Manual for health-care workers (HCW's) on blood-borne viral occupational diseases.

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Price : Rs 40

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Preface

Doctors and other medical employees care for patients. While caring for patients, health-care workers themselves are exposed to many risks.

In our trainings, we realised that the risks faced by health care workers (including doctors) are not paid enough attention. Doctors, Laboratory workers, nurses and others have expressed a need for information regarding occupational health problems of others and their own too.

The risks involve diseases due to bacteria, viruses, chemical liquids, gases and also electrical accidents and falls.

Here we have concentrated only on viral blood borne pathogens. Due to increasing scare of AIDS many research projects, educational projects are ongoing but in these the risk of doctors and medical workers seem to be neglected.

Actually part of the funds for AIDS control need to be spent on good protective equipments such as gloves, aprons etc. When it comes to treatment, "progress" is being made every year regarding AIDS. We have tried to put together latest information, but one will have to keep abreast of latest information, or we can be contacted for the same.

PRIA is involved in the field of occupational health for the last 15 years. For the past 3 years, PRIA is working with doctors too. In our orientation training programmes for doctors, we felt the need for a manual on viral blood borne pathogens.

Please do send us your comments to us regarding the manual.

Vijay Kanhere
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July 1999.
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Introduction:

Bloodborne pathogens are microorganisms such as viruses or bacteria that are carried in blood and can cause disease in people.

There are many different bloodborne pathogens including malaria, syphilis, and brucellosis, but Hepatitis B (HBV), Hepatitis C (HCV) and the Human Immunodeficiency Virus (HIV) are the three diseases specifically important since there is no cure hence the infected patient will have life-long disabilities or lead to death.

While this module will focus primarily on HBV, HCV and HIV, it is important to know which bloodborne pathogens (from humans or animals) you may be exposed to at work, especially in laboratories. For example, personnel in the College of Veterinary Medicine might have the potential for exposure to rabies, and it would therefore be important to know specific information about rabies.

This module is meant for all Health-care workers (HCW). It gives recent relevant information on Hepatitis B and C and HIV without going into details of symptomology, differential diagnosis and treatment. The references used for preparing the document are given at the end of the document and can be procured from any medical college’s library in India. A notable feature of some of the references is that they are in the public domain, the names of hospitals where occupationally acquired viral infections have occurred being clearly mentioned—a far cry from the situation in India where such incidents are held secret. There have been anecdotal evidence of occupationally acquired HIV infection in health-care workers in Mumbai, Ahmedabad and Vellore.
Risk of Transmission:

Bloodborne pathogens such as HBV, HCV, and HIV can be transmitted through contact with infected human blood and other potentially infectious body fluids such as:

- Serum
- Vaginal secretions
- Cerebrospinal fluid
- Synovial fluid
- Peritoneal fluid
- Amniotic fluid
- Saliva (in dental procedures), and
- Any body fluid that is visibly contaminated with blood.

It is important to know the ways exposure and transmission are most likely to occur in your particular situation, be it providing first aid to a student in the classroom, handling blood samples in the laboratory, or cleaning up blood from a hallway.

HBV and HIV are most commonly transmitted through:

- Sexual Contact
- Sharing of hypodermic needles
- From mother to their babies at/before birth
- Accidental puncture from contaminated needles, broken glass, or other sharps
- Contact between broken or damaged skin and infected body fluids
- Contact between mucous membranes and infected body fluids
- Contact with contaminated waste, especially in case of hepatitis B, which can last in dried body fluids for as long as 7 days.

Accidental puncture from contaminated needles and other sharps can result in transmission of bloodborne pathogens.

In most work or laboratory situations, transmission is most likely to occur because of accidental puncture from contaminated needles, broken glass, or other sharps; contact between broken or damaged skin and infected body fluids; or contact between mucous membranes and infected body fluids. For example, if someone infected with HBV cut their finger on a piece of glass, and then you cut yourself on the now infected piece of glass, it is possible that you could contract the disease. Anything there is blood-to-blood contact with infected blood or body fluids, there is a slight potential for transmission.
Unbroken skin forms an ingenuous barrier against bloodborne pathogens. However, infected blood can enter your system through:

- Open sores
- Cuts
- Abrasions
- Acne
- Any sort of damaged or broken skin such as sunburn or blisters

Bloodborne pathogens may also be transmitted through the mucous membranes of the:

- Eyes
- Nose
- Mouth

For example, a splash of contaminated blood to your eye, nose, or mouth could result in transmission.

**Sero-conversion following exposure:**
Seroconversion means after being exposed to body fluids from an proved infective source—the percentage of HCWs developing the infection.

(see also Table 1 in pg. 4)

<table>
<thead>
<tr>
<th>Seroconversion rate</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV</td>
<td>0.3%</td>
</tr>
<tr>
<td>HBV</td>
<td>30%</td>
</tr>
<tr>
<td>HCV</td>
<td>10%</td>
</tr>
</tbody>
</table>

Blood is the single most important source of HIV infection in the health-care setting. Several studies have evaluated HCWs prospectively following an occupational exposure to blood from a patient with documented HIV infection as a result of a percutaneous injury or mucous membrane or cutaneous contact. In these studies, HCWs were tested for HIV antibodies at the time of exposure of HIV-infected blood (baseline testing) and at periodic intervals thereafter for up to 12 months. Collectively, more than 300 workers with percutaneous exposure to HIV-infected blood have been enrolled in such studies to date. The average risk of seroconversion after a needlestick injury has been found to be approximately 0.3%. Nearly all of the documented seroconversions in these studies occurred after a percutaneous injury with a hollow-bore needle; one each followed a cut with a lancet and broken glass.

Although individual cases of transmission of HIV after a mucous membrane exposure have been reported, only one seroconversion has occurred in the setting of a prospective study. Data from 21 studies worldwide include one seroconversion among 1107 mucous membrane exposures, for an estimated rate of 0.06%.

The likelihood of seroconversion following a percutaneous injury involving blood from an HIV-infected patient appears to be affected by overlapping factors related to:
(1) the circumstances of the injury,

(2) the infectiousness of the source patient, and

(3) the susceptibility of the HCW.

First, possible considerations relevant to the injury include the time interval between needle use and exposure, the depth of severity of the exposure, the quantity of blood injected, and the bore of the needle. To date, none of the documented sero-conversions from percutaneous exposures have occurred following an injury with a solid suture needle. Studies have suggested that more blood is transferred by deeper injuries and by hollow-bore phlebotomy needles, especially those of larger gauges than with solid suture needles. Two studies have shown that one layer of surgical gloves appears to decrease the volume of blood injected by solid suture needles by 70% or more in almost every simulation, adding a second layer of gloves resulted in further reductions of 30% or more.

Second, factors related to the source patient that may be associated with subsequent transmission and sero-conversion in the HCW include the patient’s clinical status or stage of HIV-related disease and whether the patient is receiving antiretroviral therapy, both of which in turn may affect the titer of circulating virus. Some data suggest that antiretroviral therapy can decrease the risk of sexual or perinatal HIV transmission; such therapy may influence the risk of transmission through other routes, such as percutaneous injection.

