Abstract. Surgeons are at risk for contracting human immunodeficiency virus (HIV) from patients. The purpose of this paper is to discuss the risk of HIV transmission between patients and surgeons, and to discuss potential strategies to reduce the risk of HIV transmission. Continuous occupational exposure makes the risk of HIV transmission greater for surgeons than patients. Although the risk of seroconversion after a single exposure is relatively low, the risk for surgeons is more appropriately expressed as a cumulative lifetime risk. The estimated cumulative risk of HIV seroconversion for surgeons may be as high as 1-4%.

Currently available strategies to prevent HIV transmission require knowledge of the mechanisms of exposure. Adequate barriers, such as double-gloving, waterproof outerwear, and face protection, should be worn for most, if not all, orthopaedic procedures. Additional specific strategies, however, are required to minimize sharp injuries.

Surgeons should report any significant exposure to the occupational health department of their institution. Hospitals should have appropriate guidelines and procedures for counseling exposed surgeons, HIV testing of source patients, consideration of Zidovudine prophylaxis, and disability insurance policies for surgeons who are occupationally infected with HIV.

Introduction. Transmission of blood-borne pathogens, such as Human Immunodeficiency Virus (HIV) and hepatitis, represents a substantial occupational risk for health care workers. Among health care professionals, surgical staff have been shown to have high rates of exposure to blood. Concern about exposure to blood has begun to affect the types of practices surgeons chose and may ultimately affect the quality of care patients receive.

Surgeons are at risk for contracting HIV and hepatitis B after exposure to contaminated blood is greater than the risk of contracting HIV we have focused on HIV in this article for two reasons. First, vaccination is effective in preventing hepatitis infection, and, second, hepatitis is fatal in less than 10% of cases. In contrast, there is no effective vaccine against HIV infection and, if contracted, it almost certainly leads to Acquired Immunodeficiency Syndrome (AIDS) and death.

The purpose of this paper is to discuss the risks of HIV transmission from patients to orthopaedic surgeons, to detail the factors that affect the risk of seroconversion for surgeons, and to discuss the risk of HIV transmission from seropositive surgeons to patients; 2) to review the mechanisms of exposure to blood for surgical personnel and the potential strategies for prevention of HIV transmission; and 3) to suggest areas for future research. The American Academy of Orthopaedic Surgeons published a monograph in 1989 entitled "Recommendations for the Prevention of Human Immunodeficiency Virus (HIV) Transmission in the Practice of Orthopaedic Surgery." The intent of this article is to consider some areas not discussed in that paper and highlight information published since its release.

Risk of HIV Transmission Between Patients and Surgeons. Although blood-borne pathogens may be transmitted in either direction, continuous occupational exposure makes the risk of disease transmission to surgeons much greater than the risk of transmission to patients.

Risks of Seroconversion for Surgeons After Single Exposure. The risk of seroconversion after a sharp injury contaminated with the blood of an HIV infected person is about 0.3 - 0.4%. The risk of seroconversion, however, is probably not uniform being affected by factors relating to the exposure, the source of the HIV, and the recipient.
First, the risk of HIV transmission may be affected by the volume of infected fluid, the type, and severity of exposure. Health care professionals exposed to large amounts of blood by deep injection, such as the entire contents of syringes, have a greater risk of seroconversion. The type of exposure also affects the risk of transmission; sharp injuries have the greatest risk of disease transmission. Further, hollow needles, when compared to solid needles, may be more likely to result in seroconversion possibly because they transmit a larger inoculum of blood. Because surgeons are more likely to be exposed by non-hollow needle-sticks from suture needles they may be at lower risk for seroconversion after a single exposure. Surgeons are also protected by gloves because the volume of blood transmitted by needle-sticks is reduced by at least 50% when the needle first passes through a glove.

Secondly, source factors affect the risk of disease transmission. Viral atres are much higher in blood than in other body fluids. The virus concentration of blood is lower during Early stages of the disease and may be reduced by treatment, such as Zidovudine.

