

Guidelines Regarding HIV and Other Bloodborne Pathogens in Vascular/Interventional Radiology

Margaret E. Hansen, MD, Subcommittee Chair, Curtis W. Bakal, MD, MPH, G. David Dixon, MD, David J. Eschelmann, MD, Keith M. Horton, MD, Michael Katz, MD, Eric W. Olcott, MD, David Sacks, MD, and the Members of the Society of Interventional Radiology Technology Assessment Committee¹

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CONCERN about human immunodeficiency virus (HIV) and other bloodborne pathogens is rising throughout society as infection becomes more prevalent. Many members of the Society of Interventional Radiology (SIR) have expressed the need for an official statement from the Society that addresses practice issues unique to interventional radiology. As a result, the SIR Subcommittee on HIV and Bloodborne Pathogens was formed to review current knowledge about risk of bloodborne pathogen transmission during interventional radiology procedures, to summarize exposure control regulations and recommendations as they pertain to the practice of interventional radiology and review ways that risk can be reduced, and to formulate a policy for the Society to assist its members in dealing with this complicated subject.

LEVEL OF RISK IN INTERVENTIONAL RADIOLOGY

Information about the risk of bloodborne pathogen transmission during procedures in interventional radiology is limited. Transmission of HIV from health care worker to patient during an interventional radiology procedure has not been reported to date, nor have cases of transmission in the opposite direction been confirmed. Due to the extremely low level of risk, however, it is possible that transmission has not been reported because the number of procedures done is relatively small. This document will review what is currently known about the level of risk in interventional radiology, and compare that to what is known for surgery, which is probably the medical specialty with the greatest risk.

Many pathogens are of concern in medical practice today, including *Mycobacterium tuberculosis* and others, but bloodborne agents pose a special risk in interventional radiology. Accordingly, this document will focus on the bloodborne agents HIV, hepatitis B virus (HBV), and hepatitis C virus (HCV).

Body fluids considered infectious or potentially infectious include blood; semen; cerebrospinal, vaginal, synovial, pleural, pericardial, peritoneal, or amniotic fluid; any fluid that is either contaminated with blood, mixed with another potentially infectious fluid, or of uncertain origin; and saliva in den-

tal procedures. Stool is included only if visible blood is present. Urine is generally not included either, but it should be considered potentially infectious if the urinary tract has sustained trauma or been instrumented. All such materials other than blood are grouped under the term "other potentially infectious materials," or OPIM.

Patient-to-Health Care Worker Risk

Transmission of bloodborne pathogens in the health care setting has been documented to occur through percutaneous exposure, mucous membrane exposure, or contact with nonintact skin (1–7). Such exposures, to blood or to other fluids, can occur during interventional radiology procedures (8–11). Infection through contact with intact skin has not been documented (2,7).

The risk of bloodborne pathogen transmission during an interventional radiology procedure depends on several things: the likelihood of a sharps injury or other parenteral exposure occurring during a procedure, the prevalence of infection in the population, and the likelihood of establishment of infection after a parenteral exposure.

The rate of needlestick and other sharps injuries in interventional radiology is low. In a national survey of practicing interventional radiologists, the median number of injuries per year of practice was 0.3 (95% confidence interval [CI]: 0–1.9) (8). The es-

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From the HIV/Bloodborne Pathogens Subcommittee of the SIR. Address correspondence to SIR, 10201 Lee Highway, Suite 500, Fairfax, VA 22030.

¹ Gary J. Becker, MD, Dana R. Burke, MD, Patricia E. Cole, MD, Michael D. Dake, MD, Richard J. Gray, MD, Ziv J. Haskal, MD, Robert W. Holden, MD, Lindsay S. Machan, MD, Nilesh H. Patel, MD, and Richard Shlansky-Goldberg, MD.

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timated number of injuries per 100 procedures ranged from 0 to 2.2, with a median of 0.06 and a mean of 0.12 (95% CI: 0–0.42). In a prospective study of interventional radiology procedures, sharps injuries occurred in only 0.6% of cases (9). In contrast, the frequency of sharps injuries in surgery ranges from 1.7% to 15.4% of procedures (12–16), whereas surgeons reported a median of two injuries per year in a New York City survey (17). In another recent study, the sharps injury rate was 3.1 per 100 surgical procedures, and the total exposure rate, including both skin contact and sharps injuries, was 10.4 per 100 operations (18).