Third, the HCW's susceptibility to infection may be affected by the use of barriers, such as gloves, which may reduce the amount of inoculum, and post-exposure treatment, including the use of zidovudine. However, several reported failures of zidovudine to prevent HIV infection in HCWs following an occupational exposure to HIV-infected blood suggest that if zidovudine is protective, such protection is not absolute. (see table below)

**Table 1**

*Potential Risk Factors for Seroconversion Following Pericutaneous Injury*

1. Interval between needle use and exposure
2. Depth or severity of exposure
3. Quantity of blood injected
4. Bore of needle
5. Source Patient
6. Clinical status
7. Titer of circulating virus
8. Use of antiretroviral agents
9. Health care worker
10. Use of barriers
11. Postexposure management
More recently, Cardo et al.\textsuperscript{16} conducted a retrospective case control analysis of 33 HCWs who
occasionally acquired HIV infection following percutaneous exposure to HIV-infected blood
and 679 HCWs who did not seroconvert after a similar exposure. Preliminary analysis identified
several potential risk factors that were statistically significant, including a "deep" injury, visible
blood on the device causing the injury, injury by a device used to draw blood or used for vascular
access, a source patient in the terminal stage of AIDS, and the lack of postexposure use of
zidovudine. For needlestick injuries, injury with a large-gauge hollow needle was also a
significant risk factor. Ippolito et al.\textsuperscript{21} also followed up nearly 1500 HCWs who suffered exposure
to HIV-infected blood.
Controls:

At source:

Warning labels need to be affixed to containers of regulated waste, refrigerators and freezers containing blood or other potentially infectious material; and other containers used to store, transport, or ship blood or other potentially infectious materials.

These labels are fluorescent orange, red, or orange-red, and they can be easily produced by institutions. Bags used to dispose of regulated waste must be red or orange-red, and they, too, must have the biohazard symbol clearly visible upon them. Regulated waste should be double-bagged to guard against the possibility of leakage if the first bag is punctured.

Regulated waste refers to:

- Any liquid or semi-liquid blood or other potentially infectious material
- Contaminated items that would release blood or other potentially infectious materials in a liquid or semi-liquid state if compressed
- Items that are coated with dried blood or other potentially infectious materials and are capable of releasing these materials during handling
- Contaminated sharps
- Pathological and microbiological wastes containing blood or other potentially infectious materials

All regulated waste must be disposed of in properly labeled containers or red biohazard bags. These must be disposed of at an approved facility. In India the waste is taken by workers belonging to civic bodies and taken to an approved incineration/disposal facility.

Non-regulated waste (i.e. does not fit the definition of regulated waste provided above) that is not generated by a medical facility or human health-related research laboratory may be disposed of in regular plastic trash bags if it has been decontaminated or autoclaved prior to disposal.

However, all bags containing such materials must be labeled, signed, and dated, certifying that the materials inside have been decontaminated or autoclaved and pose no health threat. Pre-printed labels designed for this purpose can be easily made, and they must be placed on the bag so that they are readily visible.

Workers and housekeepers will not remove bags containing any form of blood (human or animal), vials containing blood, bodily fluids, bodily fluids, exchanges, or hazardous waste, etc. from laboratories unless the bag has one of these labels on it. They have to be given very strict instructions not to handle any non-regulated waste unless it has been properly marked and labeled (including signature).

Workers will not handle regulated waste (unless trained and segregated)

For more information on this as it pertains to laboratories, check our Bio-Safety Manuals.

Personal Protective Equipment (PPE):

It is extremely important to use personal protective equipment and work practice controls to protect yourself from bloodborne pathogens. It is best for nurses and attendants to wear gloves while collecting blood samples, starting IV infusions, giving injections, and changing bed sheets.
“Universal Precautions” (see also pg.22) is the name used to describe a prevention strategy in which all blood and potentially infectious materials are treated as if they are, in fact, infectious, regardless of the perceived status of the source individual. In other words, whether or not you think the blood/body fluid is infected with bloodborne pathogens, you treat it as if it is. This approach is used in all situations where exposure to blood or potentially infectious materials is possible. This also means that work practice controls shall always be utilized in situations where exposure may occur.

**Personal Protective Equipment:**

Probably the first thing to do in any situation where you may be exposed to bloodborne pathogens is to ensure you are wearing the appropriate personal protective equipment (PPE). For example, you may have noticed that emergency medical personnel, doctors, nurses, dentists, dental assistants, and other health care professionals always wear latex or protective gloves. This is a simple precaution they take in order to prevent blood or potentially infectious body fluids from coming in contact with their skin. To protect yourself, it is essential to have a barrier between you and the potentially infectious material.

Rules to follow:

- Always wear personal protective equipment in exposure situations.
- Remove PPE that is torn or punctured, or has lost its ability to function as a barrier to bloodborne pathogens.
- Replace PPE that is torn or punctured.
- Remove PPE before leaving the work area.

If you work in an area where exposure to blood or potentially infectious materials is routinely possible, the necessary PPE should be readily accessible.

Contaminated gloves, clothing, PPE, or other materials should be placed in appropriately labeled bags or containers until it is disposed of, decontaminated, or laundered. It is important to find out where these bags or containers are located in your area before beginning your work.

**Gloves**

(see also Table 2 in pg. 7)

Gloves should be made of latex, nitrile, rubber, or other water impermeable materials. If glove material is thin or thinny, double gloving can provide an additional layer of protection. Also, if you know you have cuts or nicks on your hands, you should cover these with a bandage or similar protection as an additional precaution before donning your gloves. You should always inspect your gloves for tears or punctures before putting them on. If a glove is damaged, don’t use it. When taking contaminated gloves off, do so carefully. Make sure you don’t touch the outside of the gloves with any bare skin, and be sure to dispose of them in a proper container so that no one else will come in contact with them, either.

**Always check your gloves for damage before using them.**

(see table below)
Table 2

- **VOLUME OF BLOOD TRANSFERRED BY PHLEBOTOMY AND SUTURE NEEDLES IN LABORATORY SIMULATIONS**

<table>
<thead>
<tr>
<th>Author</th>
<th>Depth of Penetration</th>
<th>Size</th>
<th>Needle type</th>
<th>Diameter (mm)</th>
<th>Mean Blood Volume (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matt et al</td>
<td>0.5 cm</td>
<td>18-G</td>
<td>Hollow</td>
<td>0.37</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22-G</td>
<td>Hollow</td>
<td>0.72</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25-G</td>
<td>Hollow</td>
<td>0.85</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**Goggles:**

Anytime there is a risk of splashing or vaporization of contaminated fluids, goggles and/or other eye protection should be used to protect your eyes. Again, bloodborne pathogens can be transmitted through the thin membranes of the eyes so it is important to protect them. Splashing could occur while cleaning up a spill, during laboratory procedures, or while providing first aid or medical assistance.