Different strains of HIV may also have differing ability to infect cells. Finally, recipient factors, such as the first-aid procedures, integrity of skin, duration of exposure, and Immunologic status of the exposed person may affect the risk of transmission. Although sharp injuries represent the most significant risk of HIV transmission, exposure to blood for operating room personnel may occur in at least four other forms; exposure to mucous membranes, to intact skin, to open wounds, and by aerosol droplets. Although the risk of disease transmission via these routes of exposure is much lower than after needle-sticks, for surgical personnel these modes of exposure are more frequent than needle-sticks.

Further, surgical personnel may have a higher risk for blood-borne disease transmission after cutaneous exposure than other health care workers for two reasons. First, frequent surgical scrubbing may cause minor skin abrasions on their hands and fingers, a common site of cutaneous exposure. Secondly, many glove tears in the OR are noted incidentally at the end of the procedure. The failure to immediately recognize a glove tear results in prolonged cutaneous exposure which also may increase the risk of disease transmission.

Lifetime risk is defined as a surgeon’s cumulative risk of HIV seroconversion over an entire surgical career. For an individual surgeon, this risk is dependent on four factors: the risk of seroconversion after a single exposure, which has already been discussed, prevalence of HIV infection in the patient population, the rate of exposure per surgical procedure, and the number of procedures performed throughout a surgical career.

Higher patient seroprevalence obviously results in an increased cumulative risk. The seroprevalence of HIV in specific surgical populations is unknown. Rates vary significantly by geographic location and by patient characteristics. Data from the HIV Sentinel Hospital Group Survey provides a reasonable overall U.S. seroprevalence estimate of unrecognized HIV infection in urban hospitals of 1.3%. The seroprevalence at San Francisco Hospital, however, has been estimated to be as high as 25%. Further, within any geographic area certain patient subgroups, such as trauma patients, may have much higher infection rates than other patient populations. The cumulative risk of HIV infection is also affected by the rate of exposure per surgical procedure, which varies between hospitals and between surgical subspecialties.

The reported rates of sharp injuries ranges from 1.3 exposures to 5.6 exposures per 100 procedures. The exposure rate to blood, including both cutaneous exposures and sharp injuries, has been reported to be as high as 30.1% of surgical procedures. Although comparison between hospitals and services is somewhat problematic because of possible under reporting and dissimilar hospital case-mix, exposure rates for OR personnel are clearly substantial. Further, trauma surgery and orthopaedic surgery have significantly higher rates of exposure to blood than other types of surgery.

Given this data, and a few assumptions, the theoretical lifetime risk of HIV seroconversion for an orthopaedic surgeon can be estimated. The average U.S. surgeon performs 8.4 cases per week and the seroconversion rate after a sharp injury with infected blood is 0.42%. Assuming a surgical career span of 30 years and a seroprevalence of 1.3%, the lifetime cumulative risk would be 0.9% at the exposure rate of 1.3 sharp injuries per 100 procedures observed in San Francisco, and 3.9% at an injury rate of 5.6 injuries per 100 procedures observed in Saudi Arabia. As shown in Table 1, the cumulative risk of seroconversion varies with the number of procedures performed. It must be emphasized that the cumulative risk is only an approximate estimate and this risk may be an over-estimate if the risk of
seroconversion per injury is less than 0.42% because most injuries to surgeons are with suture (non-hollow) needles and through gloves. However, the risk may be higher for busy surgeons, for areas of high seroprevalence, and because these theoretical rates do not include any consideration of disease transmission from cutaneous exposures.

