The Threat of Bloodborne Hepatitis Infection to OR Personnel

Donald E. Fry, MD

The epidemic of AIDS in the United States has led to enormous concerns among OR personnel about the potential for occupational infections with this virus. While the actual number of documented infections from HIV in the health care setting is less than 50 cases (Table 1),[1] and no seroconversions have actually attended an OR exposure, the concern over this subject has approached near hysteria in some areas. Some OR personnel have worn space-suit equipment in the OR to avoid blood exposure. Others have advocated routine testing of patients to identify those infected with HIV so special precautions can be exercised. Clearly, HIV has increased OR personnel's concern about occupational infection as a result of bloodborne pathogens in the OR.

While AIDS has drawn much of the publicity surrounding bloodborne occupational infection, hepatitis, in its various forms, represents a greater occupational risk to OR personnel. Evolving information indicates that surgeons and nurses with previously acquired chronic hepatitis may be infectious to their patients. This observation may lead to policies that will restrict nurses and physicians infected with hepatitis from continuing to practice their professions. It is very important for surgical staff members to understand the various hepatitis particles that pose a potential risk. It is imperative for them to realize that taking precautions in the OR is essential for their own health and for their continued practice privileges.

Currently, seven separate hepatitis particles have been identified (Table 2).[2] Because hepatitis G is a new bloodborne viral particle, it may have future risks as an additional occupational infection for health care workers.[3] At the present time, no evidence is yet available to define the risks associated with this new virus. This article, however, focuses only on hepatitis B virus (HBV) and hepatitis C virus (HCV).

Table 1

HEALTH CARE WORKERS AND HIV*

The number of health care professionals who are documented to have acquired HIV after exposure to an infected patient:

Nurses	16
Clinical laboratory technicians	15
Nonsurgical physicians	6
Nonclinical laboratory technicians	3
Surgical technologists	2
Health aide/attendant	1
Housekeeper/maintenance	1
Respiratory therapist	1
Dialysis technicians	1
	46

*Centers for Disease Control and Prevention, *HIV/AIDS Surveillance Report* (Washington, DC: Centers for Disease Control and Prevention, 1995).

HEPATITIS B VIRUS

Hepatitis B infection occurs when the virus gains access to human circulation and selectively binds to the surface of and infects liver cells. The most commonly identified route of infection occurs among

The Threat of Bloodborne Hepatitis Infection to OR Personnel

Donald E. Fry, MD

The epidemic of AIDS in the United States has led to enormous concerns among OR personnel about the potential for occupational infections with this virus. While the actual number of documented infections from HIV in the health care setting is less than 50 cases (Table 1),[1] and no seroconversions have actually attended an OR exposure, the concern over this subject has approached near hysteria in some areas. Some OR personnel have worn space-suit equipment in the OR to avoid blood exposure. Others have advocated routine testing of patients to identify those infected with HIV so special precautions can be exercised. Clearly, HIV has increased OR personnel's concern about occupational infection as a result of bloodborne pathogens in the OR.

While AIDS has drawn much of the publicity surrounding bloodborne occupational infection, hepatitis, in its various forms, represents a greater occupational risk to OR personnel. Evolving information indicates that surgeons and nurses with previously acquired chronic hepatitis may be infectious to their patients. This observation may lead to policies that will restrict nurses and physicians infected with hepatitis from continuing to practice their professions. It is very important for surgical staff members to understand the various hepatitis particles that pose a potential risk. It is imperative for them to realize that taking precautions in the OR is essential for their own health and for their continued practice privileges.

Currently, seven separate hepatitis particles have been identified (Table 2).[2] Because hepatitis G is a new bloodborne viral particle, it may have future risks as an additional occupational infection for health care workers.[3] At the present time, no evidence is yet available to define the risks associated with this new virus. This article, however, focuses only on hepatitis B virus (HBV) and hepatitis C virus (HCV).

Table 1

HEALTH CARE WORKERS AND HIV*

The number of health care professionals who are documented to have acquired HIV after exposure to an infected patient:

Nurses	16
Clinical laboratory technicians	15
Nonsurgical physicians	6
Nonclinical laboratory technicians	3
Surgical technologists	2
Health aide/attendant	1
Housekeeper/maintenance	1
Respiratory therapist	1
Dialysis technicians	1
	46

*Centers for Disease Control and Prevention, *HIV/AIDS Surveillance Report* (Washington, DC: Centers for Disease Control and Prevention, 1995).