**Face Shields:**

Face shields may be worn in addition to goggles to provide additional eye protection. A face shield will protect against splashes to the nose and mouth. They may be used during laboratory and delivery-related procedures.

**Aprons:**

Aprons may be worn to protect your clothing and to keep blood or other contaminated fluids from soaking through to your skin. Normal clothing that becomes contaminated with blood should be removed as soon as possible because fluids can seep through the cloth to come into contact with skin. Contaminated laundry should be handled as little as possible, and it should be placed in an appropriately labeled bag or container until it is decontaminated, disposed of, or laundered.

**Footwear:**

Footwear that covers your feet completely, can be worn in places like trauma wards, operating theaters, mortuaries, etc.

Remember to use universal precautions and treat all blood or potentially infectious body fluids as if they are contaminated. Avoid contact whenever possible, and whenever it’s not possible to avoid contact, wear personal protective equipment. If you find yourself in a situation where you have to come in contact with blood or other body fluid and you don’t have any standard personal protective equipment handy, you can improvise like a glove, plastic bag, or some other barrier to help avoid direct contact.

**Hygiene Practices:**

Handwashing is one of the most important and easiest practices used to prevent transmission of bloodborne pathogens. Hands or other exposed skin should be thoroughly washed as soon as possible following an exposure incident. Use soap and water or alcohol-based hand sanitizer if available. Avoid harsh, abrasive soaps, as these may open fragile skin or other areas.

Hands should also be washed immediately (or as soon as feasible) after removal of gloves or
other personal protective equipment. Because hand washing is so important, you should familiarize
yourself with the location of the hand washing facilities nearest to you.

Laboratory sinks, public restrooms, janitor closets, and so forth may be used for
hand washing if they are normally supplied with soap. If you are working in an area without
access to such facilities, you may use an antiseptic cleanser in conjunction with clean
dish/paper towels or antiseptic wipes. If these alternative methods are used, hands
should be washed with soap and running water as soon as feasible. If you are working in an
area where there is reasonable likelihood of exposure, you should never:

- Eat
- Drink
- Smoke
- Apply cosmetics or lip balm
- Handle contact lenses

No food or drink should be kept in refrigerators, freezers, shelves, cabinets, or
on counter tops where blood or potentially infectious materials are present.

You should also try to minimize the amount of splashing, spraying, splattering, and
generation of droplets when performing any procedures involving blood or potentially
infectious materials, and you should NEVER pipette or suction these materials by
mouth.

Decontamination and Sterilization:

All surfaces, tools, equipment and other objects that come in contact with blood or potentially
infectious materials must be decontaminated and sterilized as soon as possible. Equipment and
tools must be cleaned and decontaminated before servicing or being put back to use.

Decontamination should be accomplished by using:

- A solution of 5.25% sodium hypochlorite (household bleach/Clorox) diluted with water to
  make a 1% solution.
- Lysol or some other virucidal disinfectant

Check the label of all disinfectants to make sure they meet the requirement, i.e.
destruction of HIV virus and mycobacteria (TB).

If you are cleaning up a spill of blood, you can carefully cover the spill with paper towels or rags,
then gently pour your 1% solution of sodium hypochlorite over the towels or rags, and leave it
for at least 10 minutes.

This will help ensure that the bloodborne pathogens are killed before you actually begin cleaning
or wiping the material up. By covering the spill with paper towels or rags, you decrease the
chances of causing a splash when you pour the bleach on it.

If you are decontaminating equipment or other objects like it scalpels, microscope slides, broken
glasses, saw blades, tweezers, mechanical equipment upon which someone has been cut, first aid
boxes, or whatever) you should leave your disinfectant in place for at least 10 minutes before
completing the cleaning process.

Of course, any materials you use to clean up a spill of blood or potentially infectious materials
must be decontaminated immediately, as well. This would include mops, sponges, re-usable
gloves, buckets, pails, etc. Sharp. Far too frequently, housekeepers, custodians and others are punctured or cut by improperly disposed needles and broken glass. This, of course, exposes them to whatever infectious material may have been on the glass or needle. For this reason, it is especially important to handle and dispose of all sharps carefully in order to protect yourself as well as others.

**Needles:**

- Needles or other sharps should not be bent, recapped, or moved except as noted below.
  - Needles may be recapped only by using a mechanical device.
  - Needles should be moved only by using a mechanical device or tool such as forceps, pincers, or broom and dust pan.
- Never break or shear needles.
- Needles shall be disposed of in labeled sharps containers only.
  - Sharps containers shall be cloche, puncture-resistant, leak-proof on sides and bottom, and must be labeled or color-coded.
  - When sharps containers are being moved from the area of use, the containers should be closed immediately before removal or replacement to prevent spillage or protrusion of contents during handling or transport.

**Broken Glassware:**

- Broken glassware that has been visibly contaminated with blood must be sterilized with an approved disinfectant solution before it is disturbed or cleaned up.
- Glassware that has been decontaminated may be disposed of in an appropriate sharps container, i.e. cloche, puncture-resistant, leak-proof on sides and bottom, with appropriate labels.
- Broken glassware will not be picked up directly with the hands.
  - Sweep or brush the material into a dustpan.
- Uncleaned, broken glassware may be disposed of in a cloche, puncture-resistant container such as a cardboard box or coffee can.

By using Universal Precautions and following these simple work practice controls, you can protect yourself and prevent transmission of bloodborne pathogens.
The negative aspects of using specific kinds of PPE (like plastic aprons, face shields, etc.) to reduce blood exposure must also be considered. The most important negative aspect for most surgeons is the loss of comfort that comes with wearing impervious or almost impervious garments. As already stated, the risk of acquiring and HIV infection in the operating room is extremely low, and we may be overreacting by going to some of these extremes to prevent conscious blood exposure. There is little doubt that continued use of these garments has helped to fuel the hysteria that is prevalent in many operating rooms and leaves our colleagues believing that we are all in grave danger of acquiring HIV infection during surgery. Again, although the risk of acquiring and HIV infection is extremely small, any maneuvers used to avoid exposure to the hepatitis A or C viruses are highly recommended. Many of these garments are costly, and many have questioned whether the additional expense is justifiable.

The groups of individuals at greatest risk for blood exposure in uncontrolled or emergent circumstances are as follows for whom PPE is a must:

- Trauma surgeons
- Operating room personnel
- Intensive care unit personnel
- Emergency medicine physicians and nurses
- Labour room and neonatal unit
- Dialysis nurses and technicians
- EMTs and paramedics
- Police and firefighters
- Some laboratory personnel
- Mortuary attendants
- First-aid workers in road accidents and railways.