There are several important differences between interventional radiology and surgery that could account for lower rates of sharps injury during interventional radiology procedures. First, interventional radiology procedures are less invasive than most surgical procedures because they are done through very small incisions. As a result, there is less blood loss in most cases. Second, many interventional radiology procedures are shorter in duration than surgical ones, and require use of fewer sharp instruments. When such instruments are used in interventional radiology, both of the operator's hands are almost always in full view, and work in confined body cavities is very rare. Both of these factors reduce the likelihood of inadvertent injury to the nondominant hand, a common site of injury during surgery. Lastly, the use of suturing techniques (such as palpating for the tip of a needle with the index finger of the nondominant hand) and suturing materials (such as wire) that increase the risk of puncture injury is rare in interventional radiology.

The prevalence of HIV infection in the general population of the United States is estimated to be less than 1% (19). Among hospitalized patients, however, the prevalence may be higher: in one study, from 0.2% to 14.2% of inpatients had evidence of HIV infection (20). Infection may also be more prevalent among patients seen in the emergency department: in one urban hospital, 19% of young adults admitted with penetrating trauma were HIV-positive, as were 6% of all emergency department patients (21). In a related study, evidence of HBV and

HCV infection was found in 5% and 18%, respectively, of patients in the same emergency department (22). In certain subgroups, the rates were much higher: HCV was found in 83% of injecting drug users, 21% of transfusion recipients, and 51% of black men aged 35–44 years old (22). In another center, 19% of hemodialysis patients were HCV-positive (23). Evidence of HBV and HCV exposure in the general population is less common (3%–14% and 0.6%, respectively [7,24,25]), but up to 1% of hospitalized patients may be chronic carriers of HBV (7), most of whom are asymptomatic. It is estimated that 0.1%–0.7% of the general population are HBV carriers, although the prevalence of HBsAg in certain high-risk groups may be as high as 15% (6,7).

For a given exposure, the risk of subsequent infection or seroconversion is likely to depend, in turn, on several factors. These include the type of exposure (cutaneous, mucous membrane, or percutaneous) and its severity (depth of penetration), the type (blood or OPIM) and amount of fluid in the inoculum, the viral titer in the source individual's blood at the time, his/her stage of illness, whether or not he/she is receiving antiviral medication, and the number and concentration of infected cells circulating in his/her blood at the time (26–29). For sharps injuries, the type of instrument is also important: hollow-bore needles pose a higher risk than other sharp instruments; this is thought to be because they introduce a larger amount of blood or OPIM into the injured tissue. Given all this, the risk of seroconversion after a single percutaneous or mucous membrane exposure to HIV has been estimated at 0.3%–0.4% (2–4). HBV is much more easily transmitted: the risk of infection after a single parenteral exposure can be as high as 30% (6). HCV is not as infectious as HBV, but is more so than HIV: the risk of infection after a single parenteral exposure was 2.7% in one report (5).

The cumulative career or lifetime risk that an interventional radiologist will become occupationally infected with HIV or another bloodborne pathogen is unknown. Attempts have been made to estimate this risk for surgeons, ranging from 1% (30) to 20% (31) during a 30- or 40-year career, depending on the prevalence of infec-

tion in the patient population served. Gynecologic surgeons and oral surgeons are at the greatest risk because their work frequently involves manipulation of sharp instruments inside a body cavity where visual control is limited or nonexistent. The fact that no surgeons without behavioral risk factors have tested positive in studies to date (32) casts doubt on the accuracy of these models, suggesting that the actual lifetime risk of occupational infection may be much lower (33). Certainly, the lifetime risk of occupational HIV infection should be lower still for interventional radiologists because blood contacts and parenteral exposures are much less frequent in this field than in surgery (8–18). In a study based on computer models similar to those used for surgery, the lifetime occupational risk for interventional radiologists was estimated to be between .009% and 16% for a 30-year career (34). Recent studies have found that the prevalence of HCV infection among health care workers is also very low, in the range of 1% (25). Occupational infection with HBV, however, remains common: 3%–10% of unvaccinated health care workers who do not have frequent blood contacts show evidence of HBV infection (24), as do 10%–30% of those with frequent blood contacts (6). The Centers for Disease Control and Prevention (CDC) estimates that 12,000 health care workers acquire HBV infection on the job each year (6).

Health Care Worker-to-Patient Risk

The risk of bloodborne pathogen transmission from health care worker to patient during an interventional radiology procedure depends on the likelihood of a sharps injury or other parenteral exposure occurring during a procedure, the prevalence of infection in the population of health care workers, and the likelihood of establishment of infection after an exposure. Because all of these events are uncommon, the level of risk during an interventional radiology procedure is probably extremely low.