HEPATITIS B VIRUS

Hepatitis B infection occurs when the virus gains access to human circulation and selectively binds to the surface of and infects liver cells. The most commonly identified route of infection occurs among

Table 2

TYPES OF HEPATITIS*

Type of Hepatitis	Route of Transmission	Nucleic Acid
A	Fecal-oral	RNA
B	Bloodborne; sexual	DNA
C	Bloodborne; sexual (?)	RNA
D	Bloodborne	RNA
E	Fecal-oral	RNA
F	Fecal-oral	DNA
G	Bloodborne	RNA

*DE Fry, "Occupational risks for surgeons: Hepatitis," in *Surgical Infections* (Boston: Little, Brown Co, 1995).

IV drug abusers. While contaminated transfusions were a source of hepatitis in the past, they have become less common with the advent of appropriate antibody screening methods. HBV also is easily transmitted by sexual contact. Sexual transmission represents a major source of hepatitis B infection among the US population. Health care workers are subject to potential occupational infection following percutaneous injury with needles and other sharp instruments and following contamination of mucous membranes (ie, eyes, mouth). They may even be infected from blood contact with compromised skin.

Hepatitis B infection in adults results in chronic infection in 5% to 10% of acutely infected individuals.[4] Chronically infected individuals may well proceed to develop end-stage liver disease with cirrhosis, portal hypertension and its sequelae, or hepatoma of the liver. Approximately 250 health care workers die annually from chronic hepatitis B infection.[5] Health care workers who most commonly develop chronic hepatitis B are nurses and surgeons. The natural history of the disease requires 20 or more years from the time of infection until evolution of the end stages of the disease process. Thus, those individuals who die today from hepatitis B represent acute infections that developed many years ago.

Another ominous feature of HBV is that acute infection may be clinically occult. Only 25% of acute HBV infections are clinically identified with patients having clinical jaundice and clinical hepatitis syndrome.[6] Thus, 75% of individuals who have acute hepatitis B are not aware that acute infection has occurred. Moreover, the risk of developing chronic hepatitis from the acute infection is the same, independent of whether patients have the clinical syndrome.

Hepatitis B is a preventable infection among OR personnel. A hepatitis B vaccine has been developed that is highly effective in 95% of individuals who receive three doses. Approximately 5% of individuals do not respond to the hepatitis B vaccine. Documentation of an antibody response after vaccination is essential so nonresponders may receive a second course of the vaccine.

Health care workers who have chronic hepatitis B are potentially infectious to their patients. Numerous reports have identified dentists and surgeons who were chronically infected with HBV and transmitted the infection to patients.[7] These infected dentists and surgeons were positive for the "e" antigen of HBV. While OR nurses have not yet been demonstrated to have infected patients, that risk must be considered plausible. It is likely that those chronically infected with HBV may be restricted from practice in the OR in the future.

HEPATITIS C

Following the development of methods of detecting hepatitis A and hepatitis B antibodies, it became apparent that a large number of patients who developed hepatitis infections were negative for both antibodies to the two known hepatitis particles (ie, hepatitis A and hepatitis B). The so-called non-A/non-B hepatitis infections were most notably identified among transfusion recipients. In 1989, hepatitis C was identified as a new bloodborne hepatitis virus.[8] Hepatitis C appears to account for approximately 80% of all non-A/non-B hepatitis infections. Additional but as yet unidentified viruses are likely responsible for the other 20% of hepatitis infections formerly categorized as non-A/non-B infection.

Hepatitis C infections appear to be transmitted in a fashion similar to that of HBV. Accordingly, IV drug abusers have a high rate of HCV infection. Hepatitis C is probably a sexually transmitted disease, although it does not appear to be as efficiently transmitted as HBV. Because there is a 6-month time period before antibodies develop following acute infection, HCV continues to be a major source of posttransfusion hepatitis infection. Unfortunately, there is now evidence that HCV is transmitted to health care workers who sustain percutaneous injuries and exposure to the blood of infected patients.[9] Because there is no vaccine for hepatitis C, all health care workers are susceptible to HCV infection.