Of course, any barrier that reduces a surgeon's exposure to blood contamination also reduces the chance that his skin bacteria will contaminate a patient's wound, and that should lead to a decrease wound infection rate during clean procedures.
Epidemiology of Injuries by Needles and Other Sharp Instruments

Who is Being Injured? 19
(see also Table 8 pg. 29)

Injury epidemiology can help delineate the personnel in surgical and obstetric settings who are at greatest risk for injury. In a study to identify risk factors for percutaneous injury during surgery, Tolins and colleagues observed 1982 orthopedic, general surgery, gastrology, trauma, and cardiac procedures, in areas of high AIDS incidence in the United States. At least one percutaneous injury occurred during 6.9% of these procedures (39 total injuries). Resident and attending surgeons had the highest rates (2.7 and 2.3 per 100 person-procedures, respectively) of injury, other personnel in the operating room were less likely to be injured.

When and Where Do Injuries Occur? 19

To target prevention strategies, it is important to assess the risk of percutaneous injury according to procedure. In the Tolins et al study, the rate of injury ranged from 4% in orthopedic procedures to 10% in gynecologic procedures. Within a specialty, rates of injury also varied; the rate in abdominal hysterectomies was 10%, whereas the rate for vaginal hysterectomies was 21%. Other studies have also found procedure-specific differences in rates of injury. For example, in a study of 664 vaginal and 181 cesarean deliveries, the rate of percutaneous injury in HCs during cesarean sections, 3.5%, was higher than the rate during vaginal deliveries, 0.8%. Gynecology data showed that personnel sustained one or more percutaneous injuries during 7% (61/832) of procedures (64 total injuries). Procedure-specific rates of percutaneous injury ranged from 5% (8/144) in vaginal hysterectomies to 9% (29/295) in abdominal hysterectomies, to 12% (17/143) in myomectomies. In another study across several specialties, the highest rate of injury was found in trauma surgery, 9.3% (10/108), plastic surgery, 5% (6/120), and obstetrics and gynecology, 7.4% (14/188).

Table 3: Showing Injuries sustained in procedures (various) and depts.

<table>
<thead>
<tr>
<th>Dept/Procedures</th>
<th>Number</th>
<th>Total Cases</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trauma</td>
<td>10</td>
<td>10.5</td>
<td>9.5%</td>
</tr>
<tr>
<td>Hysteric surg</td>
<td>6</td>
<td>55</td>
<td>9%</td>
</tr>
<tr>
<td>OB/GY</td>
<td>14</td>
<td>189</td>
<td>7.4%</td>
</tr>
<tr>
<td>Vaginal Hysterectomy</td>
<td>8</td>
<td>174</td>
<td>5%</td>
</tr>
<tr>
<td>Abdominal Hysterectomy</td>
<td>25</td>
<td>295</td>
<td>9%</td>
</tr>
<tr>
<td>Myomectomy</td>
<td>17</td>
<td>143</td>
<td>12%</td>
</tr>
<tr>
<td>Caesarian</td>
<td></td>
<td></td>
<td>3.3%</td>
</tr>
</tbody>
</table>

How Are Injuries Occurring?

Intensive of specialty or procedures performed, most percutaneous injuries in operative and delivery room settings are caused by sharps needles. Blunt tip needles are now available that may reduce the likelihood of sharps related injuries. Other objects that cause percutaneous injuries
include scalpels, electrocutenary instruments, hollow bone needles, and occasionally retractors, wires, bone fragments, suture thread, and other specialty-specific equipment.

**SAFETY WITH SHARP INSTRUMENTS:**

When sharp instruments must be used, operating room personnel should take certain precautions. Scalpels and sharp needles should not be left exposed on the operative field but should be removed promptly by the scrub nurse. A surgeon or nurse who places a sharp instrument on the field should announce that fact aloud. Scalpels should ideally be passed in a pan rather than directly. Nurses may make direct passes of sharp instruments (they are educated to do so), but physicians should not (unless they are trained). There currently is no indication for the use of wire sutures in abdominoplasty procedures. Tygge, made frequently causes lacerations and punctures. Furthermore, the sharp cut ends of the sutures stick in the body to increase the next surgeon to operate. The use of wire in abdominal operations should be abandoned. Thick monofilament sutures made of polymers such as polyglycolic (Monocryl), polyglycolic acid (PGA), nylon (Nougin), and polypropylene (Prolene) incite minimal tissue reaction and retain their tensile strength for sufficient time to permit wound healing. These provide a satisfactory alternative to wire even in patients at highest risk for abdominal wound dehiscence.

When using sharp needles, surgeons should observe three precautions. First, they should grasp the needle with the instrument in the needle holder. Second, they should avoid passing the needle toward the dominating hand or toward an assistant’s hand. Surgeons often strike tissue manually or have an assistant do so. They may then have to insert the suturing hand and frequently such it. The necessary retraction can inadvertently be obtained with retractors, sponge sticks, or hypotensive packs. Finally, when sowing at a bloody field, surgeons should not grasp for a sharp needle to identify its location. It is common for an obstetrician to repair prolapsed bleeding vaginal or cervical amn. When a needle is sewn through tissue, the tip sometimes is covered in a pool of blood. This is an ideal circumstance to use blunt needles; if sharp needles are chosen, the needle tip should be identified by visualization, achieved if necessary by suction of the blood. Attempts to palpate the needle tip are likely to result in puncture injury. This is especially true during vaginal hysterectomy, which is associated with a permanent injury rate for the surgeon of 21%. Such bleeding that occludes a needle tip may also occur deep in the pelvis during difficult procedures such as those for endometrial or ovarian cancer.

There must be a continuous training program on safety in the operating theater.

**Exposure to body fluids:**

Lab technicians should use autopsies for drawing samples.

In an emergency situation involving blood or potentially infectious materials, you should always use Universal Precautions and try to minimize your exposure by wearing gloves, splash goggles, pocket mouth-to-mouth resuscitation mask, and other barrier devices.

If you are exposed, however, you should:

1. Wash the exposed area thoroughly with soap and running water. Use non-irritating, antibacterial soap if possible.
   - If blood is splashed in the eye or mucous membranes, flush the affected area with running water for at least 15 minutes.
2. Report the exposure to your supervisor as soon as possible.
3. Fill out the exposure report form, if you desire. This form can be kept in your personnel file for 40 years so that you can document workplace exposure to hazardous substances.
This report can be made available from your supervisor.

4. You may also request blood testing or the Hepatitis B vaccination if you have not already received it.

There should be a specific set of procedures they will have to be followed for all post-exposure cases. These are:

- Document the route(s) of exposure and the circumstances under which the exposure incident occurred.

- Identify and document the source individual unless such documentation is impossible or prohibited by law.

- Test the source individual’s blood for HBV and HIV as soon as possible after consent is obtained. If the source individual is known to be seropositive for HBV or HIV, testing for that virus need not be done.

- Collect your blood as soon feasible, and test it after your consent is obtained.

  + If you consent to baseline blood collection, but do not give consent at that time for HIV serological testing, your blood sample will be kept for at least 90 days. If, within 90 days of the incident, you decide to consent to have the baseline sample tested, such testing shall be done as soon as possible, and at no cost to you.

- Administer post exposure prophylaxis, when medically indicated, as per standard recommendations. (see below)

- Provide counseling.

- Evaluate reported illnesses.

