Editorial

Management of HIV-l Infection in the Hospital Setting

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First described in 1981, the acquired immunodeficiency syndrome (AIDS) has become the major public health problem of the 1980s. The discovery of the etiologic agent responsible for AIDS, the human immunodeficiency virus (HIV-l), allowed the development of serologic tests of' infection and has led to an increased understanding of the epidemiology of HIV-1 infection. The rapid increase in the number of infected individuals led to great concern regarding the risks of nosocomial transmission. This editorial is intended as a synopsis of (1) the risks HIV-l-infected patients pose to health care providers, (2) guidelines to minimize these risks, (3) yet-to-be-resolved management issues of caring for the HIV-l-infected patient, and (4) examination of the evidence that suggests HIV-l infection predisposes to acquisition of nosocomial infections.

EXTENT OF THE EPIDEMIC

As of August 29, 1988, a total of 72,024 AIDS cases had been reported in the United States[1] The Public Health Service now projects a cumulative total of 365,000 cases will be diagnosed by the end of 1992, with 263,000 cumulative deaths. In 1992 alone, 80,000 cases are expected to be diagnosed and 66,000 deaths to occur. The Public Health Service estimates that 172,000 AIDS patients will require medical care in 1992 at a cost expected to range from $5 to $13 billion dollars.

Unfortunately, the prevalence of HIV infection in the United States is unknown. The Centers for Disease Control estimates that 1 to 1.5 million Americans are currently infected.[1] Data regarding the seroprevalence of HIV infection in the general population have been derived from studies of military personnel, blood donors, pregnant women, and hospitalized patients.[2] Universal screening of military personnel has revealed the tbllowing seroprevalence rates: civilian applicants for military service, 0.14%[3]; US Army reservists, 0.21%[4]; and active-duty personnel, 0.13%.[5] Data collected by the American Red Cross have shown that the overall prevalence among first-time donors of HIV-l antibodies in the period 1985-1987 was 0.043%,.[y] Testing of patients hospitalized predominantly in Midwestern institutions revealed an overall seroprevalence of 0.3% for the first 18,800 persons tested.[1] Testing of newborn blood has revealed the following seroprevalence rates of childbearing women: Massachusetts, 0.21%[6]; New York City, 1.6%[7]; and New York State, 0.8% .[7] Higher rates have been reported from inner-city urban hospitals.[8]

Given the endemic rate of HIV-l infection in the general population, it was not surprising that several studies provided evidence that health care workers may be exposed to HIV-infected patients or contaminated blood despite the labeling of known infected patients with blood and body fluid precautions. Among 506 patient specimens submitted to a hospital laboratory at an urban teaching hospital in Seattle, hepatitis B surface antigen was present in 6.3%, HIV-l antibody in 3.0%, or either of these in 8.7%. Among unlabeled specimens, HIV-l antibody or hepatitis B surface antigen or both were present in 5.7% .[9] Studies in 1986 and 1987 at an inner-city hospital in Baltimore revealed 3.0% and 4.0%, respectively, of patients presenting to the emergency room without a history of HIV-l infection were in fact seropositive.[10,11] These studies ernphasize the need for handling all blood specimens and patients as if contaminated with transmissible agents such as hepatitis B and HIV-l.

RISKS OF NOSOCOMIAL ACQUISITION OF HIV

Reports of Occupational/Nosocomial HIV-l Infection

Over 20 health care providers have been reported who may have acquired HIV-l infection through occupational exposure.[12,13] Most workers experienced needlestick injuries but mucous-nembrane or nonintact skin contamination were also noted. Although these reports document that HIV-l infection may be acquired in the hospital setting, the lack of denominator data makes it impossible

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to develop risk estimates. Other problems with interpreting the significance of these reports include: baseline serum was not available in one third of cases and hence seroconversion could not be determined; heterosexual transmission could not be ruled out in all cases; and inclusion of laboratory workers exposed to high titers of cultured virus may cause inappropriate conclusions to be drawn regarding the risk to health care personnel.

Seroprevalence Studies of Health Care Personnel

Henderson[14] recently summarized the results of 13 seroprevalence surveys of hospital personnel.[15-27] A total of 6,619 health care workers were screened; 970 persons reported HIV-l-related needlestick exposure and 238 other HIV-l-related exposures. Eight (0.12%) seropositive health care workers were detected who reported no community risk factors. This seroprevalence rate would appear to he similar to those reported in surveys noted above, which are representative of the general population.

A recently published seroprevalence study of hospital personnel in Kinshasa, Zaire, an area of high HIV-I endemicity, revealed that 8.07% of 2,193 hospital workers were HIV positive compared to 8.4% of 4,890 women attending antenatal clinics and 6.5% of 7,440 mate volunteer blood donors. Further, the incidence of new infection between 1984 and 1986 did not vary according to age, sex, or occupational category within the hospital.[28]

Prospective Studies of HIV-l Infection in Health Care Personnel Following Exposure to Contaminated Body Fluids

The magnitude of risk of acquiring HIV-I infection following a direct exposure to contaminated body fluids can best be determined by careful prospective studies. Table 1 summarizes the data currently available from such studies.[29-37] In these studies, six health care workers seroconverted following parenteral injury via a needlestick or sharp object for a risk of 0.40% per exposure or 0.43% per person.