As with HBV, nearly two-thirds of HCV infections are clinically asymptomatic. A disturbing feature of HCV

Table 3

BLOOD EXPOSURE RISK*

The 293 personnel who were exposed to patient blood during 684 surgical procedures

Type of Personnel	Number of Events
Circulating nurses	79
Anesthesia providers	65
Primary surgeons	59
Surgical first assistants	49
Scrub nurses/technologists	26
Other	15
Total	293

*S.L. Popejoy, DE Fry, "Blood contact and exposure in the operating room," Surgery, Gynecology & Obstetrics 172 (June 1991).

infection is that 50% to 80% of individuals with acute infection will develop chronic hepatitis C.[10] It is estimated that more than three-million US residents have chronic hepatitis C. Hepatitis C has a slow and indolent clinical course not unlike HBV, which leads to end-stage liver disease over many years. Hepatitis C is now the leading indication for liver transplantation. The magnitude of this problem as an occupational risk for OR personnel is much greater than that posed by HIV. This greater risk is directly attributable to the higher infectivity of HCV and the larger number of patients who potentially carry this virus. Unfortunately, there is now evidence that HCV may be transmitted from OR personnel to patients.[11] Because there is no vaccine and no treatment for individuals who are infected with HCV, prevention is the only strategy that can be employed to protect OR personnel.

PREVENTION STRATEGIES IN THE OR

All members of the surgical team are at risk for blood exposure during surgical procedures. In a study performed at the University of New Mexico Hospital, Albuquerque, circulating nurses were identified as being at considerable risk for blood exposure (Table 3).[12] Emergent procedures and those with large volumes of blood loss seem to pose the highest risk of blood exposure to OR personnel. Surgical personnel must employ more efficient barriers and different methods of minimizing blood exposure. When blood exposure occurs, it is essential that a prompt response be employed to minimize the duration of blood contact with the skin.

Scrubbed personnel must wear eye protection during all surgical procedures to avoid blood splash to the mucous membranes of the eye. Double-gloving is also desirable, particularly for long procedures.[13] Material fatigue during prolonged procedures places scrub personnel at risk for glove failure and blood exposure to the hands. Circulating personnel must handle sponges and other blood-contaminated materials with gloved hands. After appropriate counts and estimates of blood loss have been made, sponges and other blood-contaminated materials should be packaged.

Techniques that pose a risk of blood contamination to both scrub and circulating personnel must be modified. Scrub personnel run the special risk of percutaneous injury through the frequent passage of loaded needle holders. Using a basin to exchange loaded needle holders and using a Mayo stand to pass loaded needle holders between OR nurses and surgeons are potential methods of reducing the risk of percutaneous injury. Circulators should avoid recapping hollow-bore needles and must exercise appropriate concern when handling shai instruments. In the final analysis, an increased sense of awareness when handling sharp instruments is the single most important preventive strategy for avoiding percutaneous injury.

Prompt action must be taken when blood exposure occurs. The removal of the glove and irrigation of the exposed site with povidone iodine or isopropyl alcohol is recommended. While povidone iodine and isopropyl alcohol have been documented to be viricidal in laboratory studies,[14] there is no evidence that proves their utility in an actual clinical exposure situation. Exposure incidents should be reported as well. Prevention of exposure is by far the mos important consideration. Only limited information is available about the superiority of one gown over another. Laboratory efforts have been employed t examine the superiority of one material over another.[15] These experimental differences, however, have not been documented in actual clinical studies. Additional clinical studies are necessary to document the best available barriers.

The most important cost-effective measure for the surgical services manage is to monitor exposure events. Knowled that exposure events are monitored by itself will reduce the rate of events. A simple, one-page reporting form can be placed in all ORs; it can be the responsi bility of the circulator to report blood exposure events, particularly percutaneous injuries. Trends of exposure events can then be tracked by individual. Whe exposure events occur, a continuing quality-improvement strategy should be

developed with input of those exposed. Providing surgical personnel with a clear understanding of the potential consequences of hepatitis infection from bloodborne viruses and a continuous assessment of specific behavior patterns that result in exposure events are the best methods of reducing future incidents.