The CDC has reported a seroprevalence survey of orthopaedic surgeons which suggests the cumulative risk of HIV seroconversion for orthopaedic surgeons is probably lower than estimated above. The survey, performed at the meeting of the American Academy of Orthopaedic Surgery in Anaheim, California in 1991, was anonymous and completely voluntary. Only two of the 3,420 participating surgeons (0.06%) were found to be HIV positive, and both of these surgeons reported additional non-occupational risk factors. The results of this survey suggest that the risk of HIV seroconversion for orthopaedic surgeons is quite low. The rate, however, may be higher than 0.06% for three reasons. First, the survey included only 48% of eligible surgeons. Surgeons with known occupational exposures or surgeons who knew they were HIV seropositive may have refrained from the voluntary testing. Secondly, seropositive orthopaedic surgeons, either through illness or choice, may have not attended the meeting. Finally, the cumulative risk of seroconversion is spread over an entire surgical career and it may be too early to observe significant rates of infection among orthopaedic surgeons.

Occupationally Acquired AIDS. The Center for Disease Control (CDC) in the United States has reported that as of October 1989, 69 health care workers have acquired AIDS without other known risk factors, and therefore, may have acquired AIDS occupationally. The number of reported cases, however, is almost certainly an underestimate of the true number for three reasons. First, because HIV infection remains asymptomatic for a median rime of five years many cases are as yet unidentified. Secondly, there is a considerable delay between when the AIDS case is reported to the CDC and when the case investigation is completed. Finally, because of the strict CDC criteria some cases with occupationally acquired AIDS may not have been appropriately classified. For example, to be defined as a possible occupational transmission, the patient must have no other known high risk behaviors for HIV. Thus, health care personnel with other risk factors, such as homosexuality, may still have acquired the disease occupationally. Additionally, patients who died prior to interview or who refused to be interviewed may have acquired AIDS occupationally and would also be excluded from the total number.

Risk of HIV Transmission from Surgeons to Patients. The CDC has documented transmission of HIV from a dentist to five of his patients. Although the mode of Transmission is unclear, it is apparent that from this case and other cases of surgeon-to-patient transmission of hepatitis B, that seropositive surgeons performing invasive procedures can transmit virus to their patients. The CDC has identified over 300 patients who were infected with hepatitis B virus in association with treatment by an hepatitis B virus infected health care worker. In contrast to hepatitis B virus, however, the risk of HIV transmission from surgeon to patient is low with estimates of 1-25 infected patients per million procedures performed by an HIV seropositive surgeon. Among 160,000 AIDS cases reported to the CDC only these 5 cases, all from the same dentist, have been reported as being transmitted from a health care worker to their patient. Three other studies of the patients of HIV seropositive surgeons and dentists have documented no other cases of patient infection.

The American Medical Association, American Dental Association, and the American Academy of Orthopaedic Surgeons initially responded to the report of HIV transmission to a patient by recommending that seropositive physicians and dentists should either obtain their patient's informed consent or refrain from professional activities with any identifiable risk of HIV transmission. The CDC has recommended that all health care workers should know their HIV antibody status, and that those who are infected with HIV should refrain from performing "exposure-prone" procedures unless an expert review panel has advised that they must continue to do so. Detractors of these policies state that the risk of disease transmission from surgeon to patient is almost certainly substantially lower than other life-threatening surgical complications, and that the policy will further interfere with HIV patients receiving unimpeded access to medical care.

An alternative policy would be to define those procedures which pose a risk to the patient. The CDC has suggested risky procedures include those involving digital palpation of a needle tip in a body cavity or the simultaneous presence of the health care worker's fingers and a needle or other sharp instrument or object in a poorly visualized or highly confined anatomical site. Clearly, the best overall protection for patient and surgeon is the prevention of sharp injuries to surgeons. However, much research into the mechanisms of injury and the efficacy of potential preventive strategies is needed before this can become a viable option.

Strategies for Prevention of HIV Transmission. Four plausible strategies do not require any knowledge of the
exact mechanisms of exposure. 26 HIV vaccine, impene-
trable gloves, Zidovudine post-exposure prophylaxis,
and serologic screening of patients.