As we have seen in the previous section, the likelihood of parenteral exposure occurring during an interventional radiology procedure is very small: sharps injuries occur in only 0.6% of cases (9). For transmission

from health care worker to patient to occur, an infected health care worker must sustain an injury that causes bleeding and there must be subsequent additional parenteral contact between the patient and the blood of the injured health care worker. In interventional radiology, this could occur if an injured health care worker's blood contacts the patient directly, or indirectly via a needle, guide wire, or other instrument. In surgery, such "recontact" can occur if a needle is reused after an injury, or if the injured surgeon bleeds into the wound. Recontact is rare during interventional radiology procedures: in the aforementioned survey, contaminated instruments were reused in only 1% of cases after injury, and direct contact between a patient and the injured health care worker's blood occurred in only one case, or 0.2% of injuries (8). In the prospective study of interventional radiology procedures, no contaminated instruments were reused, and no contact between patients and health care workers' blood occurred (9). In comparison, recontact rates in surgery vary considerably, with reuse of contaminated instruments in up to 29% of cases in a recent study (15). Gynecologic procedures, especially vaginal hysterectomy, were associated with the highest rates of sharps injury and recontact in this study.

The prevalence of HIV infection among health care workers is not known, but probably resembles that of the general population. A study of dental professionals found that only one of 1,309 (0.07%; 95% CI: 0%–0.4%) individuals without behavioral risk factors for HIV infection was seropositive, despite frequent puncture injuries and occupational exposure to bloody fluid (35). Voluntary testing of surgeons attending the 1991 Annual Meeting of the American Academy of Orthopaedic Surgeons found that none of the 3,267 (95% CI: 0%–0.09%) participants without behavioral risk factors were HIV-positive, despite frequent blood exposure and sharps injuries (32). Of the 108 participants with reported behavioral risk factors, two (1.9%; 95% CI: upper limit = 5.7%) were HIV-positive (32). As mentioned previously, evidence of exposure to HCV is found in only 1% of health care workers (25). Evidence of exposure to HBV can be found in up to 10% of

health care workers who do not have frequent blood contact, but the prevalence of the carrier state (as manifested by chronic HBsAg positivity) is only 0.3% (24).

Quantitation of the risk to patients from HIV-infected health care workers has been attempted with use of computer modeling techniques and probability theory. Their practical utility is uncertain, but all such estimates have been very low. The CDC estimated the risk of an infected surgeon transmitting HIV to a patient during surgery to range from one in 420,000 procedures to one in 42,000 procedures (0.00024% to 0.0024%) (36). Lowenfels and Wormser estimated that one incident of HIV transmission would occur per 83,000 hours of surgery (37). Rhame, in an editorial in *JAMA*, estimated the risk at one in 1,000,000 operations (0.0001%) to one in 100,000 operations (0.001%) (38). More recently, Schulman et al have estimated the risk of transmission of HIV from surgeon to patient to be less than one in 1,000,000 procedures (39). All of these numbers are based on the estimated risk of seroconversion after a single percutaneous or mucous membrane exposure to blood containing HIV, which is approximately 0.3%–0.4% (2–4), combined with various estimates of how often such exposures may occur, and estimates of the prevalence of HIV infection among surgeons. The actual risk of transmission of HIV from an infected health care worker to a patient is probably lower than 0.3% for a single exposure because the infectivity of a person's blood is related to his/her viral titer. Higher titers, which are believed to confer greater risk of disease transmission, are associated with more severe clinical disease, which may be incompatible with the demands of interventional radiology practice. It is, therefore, likely that infected physicians still well enough to practice interventional radiology would have much lower titers. For the reasons previously discussed, interventional radiology procedures are likely to pose significantly lower risk of HIV transmission to patients than surgical procedures. The risk of such transmission is certainly much lower than many other risks associated with medical care, which are accepted without question by patients and providers alike. With use of modeling tech-

niques similar to those used for surgery and the injury (8,9) and seroprevalence (19) data given previously, we estimate the risk of HIV transmission from an infected interventional radiologist to a patient to be 7.5 per million procedures (95% CI: 0–15.3 per million procedures) (34). If the HIV status of the interventional radiologist is unknown, the risk is estimated to be .03 per million procedures (95% CI: 0–3.8 per million procedures) (34). To put this risk in perspective, it would be helpful to know the total number of interventional radiology procedures performed annually in the United States. Unfortunately, this number is difficult to determine from available data. We have used data from a survey of SIR members (8) to estimate the total number of procedures they perform in 1 year; the result is $1,017,450 \pm 726,750$ (range, 290,700–1,744,200; Hansen ME, McIntire DD, unpublished data, 1993). This is an underestimate of the actual number because non-SIR members and nonradiologists were not included in the original survey. It is not known what proportion of interventional radiology procedures are done by non-SIR members or nonradiologists.