SUMMARY

Surgical services personnel must consider blood to be a toxic substance. While effective vaccination for HBV will prevent infections, exercising improved safety practices and consistently using appropriate barriers are the only protections presently available for HCV. The single most-important preventive strategy is an increased sense of awareness in preventing exposure of everyone in the OR. A prompt response must be made when blood contact with the skin occurs. Strategies to monitor and evaluate behavioral patterns that result in exposure events will bring continuous attention to the problem and will reduce the frequency of these events.

Hopefully, vaccines and other preventive treatments will be developed to deal with HIV, HCV, and future hepatitis particles. However, the current hepatitis epidemic represents only one kind of potential bloodborne viral pathogen, and it should be emphasized that other bloodborne infections will likely be identified. Blood exposure in the OR is no longer an acceptable practice, and each individual must focus his or her attention on preventing needless exposure events. ▲

REFERENCES

1. *HIV/AIDS Surveillance Report*. Washington, DC: Centers for Disease Control and Prevention; 1995:15.
2. Fry DE. Occupational risks for surgeons: Hepatitis. In: *Surgical Infections*. Boston, Mass: Little, Brown Co; 1995:657-668.
3. Linnen J, et al. Molecular cloning and disease association of hepatitis G virus: A transfusion-transmissible agent. *Science*. 1996;271:505-508.
4. Seeff LB, Koff RS. Evolving concepts of the clinical and serologic consequences of hepatitis B virus infection. *Seminars in Liver Disease*. 1986;6:11-22.
5. 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. 1989;38:1-37.
6. Ibid.
7. Heptonstall J, et al. Restricting practice of HBeAg-positive surgeons: Lessons from hepatitis B outbreaks in England, Wales, and Northern Ireland 1984-1993. Presented at the Conference on Prevention of Transmission of Bloodborne Pathogens in Surgery and Obstetrics; February 13-15, 1994; Atlanta, Ga. Harpaz R, et al. Hepatitis B virus transmission associated with cardiothoracic surgery. Presented at the Conference on Prevention of Transmission of Bloodborne Pathogens in Surgery and Obstetrics; February 13-15, 1994; Atlanta, Ga.
8. Choo QL, et al. Isolation of a cDNA clone derived from a blood-borne, non-A, non-B viral hepatitis genome. *Science*. 1989;244:359-362.
9. Mitsui T, et al. Hepatitis C virus infection in medical personnel after needlestick accident. *Hepatology*. 1992;16:1109-1114; Sodeyama T, et al. Detection of hepatitis C virus markers and hepatitis C virus genomic-RNA after needlestick accidents. *Arch Intern Med*. 1993;153:1565-1572.
10. Alter MJ. Community acquired viral hepatitis B and C in the United States. *Gut*. 1993;34 (suppl 2):S17-S19.
11. Esteban JI, et al. Repeated transmission of HCV from surgeon to patients during cardiac surgery. *Hepatology*. 1995;22:347A; Hepatitis C virus transmission from health care worker to patient. *Comm Dis Rep Week*. 1995;5:121.
12. Popejoy SL, Fry DE. Blood contact and exposure in the operating room. *Surg Gynecol Obstet*. 1991;172:480-483.
13. Quebbeman EJ, et al. In-use evaluation of surgical gowns. *Surg Gynecol Obstet*. 1992;174:369-375; Quebbeman EJ, et al. Double gloving: Protecting surgeons from blood contamination in the operating room. *Arch Surg*. 1992;127:213-217.
14. Zamora JL. Chemical and microbiological characteristics and toxicity of povidone iodine solutions. *Am J Surg*. 1986;151:400-406.
15. Smith JW, Nichols RL. Barrier efficiency of surgical gowns: Are we really protected from our patients' pathogens? *Arch Surg*. 1991;126:756-763.

***Donald E. Fry, MD**, is professor and chairman, Department of Surgery, University of New Mexico School of Medicine, Albuquerque.*

Adapted with permission, *Surgical Services Management*™, Vol 3, January 1997, pp 36-38.