An HIV vaccine and impenetrable gloves, however, are
not currently available and remain an eagerly awaited
development. Impervious or impenetrable gloves
would completely eliminate sharp injuries which pose
the most significant risk of disease transmission. How-
ever, currently available gloves, such as Kevlar and
chain-link gloves, do not eliminate the risk of needlec
sticks, and the gloves are frequently too thick and stiff
to permit surgery.

Drug prophylaxis acts theoretically by reducing the risk
of seroconversion after exposure has occurred. Zi-
dovudine, a chemotherapeutic agent, has been shown
to minimally increase the life span of patients with HIV
and AIDS. 14 Although the animal studies of efficacy are
inconclusive, Zidovudine might potentially also reduce
the risk of seroconversion in exposed individuals. 14
However, the efficacy of Zidovudine in humans is un-
known and two case reports demonstrate that Zidow-
dine, even when given promptly, is not universally
effective. 20,38 Further, Zidovudine has serious side ef-
effects of anemia and granulocytopenia. If Zidovudine is
used prophylactically, it should be given within 24
hours of exposure, and preferably immediately after
exposure. The recommended dose is 200 mg four or five
times per day. Appropriate duration of therapy is un-
known, with recommendations varying from 4 days to
4 months. 14 Although Zidovudine has been tentatively
recommended for individuals after a significant expo-
sure, 14 the risk of side effects must be balanced against
the risk of seroconversion. 56 An additional strategy,
which has invoked considerable controversy, is routine
pre-operative HIV testing of all surgical patients so that
surgeons could know which of their patients are sero-
positive. 21 The rationale of this strategy is that sero-
positive patients might either receive alternative
non-operative treatment or that special surgical precau-
tions could be taken. 21 One problem with this policy is
that patients currently have the right to refuse HIV
testing. However, even if patients consent to be tested,
or were routinely tested without consent, this strategy
has several problems. First, the currently available test
results would frequently not be available for emergency
surgery, such as for trauma patients, which may have a
higher risk of HIV seropositivity than other patients. 36
Rapid tests for HIV have yet to be approved by the
Federal Drug Administration. Second, some sero posi-
tive patients will have false negative tests, and other
patients, although infectious, will be test negative be-
cause they have not yet seroconverted. Finally, for many
HIV positive patients there may be no equally effica-
cious non-surgical therapy. Additionally, although the
staff at San Francisco General Hospital may be unique,
suspicion of HIV status for surgical patients in that
hospital had no effect on the rates of exposure. 22,24 The
ethics of HIV testing are currently being debated both
for patients and for surgeons. 3,10,55 Even if testing be-
comes widespread, however, surgeons will remain at
risk for HIV and other blood borne pathogens and thus,
specific strategies to prevent blood exposure are
required. Mechanisms of Exposure to Blood for Surgical
Personnel: Knowledge of the exact mechanisms of ex-
posure to blood for surgical personnel should aid in the
development of specific preventive strategies. Sur-
geons, as previously discussed, may be exposed to con-
taminated fluids in four ways; splash exposures, cutaneous exposures, sharp injuries, and aerosol drop-
lets. Orthopaedic surgeons are at risk for splash expo-
sures to their face and eyes. The mechanisms of these
exposures occur during the use of rongeurs, mallets,
and power equipment. 20

Exposures resulting from glove tears or sharp injuries
are comprised of two activities: the actions of the injured
hand and the actions of the injuring hand or instrument.
To better understand the mechanism of injury, a classi-
fication system based on these two activities has been
proposed. 84 Exposures are primarily classified by the
actions of the injuring hand or instrument: using a sharp
(sharp instrument being used, such as in suturing), not
using a sharp (sharp instrument being held or "free" on
the operative field), or handling sharp (such as expo-
sures during instrument passage). A separate fourth
category of miscellaneous glove tears, includes tears
caused by blunt instruments or while adjusting a retrac-
tor. In a prior study, 7 mechanisms accounted for 57% of
sharp injuries and 54% of the total number of glove tears
and sharp injuries: when the injured hand was retract-
ing, when the injured hand was holding an instrument,
and when sharps were not being used. 64