The risk of HBV transmission is more of a concern. HBV is many times more infectious than HIV, and has been transmitted to patients despite adherence to universal precautions and lack of recognized injury during procedures (40–43). In several early cases, transmission was attributed to the failure to wear gloves. The use of gloves, which is now routine during invasive procedures, has dramatically reduced the number of cases of HBV transmission. However, there have been at least three such cases that occurred despite the use of gloves and lack of recognized sharps injury during a procedure (43). In all cases in which HBV was transmitted from a chronically infected health care worker to a patient, the source was HBeAg-positive (41).

TESTING FOR HIV

Some have argued that all patients, and all health care workers, should be tested for evidence of HIV infection on the theory that identifying all infected individuals would reduce the risk of accidental transmission of the virus

during medical procedures. Not only would the cost of such testing be substantial, the logic of the argument is seriously flawed for several reasons. First, there is a certain error rate (both false positive and false negative) inherent in any test, including both the ELISA and the Western blot methods of testing for HIV exposure (44). In addition, some people who are infected will not test positive for other reasons. For example, they may be in the "window" period between exposure and seroconversion, which is believed to be 2 months or less (44) but may be as long as 6 months or more in some cases (44-46). Others who are not infected will test falsely positive, again for a variety of reasons (47). Therefore, the reliability of test results may not be adequate to achieve the goal of preventing nosocomial transmission. Second, testing of patients cannot be done without their consent in many states. What is to be done with patients who refuse? Who is to have access to the results if testing is done? Who decides which procedures pose sufficient risk to the health care worker to justify testing of patients? Third, although some physicians believe they can take additional precautions and be more careful during procedures if they know a patient is HIV-positive, study has shown this to be fallacy: knowledge of the patient's HIV status made no difference in the incidence of injuries or other blood exposures among surgeons at San Francisco General Hospital (12,48). Fourth, test results will not always be available before treatment must be given, especially in the emergency setting. Finally, and perhaps most importantly, testing for HIV will not identify patients who pose other hazards to health care workers: in one study, testing for HIV alone would have failed to identify 87% of patients infected with HBV and 80% of those infected with HCV (22). The only logical course, then, is to treat every patient as a potential source of infection, and observe universal precautions scrupulously in all cases.

Testing of health care workers for HIV poses other problematic questions. Since the passage of the Americans with Disabilities Act, which encompasses AIDS and HIV infection, job discrimination issues have been raised in several lawsuits. Other po-

tential issues related to testing of health care workers include disability, liability, and other types of insurance, and confidentiality and reporting of results, as well as questions about the frequency of testing and whether to restrict the practice of a health care worker who tests negative initially after an exposure. There are important health care delivery issues at stake as well: if physicians know their careers will end should they become infected with HIV, they will be less willing to perform invasive procedures on infected patients, thereby reducing access of such patients to needed care (39). Routine testing of physicians for HIV infection also raises the issue of patient consent to having procedures done by HIV-positive doctors.

For these reasons, the SIR joins the American Medical Association (AMA) (49), the National Commission on AIDS (50), the Association for Practitioners in Infection Control and Epidemiology and the Society of Hospital Epidemiologists of America (51), and the CDC (52) in opposing mandatory HIV testing of physicians and other health care workers. Testing should not be a condition of employment or for granting of hospital privileges, licensure, or liability insurance coverage (49-51).

The 1992 Bloodborne Pathogen Standard requires that vaccination for HBV be offered free of charge to all workers who may be at risk for occupational exposure to blood or OPIM, and prevaccination testing for evidence of previous infection may be indicated in some cases. However, mandatory testing of all health care workers for HBV and HCV would be subject to many of the limitations and concerns discussed previously, and the SIR is opposed to it as well.

PROCEDURE SAFETY: RECOMMENDATIONS AND REGULATIONS

Current Exposure Control Regulations

In 1992, the Bloodborne Pathogens Standard developed by the Occupational Safety and Health Administration (OSHA) was enacted into law (7). Failure to comply is a federal offense. A comprehensive review of the Standard is beyond the scope of this doc-

ument, but its most important features are summarized below. More detailed information can be found in a recent review by Decker (53) or in the complete text of the Standard and its supporting documents (7).