  Apart from the circumstances surrounding the exposure itself, all other findings or diagnoses should be kept confidential.
**MANAGEMENT OF NEEDLE STICK INJURY:**

Recommendations for hepatitis B prophylaxis following percutaneous exposure.

<table>
<thead>
<tr>
<th>Source</th>
<th>Unvaccinated</th>
<th>Exposed Person</th>
<th>Vaccinated</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBsAg-positive</td>
<td>1. HBIG once immediately.</td>
<td>1. Test exposed person for anti-HBs.</td>
<td>1. Test exposed person for anti-HBs.</td>
</tr>
<tr>
<td></td>
<td>2. Initiate HB vaccine series.</td>
<td>If inadequate antibody, give HBIG once immediately plus HB vaccine booster dose.</td>
<td></td>
</tr>
</tbody>
</table>

| Unknown source or high risk HBsAg-positive or low risk source | 1. Initiate HB vaccine series. | 1. Test source for HBsAg only. If exposed person is vaccine nonresponder, if source is HBsAg positive, give HBIG once immediately plus HB vaccine booster dose. |
| Low risk source | 2. Test source for HBsAg. If positive, HBIG once. | |

---


2. HBIG dose 0.06 mL/kg, IM

3. HB vaccine dose 20 µg, IM for adults, 10 µg, IM for infants or children under 10 years of age. First dose within 1 week, second and third doses, 1 and 6 months later.
PREVENTION OF HEPATITIS B VIRUS INFECTION AMONG HEALTH-CARE WORKERS

The most important approach for the prevention of occupational HBV infection is use of hepatitis B vaccine among HCWs at risk. Hepatitis B vaccine has been available since 1981. These vaccines are very safe and highly effective in preventing HBV infection. More than 90% of recipient of the vaccine respond with protective levels of antibody, and adults who respond are completely protected from clinical disease and chronic infection. Ongoing studies of cohorts vaccinated in the early 1980's indicated that the duration of protection is at least 13 years; booster doses of hepatitis B vaccine and testing to determine antibody persistence are not routinely recommended.

Since its introduction, the hepatitis B vaccine has been recommended for HCWs with frequent blood or needle exposure, preferably with vaccination occurring during training or early in their careers. However, implementation of this recommendation has been incomplete owing to the relatively high cost of the vaccine and to inaccurate perceptions among some HCWs that they are not at risk for HBV infection and therefore would not benefit from the vaccine. In 1994, the Occupational Safety and Health Administration (OSHA) issued the bloodborne standard that requires employers to offer hepatitis B vaccine to all employees with reasonably anticipated contact with blood or other potentially infectious materials, at no cost to the employee.

Additional measures to prevent HBV infection among HCWs, include (1) use of barrier precautions such as gloves, gowns, masks, and protective eyewear, when indicated; (2) proper handling and disposal of needles and other sharp instruments; (3) evaluation of the need for postexposure prophylaxis for HCWs who are exposed to HBsAg-positive material; and (4) appropriate disinfection and sterilization of surface and instruments.

Employees who have routine exposure to bloodborne pathogens (such as doctors, nurses, first aid responders, etc.) shall be offered the Hepatitis B vaccine series at no cost to themselves unless:

- They have previously received the vaccine series
- Antibody testing has revealed they are immune
- The vaccine is contraindicated for medical reasons

In these cases, they need not be offered the series.

Although the vaccine must be offered to you by your employer, you do not have to accept that offer. You may opt to decline the vaccination series, in which case you will be asked to sign a declination form.

Even if you decline the initial offer, you may choose to receive the series at anytime during your employment; however, for example, if you are exposed on the job at a later date.

As stated in the previous section, if you are exposed to blood or potentially infectious materials at work, you may request a Hepatitis B vaccination at that time. If the vaccine is administered immediately after exposure it is extremely effective (see
management of needle stick injury) at preventing the disease.

The Hepatitis B vaccination is given in a series of three shots. The second shot is given one month after the first, and the third shot follows five months after the second. This series gradually builds up the body's immunity to the Hepatitis B virus.

The vaccine itself is made from yeast cultures; there is no danger of contracting the disease from getting the shots, and, once vaccinated, a person does not need to receive the series again. There are booster shots available, however, and in some instances these may be recommended (for example, if there is an outbreak of Hepatitis B at a particular location).

PREVENTION OF HEPATITIS C VIRUS INFECTION AMONG HEALTH-CARE WORKERS

The high rate of persistent viemrta in patients with HCV infection, along with studies in chimpanzees infection after rechallenge with homologous virus, suggests that HCV infection does not result in the development of protective antibodies. Neither immunoglobulin (IG) made from screened plasma nor (IG) made from anti-HCV-positive plasma protects chimpanzees from experimental HCV infection. Effective HCV vaccines are not going to be available until quite some time from now. Consequently, preventive measures including barrier precautions and measures to protect against needlesticks are currently the mainstay for protection of HCWs against HCV infection.
HEPATITIS B AND HEPATITIS C VIRUS

Viral hepatitis is caused by at least five distinct viruses, referred to as hepatitis A, B, C, D, and E viruses. Hepatitis B virus (HBV) and Hepatitis C virus (HCV) are transmitted primarily by percutaneous exposures to blood and by sexual contact; hepatitis D virus (HDV) also is transmitted through these routes, but only to persons who are infected with HBV. HBV, HCV, and HDV can also cause chronic infection. Hepatitis A virus and hepatitis E virus are transmitted through the feco-oral route; neither virus results in chronic infection. Health-care workers (HCWs) have long been recognized to be at risk for HBV infection through occupational exposure to blood and blood-contaminated objects. Because HCV was discovered only in the last few years, only recently have data been accumulated that address the risk of HCV infection among HCWs.

EPIDEMIOLOGY OF HEPATITIS B VIRUS INFECTION:
(see also Table 4 in Pg.18)

HBV is a DNA virus and consists of an internal core of DNA and a protein (hepatitis B core antigen), and is surrounded by a coat of lipid and protein (hepatitis B surface antigen [HBsAg]). When a person is exposed to HBV, the virus enters the bloodstream and reaches the liver, which is the site of infection and viral replication. The incubation period (the time between exposure to the virus and onset of illness) ranges from 2 to 6 months and averages 4 months. Not all persons with acute infection are symptomatic; in 35% to 50% of adults and less than 10% of children, acute infection produces typical illness, consisting of variable symptoms and signs of jaundice, hyperbilirubinemia, fever, nausea, abdominal pain, pruritus, anorexia, anorexia, and other nonspecific symptoms. A small percentage (1%) of persons with acute HBV infection die from fulminant liver failure during their acute illness.

