qualified to provide counseling and perform all medical evaluations and procedures in accordance with the most current recommendations of the USPHS, including PEP when indicated. As part of their job orientation and ongoing job training, DHCP and students who might reasonably be considered at risk of occupational exposure to blood or other potentially infectious fluids should learn strategies to prevent blood contacts and the principles of postexposure management, including options for PEP.

Educational programs for dental staff and students should emphasize reporting all exposures as soon as possible, because certain interventions that may be indicated must be initiated promptly to be effective. Policies must be consistent with the practices and procedures for worker protection required by OSHA and current USPHS recommendations for managing occupational exposures to blood.^{1,14}

* Adapted from U.S. Public Health Service, Centers for Disease Control and Prevention,⁴ with the exception of the section on considerations for dentistry.

1. U.S. Public Health Service, Centers for Disease Control and Prevention. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. *MMWR Recomm Rep* 2001;50(RR-11):1-52.

2. Bell DM. Occupational risk of human immunodeficiency virus infection in health care workers: an overview. *Am J Med* 1997;102(5B):9-15.

3. Ippolito G, Puro V, De Carli G. The risk of occupational human immunodeficiency virus infection in health care workers: Italian multicenter study—the Italian Study Group on Occupational Risk of HIV Infection. *Arch Intern Med* 1993;153:1451-8.

4. Mast ST, Woolwine JD, Gerberding JL. Efficacy of gloves in reducing blood volumes transferred during simulated needlestick injury. *J Infect Dis* 1993;168:1589-92.

5. Cardo DM, Culver DH, Ciesielski CA, et al. A case-control study of HIV seroconversion in health care workers after percutaneous exposure. Centers for Disease Control and Prevention Needlestick Surveillance Group. *N Engl J Med* 1997;337:1485-90.

6. Connor EM, Sperling RS, Gelber R, et al. Reduction of maternal-infant transmission of human immunodeficiency virus type 1 with zidovudine treatment. *N Engl J Med* 1994;331:1173-80.

7. Saba J, PETRA Trial Study Team. Interim analysis of early efficacy of three short ZDV/3TC combination regimens to prevent mother-to-child transmission of HIV-1: the PETRA trial (abstract S-7). Paper presented at: Sixth Conference on Retroviruses and Opportunistic Infections, Foundation for Retrovirology and Human Health in scientific collaboration with the National Institute of Allergy and Infectious Diseases and the Centers for Disease Control and Prevention; Jan. 31-Feb. 4, 1999; Chicago.

8. Musoke P, Guay LA, Bagenda D, et al. A phase I/II study of the safety and pharmacokinetics of nevirapine in HIV-1-infected pregnant Ugandan women and their neonates (HIVNET 006). *AIDS* 1999;13:479-86.

9. Guay LA, Musoke P, Fleming T, et al. Intrapartum and neonatal single-dose nevirapine compared with zidovudine for prevention of mother-to-child transmission of HIV-1 in Kampala, Uganda: HIVNET 012 randomised trial. *Lancet* 1999;354:795-802.

10. Wade NA, Birkhead GS, Warren BL, et al. Abbreviated regimens of zidovudine prophylaxis and perinatal transmission of the human immunodeficiency virus. *N Engl J Med* 1998;339:1409-14.

11. Jochimsen EM. Failures of zidovudine postexposure prophylaxis. *Am J Med* 1997;102(5B):52-5.

12. U.S. Public Health Service, Centers for Disease Control and Prevention. Update: universal precautions for prevention of transmission of human immunodeficiency virus, hepatitis B virus, and other bloodborne pathogens in health-care settings. *MMWR Morb Mortal Wkly Rep* 1988;37:377-82, 387-8.

13. U.S. Public Health Service, Centers for Disease Control and Prevention. Guidelines for prevention of transmission of human immunodeficiency virus and hepatitis B virus to health-care and public-safety workers. *MMWR Morb Mortal Wkly Rep* 1989;38(supplement 6):1-37.

14. U.S. Department of Labor, Occupational Health and Safety Administration. Occupational exposure to bloodborne pathogens: final rule. *CFR Part 1910.1030. Fed Reg* 1991;56:64004-182.

Management of Occupational Blood Exposures*

Provide immediate care to the exposure site.

- Wash wounds and skin with soap and water.
- Flush mucous membranes with water.

Determine risk associated with exposure by

- type of fluid (e.g., blood, visibly bloody fluid, other potentially infectious fluid or tissue, concentrated virus);
- type of exposure (i.e., percutaneous injury, mucous membrane or nonintact skin exposure, and bites resulting in blood exposure).

Evaluate exposure source.

- Assess the risk of infection using available information.
- Test known sources for hepatitis B, or HBV, surface antigen; antibodies to hepatitis C virus, or HCV (anti-HCV); and HIV antibody (consider using rapid testing).
- For unknown sources, assess risk of exposure to HBV, HCV or HIV infection.
- Do not test discarded needles or syringes for virus contamination.

Evaluate the exposed person.

- Assess immune status for HBV infection (by history of hepatitis B vaccination and vaccine response).

Give PEP for exposures posing risk of infection transmission.

- HBV [**Editor's note:** A description of PEP in cases of HBV transmission is provided in U.S. Public Health Service, Centers for Disease Control and Prevention.¹]
- HCV: PEP not recommended.
- HIV [**Editor's note:** A full description of PEP in cases of HIV transmission is provided in U.S. Public Health Service, Centers for Disease Control and Prevention.¹]
- Initiate PEP as soon as possible, preferably within hours of exposure.
- Offer pregnancy testing to all women of childbearing age not known to be pregnant.
- Seek expert consultation if viral resistance is suspected.

- Administer PEP for four weeks if tolerated.

Perform follow-up testing and provide counseling.

- Advise exposed persons to seek medical evaluation for any acute illness occurring during follow-up.

HBV exposures

- Perform follow-up anti-HBs testing in persons who receive hepatitis B vaccine.
 - Test for anti-HBs one to two months after last dose of vaccine.
 - Anti-HBs response to vaccine cannot be ascertained if hepatitis B immunoglobulin was received in the previous three to four months.

HCV exposures

- Perform baseline and follow-up testing for anti-HCV and alanine aminotransferase, or ALT, four to six months after exposures.
- Perform HCV RNA at four to six weeks if earlier diagnosis of HCV infection desired.
- Confirm repeatedly reactive anti-HCV enzyme immunoassays with supplemental tests.

HIV exposures

- Perform HIV-antibody testing for at least six months postexposure (e.g., at baseline, six weeks, three months, and six months).
- Perform HIV antibody testing if illness compatible with an acute retroviral syndrome occurs.
- Advise exposed persons to use precautions to prevent secondary transmission during the follow-up period.
- Evaluate exposed persons taking PEP within 72 hours after exposure and monitor for drug toxicity for at least two weeks.

*Adapted from U.S. Public Health Service, Centers for Disease Control and Prevention.¹

1. U.S. Public Health Service, Centers for Disease Control and Prevention. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. *MMWR Recomm Rep* 2001;50(RR-11):45-6.