None of 746 exposures involving contamination of a mucous membrane or nonintact skin resulted in seroconversion, yielding a risk of <0.13% per exposure. The actual infection rate following these exposures is likely to be much smaller than the upper bounds shown in Table 1.

Summary: Risks to Health Care Personnel

Worldwide, HIV-I is primarily transmitted via sexual encounters, transfusion of blood or blood products, shared needles during intravenous drug use, and vertically from infected mother to child.[38] Studies of household contacts of HIV-l-infected patients have consistently failed to demonstrate that "casual" contact can lead to HIV- I transmission.[39,40] As opposed to prevalence studies of hepatitis B, prevalence studies of HIV-1 infection have failed to reveal higher infection rates in hospital personnel than studies representative of the general population. Thus, it appears that care of HIV-l-infected patients involving only casual contact would not place hospital personnel at risk for HIV-I acquisition.

Prospective studies have shown that parenteral exposure to contaminated blood via a needlestick or sharp injury may lead to HIV-1 infection with a risk of approximately 0.4%. Wormser and colleagues have noted that the likelihood of transmission will be determined by the volume and duration of' hospitalization of HIV-l-infected persons and the estimated number ofneedlestick injuries suffered by staff.[41] Based on data at their hospital, they estimate a 30% probability that at least one health care worker will seroconvert per every 105,000 total hospital days for HIV-l-infected patients. Greater emphasis should be placed on reducing needlestick injuries, especially since 31% are preventable by adherence to existing infection control guidelines.[33]

Case reports suggest that mucous membrane or contamination of open wounds may also lead to HIV-1 infection. The magnitude of the risk, however, is below the level of detection in current prospective series. Nevertheless, prevention guidelines have been designed to minimize such exposures.

TABLE 1
INCIDENCE OF **SEROCONVERSION** IN HEALTH CARE WORKERS EXPOSED TO BLOOD OR BODY FLUIDS OF PATIENTS INFECTED WITH HIV-1

	Parenteral Exposure To Blood*	Mucous Membrane/ Nonintact Skin Contamination†
Number of persons exposed	*1,404*	*470*
Number of seroconversions	*6*	0
Risk of seroconversion	*0.43% (95% CI, 0.15%-0.84%)‡*	*<0.21% (95% CI, 0%-0.60%)*
Number of exposures	1,494	*746*
Number of seroconversions	*6*	0
Risk of seroconversion	*0.40% (95% CI. 0.14%0.79%)*	*<0.13%* (95% CI. 0%-0.38%)

**Abstracted from references 29-37 and personal communications with BJ Fahey and CG Littell.*
†Abstracted from references 29, 37-34, 36 and personal communications with BJ Fahey and CG Littell.
‡95% confidence intervals (Poisson distribution).

NOSOCOMIAL RISKS POSED BY HIV-l-ASSOCIATED INFECTIONS

The later stages of HIV-1 infection are characterized by an increased prevalence of a variety of infections, many of which are incorporated into the Centers for Disease Control case definition of AIDS.[41] Most infectious agents associated with H1V-1 infection, such as *Toxoplasma gondii, Mycobacterium avium* complex, *Cryptococcus neoformans*, and *Pneumocystis carinii*, are not believed to represent nosocomial hazards. However, a variety of infectious agents associated with HIV-1 infection may pose a nosocomial hazard to other patients or staff (Table 2). Special

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TABLE 2*
HIV-I-ASSOCIATED INFECTIONS THAT REPRESENT A NOSOCOMIAL HAZARD

Infection	Additional Isolation **Precautionst** (Beyond Universal Precautions)
Pulmonary	
M tuberculosis	Respiratory
Cutaneous	
Herpes zoster	Respiratory/Contact
Herpes simplex	Contact
Staphylococcus aureus	Contact (significant disease)
T pallidum (syphilis)	Contact
Gastrointestinal	
Cryptosporidia	Enteric
Salmonella	Enteric
Shigella	Enteric
Systemic	
Cytomegalovirus	None
Epstein-Barr virus	None
Hepatitis B	None

**Adapted from reference 37*
†See reference 54 for discussion of body substance /so/at/on and precautions employed with this system,

vigilance is required to ensure proper precautions are employed, as persons with cutaneous infections due to herpes zoster, herpes simplex, and *Treponema* pallidum may present with unusual manifestations, including an atypical clinical appearance or prolonged duration.

Of special note is the high incidence (5% to 10%)[43-47] of tuberculosis in HIV-1-infected patients. The majority of cases, clinical tuberculosis precedes the development of AIDS (mean time: eight to ten months). Delays in diagnosis and institution of respiratory precautions may occur because the presentation of tuberculosis in these patients is characterized by a higher likelihood of anergy, negative smears and cultures using expectorated sputum, and an atypical chest radiographic appearance. To date, however, nosocomial outbreaks of tuberculosis due to misdiagnosed infection have not been reported.