1. *Materials considered infectious/potentially infectious* include blood and other fluids as listed in the first section of this document.
2. *Occupational exposure* is defined as parenteral, skin, or mucous membrane (including conjunctival) contact with blood or OPIM that may be reasonably anticipated to result from the performance of a health care worker's duties. This includes contact that is prevented by use of protective equipment, such as gloves, gowns, and face and eye protection (goggles, masks, and shields).
3. An *exposure control plan* must be developed by every employer of at least one worker whose duties put him/her at risk for occupational exposure. This plan must be reviewed with employees and contain a schedule for meeting the various requirements of the Standard regarding hepatitis B vaccination, training, record-keeping, post-exposure treatment, and so on. The plan must detail measures that the employer will take to reduce exposure risks.
4. The Standard mandates adherence to *universal precautions*, as well as certain specific engineering and work practice controls. Two-handed recapping of contaminated sharps instruments is strictly prohibited, as is bending or breaking of contaminated needles. Contaminated sharps must be placed in appropriate containers immediately after use. Handwashing facilities must be readily accessible; hands must be washed every time gloves are removed or changed. Eating, drinking, handling of contact lenses, and use of cosmetics are prohibited in work areas where exposure may occur. Specimens must be placed in sealed, leakproof containers that are red or bear the label "biohazard." Appropriate

- personal protective equipment* must be provided for employees at risk, and cleaned, repaired, or replaced as needed.
5. Employers must provide employees who are at risk for occupational exposure with *hepatitis B vaccine* free of charge. Vaccination may be refused, but the employee must sign a form indicating that it was offered and declined. *Training in infection control* must be provided within 10 days of an employee being hired and at least once annually thereafter, and must be documented. The Standard details certain elements that must be included. Records of this training must be kept for 3 years. Records relating to hepatitis vaccination and postexposure follow-up must be kept for the duration of employment, plus 30 years. Records must be made available to OSHA and to the employee.
 6. Employers must provide *postexposure prophylaxis and counseling*. Blood from the source of the exposure must be obtained and tested for HIV and HBV unless the person is already known to be infected or consent, if required, is refused, in conjunction with individual state law. Although HCV is not specifically mentioned in the OSHA Standard, testing for infection with this virus may also be indicated. Refusal must be documented. Results of testing must be provided to the exposed employee, who is to be informed of applicable laws concerning disclosure of the source's identity. The employee also may have blood collected for testing, or to be stored for at least 90 days while the employee considers whether to have testing done. The employer is to be told only that the exposed worker has been informed of the evaluation's results and of any further evaluation or treatment that is needed. The actual results of the evaluation and all other findings are considered confidential. All records pertaining to an exposure incident

must be kept for the duration of employment, plus 30 years. Although not discussed explicitly in the standard, chemoprophylaxis is warranted after high-risk exposure to HIV; more information and recommended regimens may be found in a recent report from the U.S. Public Health Service (54).

Minimizing the Risk of Bloodborne Pathogen Transmission in Interventional Radiology

We endorse the precautions delineated by OSHA (7) and the CDC (52) and urge members of the SIR to adhere to these guidelines. These general recommendations, which include adherence to universal precautions, use of appropriate protective equipment, and safe handling practices for sharps, can be expanded to yield techniques that more specifically address the practice of interventional radiology (55), as has been done for surgical practice (56–58). Accordingly, we propose four categories of specific precautions: 1) barrier devices and personal protective equipment; 2) performance of procedures; 3) equipment; and 4) handling of specimens.

Barrier Devices and Personal Protective Equipment

Standard precautions for all interventional radiology procedures should include (a) handwashing with a germicidal and virucidal agent before and after each case (immediately after removing gloves); and (b) wearing appropriate protective clothing, including gloves, transparent face shield or a mask plus goggles with side protectors, and coverage of all areas of noncontact skin with a fluid-impermeable material.

Because occult perforations in surgical gloves increase with time worn (11), it may be prudent to change gloves after 90 minutes of wear whether a perforation is apparent or not. Double-gloving is recommended when breaks in the skin are noted, and some individuals may elect to double-glove routinely. When there is a risk of splashing of blood or body fluids, such as when removing a vascular

catheter at the end of a procedure, eye and face protection should be worn, as well as gloves. Wearing a gown is also recommended if there are breaks in the skin of the arms.