Strategies to Prevent Exposure to Blood. All patients
should be considered as potentially HIV seropositive.
This is the rational for using protective barrier precau-
tions for all patients, so-called "universal precautions".
Universal precautions includes the use of gloves,
face mask, protective eye wear, gown, apron, and water-
proof shoe-wear in any circumstances under which
health care workers may come into contact with poten-
tially contaminated fluid. 12 Fluids for which universal
precautions apply include blood or any bloody fluid, as
well as semen, vaginal secretions, cerebrospinal fluid,
synovial fluid, pleural fluid, peritoneal fluid, pericar-
dial fluid, and amniotic fluid. 12 The universal precau-
tions do not apply to feces, saliva, nasal secretions,
sputum, sweat, tears, urine, or vomitus, unless they
contain blood. Additionally, workers with open wounds should refrain from patient care and handling patient care equipment to avoid the risk of exposure. When considering the following preventive strategies it must be remembered that none of the proposed strategies, with the exception of double-gloving, have been shown to be efficacious in reducing exposure to blood.

1) Splash Exposure: Several types of protective eye wear are available to reduce splash exposure. Standard eye-glasses, with or without side-protectors, and goggles can reduce exposures to the eyes but do not protect the portions of the face not covered by the surgical hat and mask. Full face-shields or shields attached to the surgical face mask prevent exposure to both eyes and face but may fog or be uncomfortable for the surgeon. "Space-suits" provide the greatest degree of protection but also are the most cumbersome to wear. Theoretically, HIV may also be present in smoke arising from laser fulguration or in aerosolized spray from orthopaedic equipment. Although this mode of HIV transmission has never been documented and is probably exceedingly small, space-suits represent the only method of decreasing this mode of exposure. Some form of face-shield should probably be worn by all orthopaedic surgeons because they frequently sustain splash exposures.

2) Cutaneous Exposure: Cutaneous exposures occur on the face from splash exposures, on the hands from glove tears, and to other body areas when fluids soak through the surgical clothing. As previously discussed, exposures to the face can be prevented by face-shields. For procedures where the feet or surgical gowns are at risk of becoming wet, waterproof gowns and shoes should be worn. The final source of cutaneous exposure are due to glove tears. The majority of glove tears occur with an unknown mechanism and are noted at the end of the case or incidentally by the surgeon. Glove tears with an unknown mechanism frequently result in exposure to blood and probably result in prolonged contact with the patient's blood. Double-gloving has been shown in several studies to significantly reduce the frequency of glove tears. Although routine double-gloving may interfere with manual dexterity, the feeling of the gloves being too tight may be offset by wearing a half-size larger glove as the inner glove. One study has shown that an outer cloth glove over an inner latex glove confers even greater protection than double latex gloves. Because of proven efficacy, double or triple-gloving should be worn for most orthopaedic procedures.

3) Sharp Injuries: Because surgical instruments are designed to penetrate tissue, simple barrier precautions are not likely to be effective in reducing exposures caused by surgical instruments. Concern about sharp injuries has led professional organizations to make non-specific recommendations such as "be aware and cautious" and "do not hurry," and "personnel must use extraordinary care to prevent injuries to hand caused by....sharp instruments". Such recommendations clearly have limited usefulness in preventing sharp injuries. Specific strategies to prevent sharp injuries depend on a clear understanding of how injuries occur and their relative frequency.

If only the activities of the injuring hand are considered, one might conclude that there are few preventive strategies possible because suturing and cutting tissue are essential surgical activities. However, if the activities of both the injured and injuring hand or instruments are considered, four general classes of possible preventive approaches become apparent: 1) eliminate the activity of the injured hand or the injuring instrument; 2) distance the injured hand from the site of injury; 3) protect the injured hand; or 4) shield the sharp instruments.