UNRESOLVED MANAGEMENT ISSUES IN CARING FOR THE HIV-1-INFECTED PATIENT

As knowledge has increased regarding transmission routes of HIV, the Centers for Disease Control has continued to develop and publish guidelines to minimize the risk of nosocomial acquisition.[48-53] These and other authoritative guidelines have covered tissue and organ procurement, invasive procedures, management of dialysis patients, laboratories, dentistry, autopsy services, housekeeping, waste disposal, and sterilization/disinfection. The mainstay of preventive measures has been the adoption of' universal precautions[14, 48,49] or body substance isolation.[54]

Despite progress in understanding the transmission of HIV-1, several issues regarding prevention of nosocomial transmission have yet to be resolved: (1) the efficacy of universal precautions or body substance isolation in preventing worker exposure; (2) the most efficacious and cost-effective method to educate staff regarding the risk of HIV-1 transmission and proper precaution techniques; (3) how to ensure compliance with universal precautions or body substance isolation; (3) do needle disposal containers in patient rooms lead to patient abuses of the needles or lower the rate of needle injuries; (5) the most effective engineering changes of syringes or needles to minimize needlesticks; (6) does leakage through tears in gloves pose a risk for health care personnel; (7) can operative techniques or equipment be altered to minimize or eliminate sharp exposure and splatter of bloody body fluids; and (8) will continuation of' prospective studies allow us to determine the risk of seroconversion following contamination of' mucous membranes or nonintact skin.

Zidovudine (azidothymidine, AZT) has been shown useful in prolonging life in AIDS patients. Theoretically, it may be useful in reducing the likelihood of HIV-1 acquisition following parenteral exposure, although there is currently no direct laboratory or clinical evidence to support this hypothesis. Burroughs-Wellcome recently initiated a double-blind, placebo-controlled trial in the United States to evaluate the potential effectiveness of prophylactic administration of zidovudine to health care workers recently (<5 days) exposed to HIV-1-infected blood or blood products via sharp injury, or mucous membrane or nonintact skin contamination. Before participating, infection control personnel and injured employees must consider the potential toxicities of drug administration, the risk of HIV-I acquisition based on current data and type of exposure, and the randomized double-blind nature of the trial. Additional information may be obtained by calling 1-800-HIV-STIK.[55]

RISK OF NOSOCOMIAL INFECTION FOR HIV-1-INFECTED PERSONS

Case reports and uncontrolled series have suggested that patients with AIDS or AIDS-related complex (ARC) commonly develop bacterial sepsis[56-61] and bacterial infections involving the respiratory tract,[62,63] gastrointestinal tract,[64] and skin.[65] Few studies have evaluated whether HIV-1-infected patients who have not progressed to AIDS are at increased risk of infection. Such patients reportedly have had unusually severe *Salmonella* infections often associated with bacteremia,[66,67] a higher frequency of bacterial pneumonia,[68] a higher frequency of infectious exzemoid dermatitis,[69] and an increased incidence of pneumococcal bacterenlia[70] Thus, HIV-1-infected patients may represent a group at high risk of acquiring nosocomial infections.

Only limited data are available regarding frequency of nosocomial infections in hospitalized HIV-1-infected patients. Rates of 9.7%[71] and 11.3%[72] have been reported in HIV-1-infected patients, the majority of whom had progressed to AIDS. Because the studies have not reported nosocomial infection rates for a group of comparably ill non-HIV-infected patients, it is impossible to determine if HIV infection per se predisposed to nosocomial infection.

HIV-1-infected patients undergoing surgery do not

appear to have higher-than-expected rates of surgical wound infections. Wound infection rates of 0%[73] and 2.5%[71] have been reported in AIDS/ARC patients undergoing lymph node biopsies. One wound infection was noted in 15 AIDS patients (6.7%) undergoing splenectomy for thrombocytopenic purpura.[75] Surgery in HIV-l-infected hemophiliacs has not been shown to lead to an increased rate of wound or other nosocomial infections compared with noninfected hemophiliacs.[76] Although the numbers were small, the same study did document that patients with AIDS undergoing invasive procedures had a significantly higher rate of all nosocomial infections compared with asymptomatic HIV-l-infected and non-HIV-l-infected hemophiliacs. AIDS patients undergoing anorectal surgery reportedly have a poor healing rate of 88% and a major complications rate of 16%.[77] Because 18% to 24% of patients with ARC or AIDS have been reported to require surgery,[78,79] the risk of surgery in these patients deserves further study.

As the number of persons being treated for HIV-associated illnesses increases into the 1990s, it is likely that more hospital workers will care for HIV-infected patients. Infection control practitioners can play a major role in educating staff about HIV-1 infection and promoting compassionate and humane care to HIV-l-infected patients. Continued emphasis should be placed on defining and minimizing the risks in managing HIV-1 infection and reducing risks to hospitalized HIV-l-infected patients. Policy formation should be based on the results of carefully conducted experiments and prospective series.

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