When there is a reasonable risk of exposure to blood or bloody fluid during any vascular or interventional procedure, the following additional protective clothing are recommended in addition to the items listed previously: surgical "scrub" attire; shoes worn only for performing procedures; fluid-impermeable gown; shoe covers or gaiters to cover lower legs and feet; and hair covering.

Generally, simple peripheral intravenous access procedures (such as starting intravenous lines or phlebotomy) would not fall into this category. Gloves and a face shield are adequate for these procedures in most cases. Whenever transfusion equipment or blood products are handled, eye protection and gloves should be worn. Contaminated work surfaces must be cleansed and disinfected promptly after contamination is noted, and at the end of each procedure whether visibly soiled or not.

Procedural Precautions

1. Recapping of needles or resheathing of scalpel blades by hand is to be avoided whenever possible. If this is not possible, one of the following methods must be used: a one-handed technique wherein the cap is "scooped up" with the point of the exposed sharp instrument, or a two-handed technique wherein the cap is held with a clamp or other mechanical device, not the operator's fingers. When needles must be removed from syringes or exchanged, this too should be done by using a clamp or other mechanical device, rather than one's fingers. Use of disposable scalpels rather than reusable metal handles is strongly recommended.
2. Immediately after being used, all disposable sharp instruments that may be reused during a given procedure should be placed into stable plastic devices designed for use on

procedure trays. These holding devices should be placed in an area of the tray where they will not be in the way and will not be readily knocked or tipped over. All members of the operating team must be aware of the nature and location of the designated container. Disposable sharp instruments that will not be reused during a given procedure should be disposed of in appropriate containers immediately after use. Sharps containers must be of adequate dimensions to contain all sharp instruments used in a procedure completely, with no portion of the instrument protruding from the opening of the container. Sharp instruments should not be bent to force them to fit into a container that is not large enough to accommodate them.

3. All nondisposable sharp instruments must be placed into designated containers immediately after use. These containers must be of adequate dimensions to contain the instruments completely, as described under section 2 (discussed previously). All members of the operating team must be aware of the nature and location of the designated container.
4. Members of the operating team should communicate verbally regarding the use and location of all sharp instruments.
5. Sharp instruments should not be handed directly from one team member to another. Rather, the "no touch" method should be used, in which the instrument is set down onto a stable surface by one team member, who then withdraws his/her hand before the instrument is picked up by a second team member.
6. Suturing should be performed only by using needle holders, never by holding or grasping the needle in one's fingers. Palpation to locate or guide the needle tip should never be done. Similarly, whenever a

sharp instrument is in use, the operator should remove his/her nondominant hand from the field unless patient safety would be compromised by doing so.

7. Disposal containers for sharp instruments must be readily available, conveniently located, and labeled according to OSHA regulations. Containers must be replaced before they are three-quarters full, or whenever items protrude from the opening (see section 2 regarding appropriate size of these containers).
8. Adequate lighting in procedure rooms is essential. For dedicated angiointerventional rooms, tableside control of room lighting is recommended. This may be accomplished via a light switch or by interconnection of the fluoroscopy controls and the room lighting.
9. Technologists or other personnel who clean procedure trays should use long-handled forceps or clamps to remove sharp instruments. Gloves should be worn in all cases, and splash protection (gown, face shield, or mask plus goggles) may be needed also.
10. If a member of the operating team sustains a sharps injury, the instrument responsible must be removed from the procedure field immediately, without being reused on the patient. Any additional pieces of equipment that have come in contact with the injured health care worker's blood, such as guide wires, catheters, gauze pads, and so on, must be discarded immediately as well. The exposed individual shall follow the procedure for reporting and treatment of exposure incidents that has been established at that facility.

Equipment Precautions

1. Closed flush and waste containment systems should be used for angiography.
2. Drainage of large fluid collec-

tions should be done with use of closed drainage sets.

3. Self-sheathing or needleless intravenous systems should be used whenever possible.
4. Glass syringes should not be used unless plastic syringes are not suitable.
5. Luer-lock fittings are preferred over the Luer-slip type for all syringes, connecting tubing, drainage systems, and the like.
6. "Bloodless" puncture systems for arterial and/or venous access are widely available and may be used at the discretion of the operator.
7. Resuscitation bag/mask sets should be available in all patient care areas, including procedure rooms.
8. Plastic containers or other stable devices designed to contain sharp instruments on procedure trays while maintaining their sterility should be used whenever possible.
9. Glass containers (such as contrast media bottles) should be disposed of in sharps containers, rather than in waste bags, to reduce the risk of injury to housekeeping personnel from breakable materials in infectious waste bags. Removal of the metal caps from contrast or medication vials should be done with a hemostat or other instrument to avoid injury, and the metal tops should then be placed in a sharps disposal container.