After acute HBV infection, the outcome of infection can follow one of two courses. Most (90% to 95%) infection in adults are self-limited; symptoms last for several weeks, and infected persons clear the virus from their bodies and have lifelong immunity to reinfection. Between 5% and 10% of persons, however, develop chronic infection with the virus. Such persons generally remain infected for their entire lives and can be identified by being persistently serologically positive for HBsAg. Some persons remain asymptomatic with chronic infection; for others, however, continued replication of the virus can result in prolonged hepatic inflammation, with subsequent chronic persistent or active hepatitis and liver cirrhosis. Persons with chronic HBV infection are also at high risk for hepatocellular carcinoma. Persons with chronic HBV infection have an estimated 20% lifetime risk of dying of cirrhosis and 6% risk of dying of hepatocellular carcinoma (see below).

Table 4

Estimates of Hepatitis B Virus (HBV) Disease Consequences in Health-Care Workers (HCWs) 1994

<table>
<thead>
<tr>
<th>Disease Consequence</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total HBV infections in the United States</td>
<td>236,000</td>
</tr>
<tr>
<td>HBV infections at high-risk HCWs</td>
<td>1012</td>
</tr>
<tr>
<td>Acute consequences</td>
<td></td>
</tr>
<tr>
<td>Clinical hepatitis</td>
<td>250</td>
</tr>
<tr>
<td>Fulminant death</td>
<td>1</td>
</tr>
<tr>
<td>Chronic consequences</td>
<td></td>
</tr>
<tr>
<td>HBV carrier</td>
<td>50</td>
</tr>
<tr>
<td>Chronic hepatitis</td>
<td>15</td>
</tr>
<tr>
<td>Death - cirrhosis</td>
<td>17</td>
</tr>
<tr>
<td>Hepatocellular carcinoma</td>
<td>4</td>
</tr>
</tbody>
</table>
In acutely and chemically infected persons who are positive for hepatitis antigen (HBeAg) (a serologic marker associated with higher circulating viral titers), the concentration of circulating HBV particles in blood is approximately 10^6 to 10^7 particles per milliliter. Other body fluids in which the virus is present, although in much lower concentrations, are semen, saliva, vaginal fluid, and serum exudates. The presence and titers of the virus in blood and various body fluids determine the routes of transmission from person to person and the risk of transmission after exposure. The most efficient route of transmission is by percutaneous exposure to blood. The risk of transmission is at least 30% after a needlestick exposure with blood from an HBeAg-positive source. The risk of transmission from HBeAg-negative blood is less than 0.1%. Blood or body fluid exposure of mucous membranes, unbroken skin, and other surface such as the cornea can also result in transmission. Transmission by saliva has been documented only after an injection (e.g., bite) and not by ingestion.

HBV is relatively stable on environmental surfaces. The Hepatitis B virus is very durable, and it can survive in dried blood for up to seven days. For this reason, this virus is the primary concern for employees such as housekeepers, custodians, laundry personnel, and other employees who may come in contact with blood or potentially infectious materials in a non-health-care or medical care situation. Therefore, another route of transmission is indirect—person-to-person transmission through contamination of environmental surfaces. This is an important route in hemodiagnosis centers, where the potential for environmental blood contamination is high. The prevalence rate of Hepatitis B in India is 4.7%.

**Occupational risk of Hepatitis B**

The prevalence among surgeons has ranged from 13% to 18%, and among dentists and oral surgeons from 12% to 27%.* In the United States, approximately 300,000 people are infected with HBV annually. The prevalence rate in India is 4.7%.

The risk to HCWs of acquiring occupationally related HBV infection has been shown to be related to several factors. The degree of exposure to blood, body fluids, or blood-contaminated sharps such as needles and other medical instruments and the duration of employment in an occupational category with frequent blood or needle exposure are directly associated with risk of HBV infection. For example, in a large seroprevalence study conducted at five hospitals in different parts of the United States, HCWs with frequent blood contact or with frequent reported needlesticks had an approximately twofold higher prevalence of HBV infection than did other HCWs. Occupational groups with a higher risk of infection included attending physicians and surgeons, medical and surgical house officers, laboratory technicians, blood bank workers, nurses in surgery and pathology, and anesthesia. Groups with a lower risk of infection (who may have had much patient contact but few blood or needlestick exposures) included clerks, pharmacists, social workers, dieticians, and food service personnel. Other studies have shown that among physicians and dentists, those in specialties with more frequent blood or needlestick exposures (e.g., obstetrician-gynecologists, anesthesiologists, pathologists, oral surgeons) have significantly elevated risk compared with those in specialties such as pediatrics or psychiatry.

An additional risk factor for acquisition of HBV infection in HCWs is the underlying prevalence of HBV infection in the patient population. Patients who are infected with HBV are the source of exposure for HCWs. Only a small percentage of hospitalized patients are hospitalized for acute hepatitis. Acute and chronic infection in most patients is unrecognized. Several studies have shown that the risk of infection to HCWs is greater in urban hospitals (compared with rural hospitals) and tertiary care hospitals (compared with primary care hospitals), each of which would be expected to have a higher percentage of patients in groups at high risk for hepatitis B (e.g., injecting drug users).

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1. HBeAg is a more sensitive indicator of infection and virulence; all HBeAg-positive patients are also positive for HBsAg. Also, HBV DNA test by PCR method also indicates infectivity.
EPIDEMIOLOGY OF HEPATITIS C VIRUS INFECTION

HCV, an RNA virus in the Flavivirus family, is the primary etiologic agent of parenterally transmitted non-A, non-B, (NANB) hepatitis and a major cause of chronic liver disease. HCV was identified in 1989, and since then several generations of serologic tests to detect antibody to HCV (anti-HCV) have been developed. Anti-HCV has been detected with these tests in 70% to 90% of patients with parenterally transmitted NANB hepatitis. Limitations of the anti-HCV test are that (1) approximately 10% of persons with HCV infection (determined by using more sensitive tests, including the polymerase chain reaction [PCR] for HCV genetic material) are not detected by the anti-HCV test; (2) in acute HCV infection, there may be a delay in appearance of anti-HCV after onset of illness; and (3) in seroprevalence studies of low prevalence populations, the false positivity rate is high. No true confirmatory tests exist for anti-HCV, but supplemental tests are available to evaluate screening assay results and should be used in the determination of anti-HCV positivity. Studies have shown an anti-HCV prevalence of 60% to 90% among injection-drug users and hemophiliacs patients, 20% among hemodialysis patients, 10% among non-drug users attending sexually transmitted diseases clinics, and less than 0.5% among voluntary blood donors. The prevalence rate in India is around 1%.

The average incubation period for hepatitis C following a blood transfusion or needlestick is approximately 7 weeks. Of persons with acute HCV infection, 25% or fewer have symptoms of acute hepatitis. However, it is believed that nearly all persons with acute HCV infection develop chronic HCV infection with persistent viroemia. Follow-up studies after HCV infection show that an average of 67% of patients who develop persistent elevated liver enzymes, 25% to 50% develop chronic active hepatitis, and 3% to 20% develop cirrhosis within several years.