The risk of exposure while "using a sharp" instrument may be reduced by either eliminating the activity or by protecting the injured hand. The simplest strategy would be to never use a hand to retract tissue or improve retractors to obviate the need for the hand as a retractor. Alternatively the injured hand could be protected with chain-link or Kevlar gloves, which although thick and stiff, might be satisfactory for retraction and provide some degree of protection. Wearing a thimble on the index finger of the non-dominant hand might reduce between 25% and 50% of sharp injuries. Alternatively the injured hand could be protected with chain-link or Kevlar gloves, which although thick and stiff, might be satisfactory for retraction and provide some degree of protection. Wearing a thimble on the index finger of the non-dominant hand might reduce between 25% and 50% of sharp injuries. Wearing a thimble on the index finger of the non-dominant hand might reduce between 25% and 50% of sharp injuries.

Injuries to the hand while holding a retractor or forceps might be reduced by distancing the hand from the site of the injury, for example by using longer forceps, by holding the forceps at a more acute angle with the skin, or by designing new forceps.

Injuries from sharps not being used may be reduced by always handing back sharp instruments to the scrub nurse. This behavior, which enjoys a long surgical tradition, needs reemphasize. An alternative strategy would be to design a shield for the scalpel blade or to use the simple maneuver of clamping the sharp tip of the needle in the jaws of the needle-holder. Therefore, even if a loaded needle-holder was laid down and not immediately handed back to the scrub nurse, it would pose minimal risk. The needle could also be removed from the needle-holder and laid flat, but might then pose a risk as a free sharp on the operative field.
Additional strategies which have been recommended include: instrument-ties and no-touch techniques, never tying with a suture needle in hand, avoiding surgeons simultaneously suturing on the same wound, and covering internal wires and pins. Other authors recommend self retaining retractors, handling sharps only with a second instrument, placing sharp instruments, such as skin hooks and scalpels, away from table edges and storing them on a remote corner of the instrument table, and preceding instrument passage with a verbal warning. Finally, the laser scalpel, ultrasonic dissection, and stapling devices may eliminate the need for some sharp instruments. Although not a frequent cause of exposure, injuries occurring during passage of instruments could be eliminated by passing instruments in an intermediate tray 2 or by having an intermediate magnetic pad.

Two further issues must be considered before any preventive strategy can be recommended. First, the efficacy of all preventive strategies require that personnel are compliant with the counter-measure. For example, compliance with "universal precautions" was shown in one trauma unit to be only 16%. Second, surgeons must also consider that a preventive strategy may have negative effects. For example, if a preventive strategy considerably lengthened the duration of a surgical procedure, patients may be at increased risk for surgical wound infection, and surgeons may be at risk of exposure to blood by other mechanisms.

Recommendations for Future Research. Several areas should be considered priorities in future research. First, studies should continue to monitor the HIV seropositivity in Orthopaedic Surgeons to confirm the initial low rates of seropositivity. The HIV seroconversion rate will hopefully be much lower than the cumulative estimated risks, however, some surgeons will almost certainly acquire AIDS occupationally and further research to reduce the risk is required. Impenetrable gloves, or gloves which confer a greater degree of protection, allowing sufficient dexterity to perform surgery should be urgently developed. Adequate barriers, such as double-gloving, waterproof outerwear, and face protection, should be worn for most, if not all, Orthopaedic procedures. Further research and product development, however, is required to improve compliance with these strategies. Knowledge of the specific mechanisms of exposure should help in the development of effective specific strategies for prevention of sharp injuries which could be incorporated into or could replace "universal precautions" for surgeons. Adequate evaluations of potential strategies will be required to demonstrate their efficacy in reducing the risk of sharp injuries for OR personnel.