Specimen Handling Precautions

1. Gloves must be worn at all times when handling specimens.
2. Specimens must be placed in clearly marked, sealed containers, which are then transported inside a second sealed container (such as a bag) that is labeled "biohazard."
3. Facial splash protection (face shield, or mask and goggles) must be worn when fluid samples are injected into containers or poured from containers.

PRACTICE GUIDELINES FOR HIV-POSITIVE PHYSICIANS

Background

Currently, there is no federal standard that defines how HIV-positive health care workers should be dealt with; rather, each state was directed by Congress to determine its own policy and legal position on this issue. As a result, policies concerning HIV-positive health care workers, and potential legal restrictions on their practice, may vary considerably from state to state. Every practicing interventional radiologist should be aware of the laws in his/her own state. In addition, we encourage every interventional radiologist to take an active role in shaping policy at each institution in which he/she practices. It is particularly important to do so before an exposure incident occurs, so that a policy protecting both patients' and health care workers' rights will already be in place, and a mechanism for handling these difficult situations will be established and available.

Despite the lack of a federal standard, several national organizations have promulgated their own policies concerning HIV-positive health care workers, including the AMA (49), the CDC (52), the National Commission on AIDS (50), the Surgical Infection Society (59), the Association for Practitioners in Infection Control and Epidemiology and the Society of Hospital Epidemiologists of America (51), the Association of Operating Room Nurses (60), and others. Numerous state and local medical societies have followed suit.

The SIR Subcommittee on HIV and Bloodborne Pathogens has developed the following policy to assist members in addressing these complex concerns with local hospital boards and other regulatory bodies should the need arise. The policy has been reviewed by representatives of the Association of Vascular and Interventional Radiographers and the American Radiologic Nurses Association, and incorporates some features of the AMA policy (49), as well as some from other sources. It must be stressed that all available evidence suggests that the risk of bloodborne pathogen transmission from health care workers to patients during interventional radiology procedures is

minimal, and thus we believe there is no reason to restrict the practice of infected individuals except in unusual cases. A policy that allows some flexibility is essential, both to ensure patient safety and to protect the rights of practitioners. Practice restrictions, if needed, should be based on a case-by-case review by a local review panel as described below.

Policy

1. Physicians must adhere to the principles of universal precautions for blood and OPIM and comply with the OSHA Bloodborne Pathogen Standard (7) and local hospital policy. This includes vaccination against HBV (unless a waiver declining vaccination is signed), with revaccination or booster doses as needed.
2. Physicians who perform invasive procedures and have non-occupational risk factors for infection with a bloodborne pathogen should be aware of their HIV, HBV, and HCV antibody status through voluntary, confidential testing.
3. Physicians should be retested voluntarily whenever there has been probable exposure to a bloodborne pathogen, or as determined by local institutional policy.
4. Physicians who are HBsAg-positive should know their HBeAg status as well, because HBeAg-positivity is associated with a higher risk of viral transmission. In accordance with CDC guidelines, persons who are HBsAg-positive but HBeAg-negative need not be restricted from performing procedures unless they have been proven to be associated with HBV transmission (6) or they have exudative or weeping skin lesions that could come in contact with patients or equipment used on patients. Whether physicians who are HBeAg-positive should be restricted from performing invasive procedures should be determined on a case-by-case basis after review by a local panel, as described below.
5. If a physician tests positive for a bloodborne pathogen, he/she shall disclose that information, if required by hospital policy, to his/her local Medical Director or other physician in similar position of authority on a confidential basis. If required by hospital policy, he/she shall also provide the Medical Director with releases allowing medical information to be obtained from his/her personal physician.
6. If required by state law, the state Health Department must be notified of the infected physician's status. Knowledge of the physician's status must be restricted to individuals with legitimate need to know, and must be held in strictest confidence. All persons who are informed of the infected physician's status must be explicitly instructed that no one else may be told without consent from the infected physician. All records pertaining to the infected physician's condition must be kept confidential and stored separately from routine hospital records, including the institutional computer system.
7. If there is concern that the infected physician's physical or mental health is such that his/her ability to practice is impaired, the case will be referred to the local Impaired Physician Committee or similar body.
8. If the infected physician performs, on a routine or emergency basis, invasive procedures that may constitute a risk to patients, his/her case will be referred to a local review panel formed to deal with his/her particular situation. The institution's Medical Director, or other person in similar position of authority, shall be responsible for forming the review panel. As recommended by the CDC (52) and AMA (49), members of this panel might include an infectious disease specialist with expertise in the epidemi-