The major route of HCV transmission is by exposure to blood. The use of surrogate marker and anti-HCV testing of blood donations has significantly reduced the incidence of HCV transmission via blood transfusions. The risk of HCV transmission after a needlestick contaminated with blood from an anti-HCV positive source has been estimated to be approximately 10% based on results from second-generation tests and PCR used to detect infection among needlestick recipients. Compared with HBV, HCV is relatively fragile, with rapid degradation at room temperature, and therefore environmental transmission is not believed to be important.

OCCUPATIONAL RISK OF HEPATITIS C VIRUS INFECTION

As with HBV infection, expected risk factors for HCV infection among HCWs include the degree of contact with blood or sharp instruments and the prevalence of anti-HCV among patients. For example, a study among New York City dentists, the percentage of professional who have spent practicing oral surgery was directly related to anti-HCV positivity, as might be expected given the high rate of HBV infection among oral surgeons. However, anti-HCV-positive dentist reported nearly 50% fewer needlesticks during the previous 5 years than did anti-HCV-negative dentists. Another study among employees at a community hospital found a history of frequent needlesticks to be independently associated with anti-HCV positivity. Conversely, among orthopaedic surgeons and hospital-based surgeons in several urban areas, no association was observed between anti-HCV status and surgeons' recall of skin, mucous membrane, or percutaneous exposure to blood during the past month or year.

Only the study among New York City dentists used a comparison group. Overall, the dentists had a 12-fold higher anti-HCV prevalence than age-matched blood donors from the same geographic area. Blood donors may not be a proper comparison group, however, because persons who have risk factors for bloodborne infections or who have a history of hepatitis are asked not to donate.

In a large case-control study conducted in the early 1990s (prior to the availability of anti-HCV testing), patients with NANB hepatitis were more likely than controls to be employed as HCWs in direct patient care or hospital laboratory work.
Altogether, because of (1) the relatively high prevalence of HCV infection among patients in some healthcare settings who serve as a source of infection for HCWs and (2) the moderate risk of transmission of needlesticks, it appears that HCWs have an occupational risk of HCV infection. The observed seroprevalence among HCWs indicates that the risk of infection is relatively low, and further studies are needed to better define the risk. These studies will require large numbers of participants, given the relatively low prevalence of infection and the consequent limited power to detect association with occupational exposures. Cohort studies among HCWs to determine the rate of new HCV infection, as conducted, may require prohibitively large numbers of HCWs.

**HUMAN IMMUNODEFICIENCY VIRUS (HIV)**

The emergence of the human immunodeficiency virus (HIV) epidemic has highlighted the need to elucidate the epidemiology of occupational blood contact, estimate the risk of infection following contact with blood from an HIV-infected patient, and develop preventive measures in both surgical and non-surgical settings to protect HCWs from blood contact, particularly percutaneous injuries (e.g., needlesticks or cuts from sharp objects).

Estimates on the number of people infected with HIV vary, but some estimates suggest that an average of 35,000 people are infected every year. By the year 2022, it is possible that 2%-9% of the American population will be infected, or 5 to 15 million people. Many people who are infected with HIV may be completely unaware of it.

In India, the prevalence of HIV is around 1%.

**HIV Seroprevalence Surveys of HCWs**

AIDS and HIV infection surveillance provide a minimum estimate of the number of HCWs in the United States with occupationally acquired HIV infection. Seroprevalence surveys can supplement national surveillance in monitoring HIV infection among HCWs. These surveys are particularly helpful for detecting previously unreported or unsuspected HIV infection. Two cross-sectional seroprevalence surveys have been conducted among surgeons. The first was an anonymous, voluntary HIV serosurvey conducted among 3420 orthopaedic surgeons attending the 1991 annual meeting of the American Academy of Orthopaedic Surgeons. The 3420 participating surgeons, who did not report non-occupational risk factors for HIV, had been in practice an average of 15 years, including an average of nearly 4 years spent in a high AIDS incidence area. Each of these surgeons performed an average of 18 surgical procedures per month. Collectively, they reported performing with many HIV patients during their careers. During the month prior to the serosurvey, these surgeons reported sustaining an average of 0.6 percutaneous injuries (1992 total). Two (0.06%) of the 3420 orthopaedic surgeons tested positive for HIV antibodies, both reported behavioral risk factors for HIV infection.

Seroprevalence surveys have certain limitations. First, the representativeness of occupational blood contact among examined surgeons is unknown. Second, the true seroprevalence may have been underestimated if HIV-infected HCWs did not participate. Finally, HIV-infected HCWs may have been misclassified as having occupationally acquired HIV infection if other occupational risk factors were present but not reported. Nonetheless, the findings of numerous HIV seroprevalence surveys among HCWs have been remarkably consistent in that a high rate of previously unreported or unsuspected HIV infection has not been found, in contrast to earlier HIV serosociologic studies.

In India, the first 2 cases of occupationally acquired HIV infection have been reported in a major medical college hospital. There have been reports of many cases of occupationally acquired HIV infection in reports published abroad (see Table 5 in Fig 27).

Window period:

Personal communication
**Table 5**

Health care workers (HCWs) with documented and possible occupationally acquired AIDS-HIV infection, by occupation, reported through September 1993, United States

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Documented Occupational Transmission</th>
<th>Possible Occupational Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental workers, including dentists</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Embalmer/morgue technician</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency medical personnel</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Health aide/attendant</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Housekeeper/maintenance worker</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Laboratory technician, clinical</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Laboratory technician, nonclinical</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>Laboratory technician, nonclinical</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Nurse</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>Physician, nonsurgical</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Physician, surgical</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Respiratory therapist</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Technician, dialysis</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Technician, surgical</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Technician/therapist, other than above</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Other health-care occupations</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>59</td>
<td>81</td>
</tr>
</tbody>
</table>

Table 6

- HIV Seroprevalence in selected groups of health care workers (HCWs)

<table>
<thead>
<tr>
<th>Author</th>
<th>Worker Group</th>
<th>No. Tested</th>
<th>No. HIV Positive (%)</th>
<th>Prevalence Excluding HCWs with Known Risks (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pandian et al</td>
<td>Surgeons high AIDS lesion</td>
<td>730</td>
<td>1 (0.13)</td>
<td>0.14</td>
</tr>
<tr>
<td>Klein et al</td>
<td>Dentists-1986 ADA meeting and New York City</td>
<td>1145</td>
<td>4 (0.04)</td>
<td>0.09</td>
</tr>
<tr>
<td>Gouininger et al</td>
<td>Dentists-1988 ADA meeting</td>
<td>1165</td>
<td>1 (0.09)</td>
<td>0.09</td>
</tr>
</tbody>
</table>

