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Continued need for strategies to prevent needlestick injuries and occupational exposures to bloodborne pathogens

by Linda S Martin, PhD, Christine A Hudson, MPH, Phillip W Strine, BS[1]

Approximately 6.9 million health care and emergency-response workers in the United States are potentially at risk of infection with the human immunodeficiency virus (HIV) and other bloodborne pathogens during performance of their jobs. The potential for occupational transmission will continue to increase as the number of persons who have HIV and other bloodborne infections and require medical care increases. In fact, hepatitis B virus (HBV) infection is the major infectious occupational hazard to health care workers, with estimates of approximately 18 000 HBV infections in health care workers each year; 12 000 of these infections occur in employees who have occupational exposure to blood. Approximately 1000 health care workers annually become HBV carriers at risk of long-term sequelae, including disabling chronic liver disease.

Problem definition

Of all the possible risks to health care workers for the occupational transmission of HIV, contaminated needles and sharp objects pose the single most serious risk. The risk of infection with HIV following one needlestick exposure to blood from a patient known to be infected is approximately 0.3% (1). This figure can be compared with that for HBV, for which the estimated risk ranges from 6 to 30% following one needlestick exposure.

For HIV, specifically, transmission has occurred primarily as a result of percutaneous inoculation of the worker with HIV-infected blood. As of December 1991 the Centers for Disease Control was aware of 28 health care workers in the United States who had seroconverted to HIV following an occupational exposure to HIV-infected blood. Of these, 12 were laboratory workers, 11 were nurses, three were physicians, and two were employed in other health care occupations. Of the 28 exposures, 23 were percutaneous, four were mucocutaneous, and one was both percutaneous and mucocutaneous. In addition, reports are available on 18 health care workers for whom HIV infection was thought to be occupationally acquired, but for whom seroconversion after a specific exposure incident could not be documented. At least 11 additional cases of occupationally acquired infection from outside the United States have been reported or published. Undoubtedly, there are other cases in addition to the published ones.

Data from the literature were compiled to help define further factors associated with the occupational transmission of potential bloodborne pathogens. Most studies were respondent surveys rather than observational investigations, the majority being directed towards hospital workers. Needlestick injuries, reported as the percentage of workers injured, ranged from 34 to 50%. The denominator figures were unavailable in many studies. Examples of data reporting include 189 needlestick injuries per 1000 health care workers (2), 107 needlestick injuries per 1000 health care workers (3), and 2134 exposures per 7065 patient days (4). Reports of needlestick injuries due to recapping ranged from 10 to 70%; intravenous lines were often associated with needlestick injuries.

McGeer et al (5) evaluated the type of sharp object, procedure, and mechanism involved in 159 house-staff injuries. Nearly all of the injuries (>98%) were needlesticks; <5% were reported to occupational health services. Most of the injuries were due to the recapping of used needles, and virtually all of the surgical injuries occurred during suturing. The rates of percutaneous injury for house officers were also compared. The rates of ward-related injury were the highest for students (0.97 per person-year), and they decreased during training. Most medical (76%) and all surgical house staff had sustained at least one injury by the end of their internship.

Puro et al (6) described types of blood exposure for 548 health care workers. From 1986—1988 a total of 548 cases of accidental blood exposure was reported, with an average of 15 accidents per month. During the recapping of needles, 206 (37.6%) incidents occurred.

In a study by Melzer et al (7), needle injuries among pediatric house officers were studied. A questionnaire was used to obtain retrospective information regarding the needle injuries of 294 house officers in medical school — affiliated pediatric training programs. A total of 205 (69.7%) had stuck themselves or had been stuck with a needle contaminated with a patient's blood; 48 (17%) reported a needle injury involving a needle con-

[1] National Institute for Occupational Safety and Health, Centers for Disease Control, Atlanta, Georgia, United States

Correspondence to: Dr LS Martin, Centers for Disease Control, 1600 Clifton Road, F40, Atlanta, Georgia 30333, USA.

taminated with the blood of a patient with suspected HIV infection.

The types of body fluids involved in exposure incidents among physicians and the procedures associated with the exposure incidents were reported by Wong et al (8); 92% of the exposures involved blood, either by contact (1379 exposures) or by needlestick injury (49 exposures). The site of the exposure was the hand in 1545 incidents (99%), which included all of the 49 needlestick injuries; 89% of these exposures occurred during procedures that involved the insertion or manipulation of needles or catheters.

Pathologists are also at risk, particularly those in training (9). Details of injuries and body-fluid exposures sustained by 36 pathologists (9 residents and 27 staff pathologists) during the handling of tissue were ascertained by a retrospective questionnaire. Residents reported a fivefold excess in injuries compared with staff pathologists. The lesions described predominately involved the oppositional area consisting of the distal thumb, index, and middle fingers of the nondominant hand.