ology of bloodborne pathogen transmission, a state or local health department representative, the infected physician's personal physician, another physician from the infected individual's department who performs the same type of procedures, if the infected physician consents to this person being informed of his/her condition, the infected physician, the chair or director of the infected physician's department, or a hospital administrator.

9. Except under unusual circumstances, to be determined by the institution's Medical Director, the infected physician shall cease performing invasive procedures until the review panel meets, which must occur within 4 business days after the Medical Director has been notified that the physician is infected.
10. The review panel will consider what is known about risk to patients for the procedures performed by the infected physician, as well as his/her individual experience, ability, and health status. The review panel may prohibit him/her from performing those procedures deemed to pose unacceptably high risk to patients. The committee may allow him/her to continue performing procedures that are believed to not pose substantial risk to patients. If required by state law, the physician must inform patients of his/her infection with HIV, HBV, or HCV, and the fact that the procedure may pose a risk of transmission. Written informed consent to such risk shall be obtained. Otherwise, disclosure is not required. As stated by the National Commission on AIDS in 1992, "... a blanket policy of disclosure of health care providers' HIV status to patients not only would fail to make the health care workplace any safer, it would also have a deleterious impact on access to health care. Mandatory disclosure of

a health care worker's HIV serostatus does little, if anything, to enhance the patient's safety. It inflates the risk of HIV transmission out of proportion to other risks and is inconsistent with the principles and practice of informed consent" (50).

11. The infected physician may appeal the review panel's decisions within 7 days, and the review panel will meet again within 4 business days of such appeal.
12. Institutions should establish policies on how to deal with incidents in which patients may have been exposed to blood or OPIM from physicians. Such policies should include notification of the patient's primary care provider and self-reporting of the incident to the infection control or occupational health program (or the review panel if the physician is known to be infected with a bloodborne pathogen). If the source physician is not known to be so infected, he/she is ethically obligated to undergo testing for HIV, HBV, and HCV. The exposed patient should be told promptly that he/she may have been exposed, but should not be given the source physician's name or told the precise circumstances of the possible exposure. He/she should be notified of the source's blood test results, and should receive counseling and postexposure prophylaxis as indicated. The patient should be asked to consent to baseline blood testing, or storage of baseline serum if testing is refused, and his/her primary care provider should be informed. If both testing and serum storage are refused, the patient should sign a written statement documenting this.
13. Refusal to abide by the recommendations of the review panel may result in suspension of medical staff privileges, as mandated by the institutional Medical Director or Credentials Committee, after

appropriate review and opportunity for appeal.

CONCLUSIONS

From the presented material, it can readily be seen that our knowledge about transmission of bloodborne pathogens is incomplete, and that some risk is unavoidable in the practice of interventional radiology. Given currently available information, however, we believe that this risk is very low indeed, both from health care worker to patient and vice versa. Current data indicate that the risk of pathogen transmission from patient to health care worker is very low, and that the risk from health care worker to patient is extremely low. With use of appropriate precautions and protective equipment and compliance with exposure control regulations, these risks can be reduced even further. It is most appropriate for each case of an infected health care worker to be evaluated individually, by people familiar with the skills, experience, and medical condition of the infected practitioner and with the nature of the invasive procedures he or she performs. We do not believe that mandatory HIV testing of all health care workers and/or patients would achieve the goal of preventing transmission of the virus in the health care setting, nor is it feasible in the current financial, legal, and social climate.

We hope the policy set out in this document provides guidance to SIR members and others who practice in related fields. It is not meant to be immutable, but will be reviewed and updated as more information becomes known, and therefore should remain a useful tool for members of the SIR and all practitioners of interventional radiology well into the future.

APPENDIX

Document Development and Approval Process

This document was developed by the Bloodborne Pathogen Subcommittee of the SIR with assistance from the Technology Assessment Committee. Consensus on its major provisions was obtained by using a modified Delphi polling method (61); three rounds of polling were conducted and consen-

sus was obtained on all items. The polling questions and related data are on file in the SIR office.

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