REFERENCES


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<th>No. of Procedures Performed</th>
<th>HIV Seroprevalence</th>
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* Assuming a 0.42% conversion rate after an infected sharp injury and an injury rate of 3.1/100 procedures.
ADDENDUM:
HIV-SEROPOSITIVE SURGEONS:
INFORMED CONSENT AND PUBLIC HEALTH POLICY

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The transmission of human immunodeficiency virus (HIV) from a health care worker to a patient was first reported in June 1990.1 The US Centers for Disease Control (CDC), Atlanta, subsequently reported that five patients contracted HIV infection from a Florida dentist2 and initially recommended that HIV-seropositive health care workers refrain from performing "exposure-prone" procedures (New York Times, Aug. 10, 1991:6). The American Medical Association (AMA)3 and the American Academy of Orthopaedic Surgeons responded to this report by recommending that physicians and dentists who are HIV seropositive either obtain informed consent from their patients or avoid any professional activity that has an "identifiable" risk of disease transmission to patients (New York Times, Mar. 9, 1991:8). The US Congress approved legislation recommending HIV serologic testing for health care professionals engaged in invasive procedures (New York Times, Feb. 7, 1991:4; Oct. 4, 1991:A9) and considered legislation that would have imposed prison sentences or fines on HIV-seropositive health care workers who were practicing on uninformed patients (New York Times, Feb. 7, 1991:4; Aug. 10, 1991:21). Because any policy concerning HIV-infected practitioners will have the greatest impact on surgeons (New York Times, Feb. 7, 1991:4) we focus primarily on this group.

Some commentators have suggested that the proposed laws and professional recommendations may be an overreaction to an extremely small risk.3-5 The New York State Health Department and the university of California Hospitals have explicitly stated that HIV-positive surgeons are required to either inform their patients of their seropositivity or refrain from surgery (New York Times, Jan. 28, 1991:B1; Aug. 20, 1991:B5). The AMA did not find feasible to develop lists of exposure-prone procedures as recommended by the CDC (New York Times, Aug. 10, 1991:21; Aug. 30, 1991:1). The DC later revised its policy and recommended that cal panels determine whether individual HIV-seropositive health care workers should perform invasive procedures and, if so, under what circumstances (New York Times, Dec. 4, 1991: A14).6 Surgeons argue that disclosure of HIV seropositivity would destroy their practice (New York Times, Aug. 20, 1991:B5). Thus, the most appropriate policy is disputed.

There are three questions that policy-makers and legislators should consider before dictating policy on HIV-infected surgeons. First, what is the risk of HIV transmission from surgeon to patient? Second, should HIV-positive surgeons disclose their seropositivity to individual patients? Third, should the practice of HIV-positive surgeons as a group be restricted?

Risk of HIV Transmission. The risk of HIV being transmitted from surgeon to patient is probably quite low. The five cases already mentioned are the only ones reported of HIV transmission from a health care worker to patients among the 182,000 cases of acquired immunodeficiency syndrome (AIDS) reported to the CDC.7 Serologic surveys of patients of HIV-positive dentists and surgeons have failed to uncover other cases of HIV transmission.8-11 The risk of transmission from surgeon to patient depends on how frequently the patient is exposed to the surgeon's blood and the risk of seroconversion after exposure. Although the frequency of exposure is unknown it can be estimated from the rate of sharp injuries that bleed - the probable cause of HIV transmission. During 2292 surgical procedures 30 sharp injuries occurred in which surgeons or surgical assistants bled while the surgical incision was open.12,13 Thus, the probability of potential patient exposure to surgeons' blood is 0.013 per procedure. The risk of HIV seroconversion after exposure can be estimated from the rate of seroconversion reported for health care workers after sharp injury, which is 0.0042.14 Thus, the risk of seroconversion for a patient operated on by a seropositive surgeon is 0.00005 (i.e., 0.013 x 0.0042), or 1 in 20,000.
This estimate is comparable to the upper limit of a previously published risk estimate of 1 transmission in 28,000 hours of surgery. Since the average US surgeon performs 8.4 procedures per week or 13,104 procedures during a 30-year career, an HIV-positive surgeon would infect 0.7 patients in his or her entire professional career. Anyone who unknowingly becomes infected also has the potential to infect others, such as sexual partners.