Researchers from the Centers for Disease Control collected data involving procedures, blood contacts, and percutaneous injuries caused during surgical services (10). Trained observers monitored a sample of operations performed by six surgical services at a large hospital. The purpose of the study was to describe the nature and frequency of blood contact and its risk factors to operating room personnel. In 62 (30.1%) of 206 operations at least one blood contact was observed. Of 1828 operating room person-procedures observed, 96 (5.3%) had 147 blood contacts (133 skin contacts, 10 percutaneous injuries, and 4 eye splashes).

An estimated 508 000 fire and rescue, ambulance, and law or correctional officers are routinely exposed in the United States to human blood or other potentially infectious material. A pilot project with seven states was initiated by the Centers for Disease Control to develop and implement a system to characterize blood exposures in emergency first-responders during the performance of their routine duties to determine what tasks provide the greatest chance of body-fluid exposure to the worker. Various data collection techniques were used which included both prospective and retrospective surveys with follow-back and passive surveillance systems. Predictor outcomes were limited to body-fluid exposures, both protected and unprotected. One study documented 115 exposures among several countywide occupational first-responder subgroups, 84% occurring among emergency medical technicians. Another state surveyed 2215 correctional facility workers and found that 88 of 149 exposures occurred in the medical or dental units. In a prospective study of a citywide work force of emergency medical technicians, 472 body-fluid exposures were documented for 1400 patient encounters. Personal protective equipment prevented skin or face contact in 87% of these exposures. Another study targeted police officers and found that 33 of 111 exposures were significant by study definition. Of the 29 source patients, three were documented as being HIV antibody positive. No seroconversions in exposed officers had occurred. Personal protective equipment such as gloves, face shields, and eyewear are used to prevent several types of exposures, but none prevent needlestick injuries. The most common type of percutaneous inoculation occurs through inadvertent needlestick injury. Research has shown that, if needles and other sharp devices can be redesigned, a significant proportion of such exposures can be directly prevented (11). There are numerous devices designed to prevent or reduce needlestick injuries, including resheathing syringes and needleless intravenous systems. However, performance and evaluation criteria to judge the efficacy in preventing needlestick injuries are not available. One set of subjective evaluation criteria has been developed in the form of questions to consider, but they have not been tested (Dr June Fisher, personal communication). They are as follows:

1. Can the product be used without extensive training?
2. Does the time needed for using the product remain the same?
3. Does use of the product require use of the safety feature?
4. Would the intended user really use the product?
5. Is the product intended for single use only?
6. Is the safety feature reliable, or does it sometimes fail to work (eg, does it break, or does the locking device not stay locked)?
7. Can the product be used in a wide variety of situations?
8. Does the product work with a wide variety of hand sizes?
9. Can the product be used with one hand?
10. Does the safety feature give a false sense of security?
11. Does the safety feature interfere with normal use?
12. Is the sharp exposed after use and prior to disposal? (The best devices guard the needle after use in order to protect workers during disposal and while emptying disposal boxes.)
13. Is the product easily disposed of in sharps containers?
14. Does the safety feature contribute bulk to disposal?
15. Are there new dangers introduced with this product?
16. Is it important that this particular syringe have a safety feature?

[The list is for guidance purposes only and should not be regarded as definitive. It has been adapted from "Training for Development of Innovative Control Technology," San Francisco General Hospital (Dr J Fisher, personal communication).]

Unfortunately, all episodes of exposure of workers to bloodborne pathogens have not been eliminated. A program should be developed for postexposure management, including record keeping, antibody testing, prophylaxis, and the testing of source patients for both HIV and HBV. General aspects of medical management for exposure to bloodborne pathogens include HBV immunization, postexposure management, and management of the infected worker. The Centers for Disease Control recommends that all workers whose jobs involve exposure to blood or other potentially infectious body fluids be vaccinated against HBV (12). The recent standard of the Occupational Health and

Safety Administration on occupational exposure to bloodborne pathogens, effective March 1992, will require that employers offer HBV vaccine at no cost to employees at risk.

Initial and periodic training programs should be established as part of a comprehensive preventive program. The training program should ensure that all workers understand the modes of transmission of bloodborne pathogens, know the types of protective clothing and equipment appropriate for specific work conditions, understand the basis for the selection of personal protective equipment, and be familiar with appropriate actions to take and person to contact if an overt exposure occurs.

Preventive strategies

Strategies to reduce risks involve interventions, including the design and evaluation of primary preventive measures (ie, safe medical devices, engineering controls, work practices, and personal protective equipment). In addition, educational programs, continued assessment of risk, evaluation of compliance with guidelines and regulations, and development of sampling and analytical methods are needed as part of a total preventive program. The development and evaluation of the safety efficacy of engineering controls, which reduce or eliminate the hazards of needlestick injuries, will be a key component in reducing occupational transmission. A comprehensive approach to the control of the occupational transmission of bloodborne pathogens is essential to the maintenance of a safe and healthy environment in which to provide health care services while maintaining a safe place for workers.

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