Although low, this estimated risk must be interpreted with caution, because it is calculated with the use of a model and not prospectively accumulated data. However, prospective information may never be available, and even this low risk is almost certainly an overestimate for four reasons. First, the frequency of patient exposure to surgeon’s blood is certainly much lower than that of sharp injuries to surgeons causing bleeding. Second, the risk of seroconversion is probably less than 0.0042, because patients are infrequently exposed to the large amounts of blood (such as the entire contents of syringes) to which health care workers who become seropositive have been exposed. Third, an HIV seropositive surgeon would be unlikely to complete a full 30-year career. Finally, such surgeons might take extra precautions that would reduce even further the frequency of sharp injury and the risk of transmission.

HIV-Positive Surgeons and Informed Consent. Does the risk of HIV transmission demand disclosure? In Canada the legal standard for disclosure is “what the average prudent person, the reasonable person, in the patient’s particular position, would agree to or not agree to, if all material and special risks of going ahead with surgery or forgoing it were made known to him.” Thus, the risk of disease transmission from an HIV-seropositive surgeon to a patient could be material. Moreover, because 88% of Americans and 87% of Canadians want to know the HIV status of their physicians it can be concluded that a reasonable person would want to know the HIV status of his or her surgeon.

If, however, patients do require this knowledge, then presumably they also require knowledge of all equal or greater risks than that of HIV transmission. For example, surgeons vary in their surgical skills, and this likely has much more of an effect on the outcome and the material risks of surgery than the risk posed by HIV transmission. In one study the patient death rate after coronary artery bypass grafting was found to vary from 2.2% to 9.3% among surgeons. If HIV-positive surgeons are required to disclose the risk of HIV transmission to their patients, then all surgeons should be required to disclose all surgical risks above this threshold.

HIV-Positive Surgeons and Public Health Policy. Does the risk of HIV transmission demand restrictions to the practice of HIV-positive surgeons? This might reduce but would not eliminate the risk to patients. Such a reduction, however, must be weighed against the detrimental effects that a policy of restriction would have. First, restricting the practice of seropositive surgeons might lead to greater general hesitancy of physicians to treat patients with AIDS. Surgeons would fear the uncompensated loss of their surgical practice if they were to become infected. Of 300 dentists surveyed after the CDC report 11% reported a change in their attitudes toward HIV-positive patients. Such hesitancy to treat these patients will lead to further restriction of their access to health care. Second, in response to official policies, patients may avoid necessary dental and medical care because of an unreasonable concern about contracting HIV infection.

If the benefits are deemed to outweigh the risks, and the policy of practice restriction is chosen, why should HIV-seropositive surgeons be singled out? The same policies should apply in the case of all equivalent or greater risks to patients undergoing surgery. For example, carotid endarterectomy was performed unnecessarily in 32% of patients, exposing them to a 9.8% risk of postoperative stroke or death. Death, whether from inappropriate or negligent surgery, the acts of an intoxicated surgeon or HIV transmission, is tragic. Negligent, incompetent or intoxicated surgeons arguably pose greater risks to patients than HIV-positive surgeons but are not identified or sought out and have not prompted the same policy recommendations from professional organizations. If HIV-positive surgeons pose a significant risk to patients, then other comparable risks warrant a similar professional and legislative response.

Conclusion. The level of risk of HIV transmission from surgeon to patient is likely extremely low and well below the level (accepted by patients and policy-makers) of other sources of risk during surgery. If surgeons are required to disclose their HIV status, then patients deserve to be informed of all the risks of surgery above this threshold. From a public health perspective, restricting the practice of HIV-positive surgeons should mean that consistent policies be applied to all preventable causes of death from surgery.

The seroconversion of the five people who visited their dentist is tragic. Because these patients were clearly
identifiable, political pressure to censure surgeons and prevent further HIV transmission to patients is great. However, anecdotal cases of disease transmission should not drive public health policy. Public health is better served by policies that treat comparable risks consistently.

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REFERENCES