ADA = American Dental Association
<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Setting</th>
<th>Location</th>
<th>No. Tested</th>
<th>No. HIV Positive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kelen et al</td>
<td>1987</td>
<td>Emergency department</td>
<td>Baltimore</td>
<td>2,302</td>
<td>199 (8.2)</td>
</tr>
<tr>
<td>Kelen et al</td>
<td>1988</td>
<td>Emergency department</td>
<td>Baltimore</td>
<td>25,544</td>
<td>152 (6.0)</td>
</tr>
<tr>
<td>Sodestrom et al</td>
<td>1987-88</td>
<td>Trauma Centre</td>
<td>Maryland</td>
<td>1,477</td>
<td>25 (1.7)</td>
</tr>
<tr>
<td>Marcus et al</td>
<td>1989</td>
<td>Emergency department</td>
<td>high AIDS</td>
<td>20,382</td>
<td>4.1 (10/250)</td>
</tr>
<tr>
<td>Chameche et al</td>
<td>1989</td>
<td>Elective surgery</td>
<td>Baltimore</td>
<td>4,087</td>
<td>15 (0.4)</td>
</tr>
<tr>
<td>Montecello et al</td>
<td>1992</td>
<td>Surgery/Obstetrics</td>
<td>Westchester</td>
<td>1,056</td>
<td>15 (1.4)</td>
</tr>
<tr>
<td>Katchinski et al</td>
<td>1986-87</td>
<td>Cord Blood</td>
<td>New York City</td>
<td>1,192</td>
<td>28 (2.3)</td>
</tr>
<tr>
<td>Donelan et al</td>
<td>1987-90</td>
<td>Cord Blood</td>
<td>Boston</td>
<td>3,845</td>
<td>93 (2.4)</td>
</tr>
</tbody>
</table>
**Table 8**

**Estimated Annual Frequency of Blood Contact in Surgical Workers**

<table>
<thead>
<tr>
<th>Author</th>
<th>Occupation</th>
<th>No. of Blood Contacts per Year*</th>
<th>No. of Sharp injuries per year*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Takacs et al</td>
<td>Surgeon</td>
<td>81-135</td>
<td>8-13</td>
</tr>
<tr>
<td></td>
<td>Scrub assistant</td>
<td>7-12</td>
<td>0.6-1.0</td>
</tr>
<tr>
<td>Pavlik et al</td>
<td>Obstetrician</td>
<td>77</td>
<td>4</td>
</tr>
<tr>
<td>Pavlik et al</td>
<td>Midwife</td>
<td>188$</td>
<td>7§</td>
</tr>
<tr>
<td>Pavlic et al</td>
<td>Scrub person</td>
<td>76#</td>
<td>NA</td>
</tr>
<tr>
<td>Robert et al</td>
<td>Gynecologist</td>
<td>124</td>
<td>14</td>
</tr>
</tbody>
</table>

- Based on observed rates of blood contact during surgical procedures
- Includes percutaneous, mucous membrane, or skin contact
- Includes general, orthopedic, cardiac, and trauma surgeons
- $ During vaginal deliveries only
- # During cesarean deliveries only
Post-Exposure prophylaxis (PEP) for HIV.

**Rationale for PEP:**

In a recent analysis of 51 seroconversions in HCWs, the estimated median interval from exposure to seroconversion was 46 days (range: 65 days); an estimated 95% seroconverted within 6 months after the exposure (34). These data suggest that the time course of HIV seroconversion in HCWs is similar to that in other persons who have acquired HIV through occupational modes of transmission.

Three instances of delayed HIV seroconversion occurring in HCWs have been reported; in these instances, the HCWs tested negative for HIV antibodies greater than 6 months postexposure but were seropositive within 12 months after the exposure.

Information about primary HIV infection indicates that systemic infection does not occur immediately, leaving a brief "window of opportunity" during which postexposure antiretroviral intervention may modify viral replication. Data from studies in animal models and in vitro tissue culture studies suggest that dendritic cells in the mucosa and skin are the initial targets of HIV infection or capture and have an important role in initiating HIV infection of CD4+ T-cells in regional lymph nodes. In a primate model of severe immunodeficiency virus (SIV) infection, infection of dendritic-like cells occurred at the site of inoculation during the first 24 hours following mucosal exposure to cell-free virus. During the subsequent 24-48 hours, migration of these cells to regional lymph nodes occurred, and virus was detectable in the peripheral blood within 5 days. HIV replication is rapid (generation time, 2.5 days) and results in bursts of up to 5,000 viral particles from each replicating cell.

The exponential increase in viral burden continues unless controlled by the immune system or other mechanisms (e.g., exhaustion of available target CD4+ T-cells). Theoretically, initiation of antiretroviral PEP soon after exposure may prevent or inhibit systemic infection by limiting the proliferation of virus in the initial target cells or lymph nodes.

There is little information with which to assess the efficacy of PEP in humans. Seroconversion is infrequent after an occupational exposure to HIV-infected blood; therefore, a prospective trial would need to enroll many thousands of exposed HCWs to achieve the statistical power necessary to directly demonstrate PEP efficacy. During 1987-1989, the Durango/Wellcome Company sponsored a prospective placebo-controlled clinical trial among HCWs to evaluate 6 weeks of ZDV prophylaxis; however, this trial was terminated prematurely because of low enrollment.

Because of current indirect evidence of PEP efficacy, it is unlikely that a placebo-controlled trial in HCWs would ever be feasible.

In the retrospective case-control study of HCWs, after controlling for other risk factors for HIV transmission, the risk for HIV infection among HCWs who used ZDV in PEP was reduced by approximately 81% (95% CI: 62%-96%). In addition, in a randomized, controlled, Failure of ZDV PEP to prevent HIV infection in HCWs has been reported in at least 14 studies. Several antiretroviral agents from at least three classes of drugs are available for the treatment of HIV disease. These include the nucleoside analogues reverse transcriptase inhibitors (NRTIs), nonnucleoside reverse transcriptase inhibitors (NNRTIs), and protease inhibitors (PIs) (See Appendix). Among these drugs, ZDV (an NRTI) is the only agent shown to prevent HIV transmission in humans.

There are no data to directly support the addition of other antiretroviral drugs to ZDV to enhance the effectiveness of the PEP regimen. However, in HIV-infected patients, combination regimens have proved superior to monotherapy in reducing HIV viral load.

Thus, theoretically a combination of drugs with activity at different stages in the viral replication cycle (e.g., NRTIs with a PI) could offer an additive preventive effect in PEP, particularly for occupational exposures that pose an increased risk for transmission.

Determining which agents and how many agents to use or when to initiate a PEP regimen is largely empirical. Guidelines for the treatment of early HIV infection recommend the use of three drugs (two NRTIs and a PI); however, the applicability of these recommendations to PEP remains unknown. In addition, the routine use of three drugs for all occupational HIV exposures may not be needed. Although the use of a highly potent regimen can be justified for exposures that pose an increased risk for transmission, it is uncertain whether the potential additional toxicity of a
third drug is justified for lower-risk exposures. For this reason, the recommendations provide guidance for two- and
three-drug PEP regimens that are based on the level of risk for HIV transmission represented by the exposure.

Side Effects and Toxicity of Antiretroviral Agents:

An important goal of PEP is to encourage and facilitate compliance
with a 4-week PEP regimen. Therefore, the toxicity profile of antiretroviral agents, including the frequency, severity,
duration, and reversibility of side effects, is a relevant consideration. All of the antiretroviral agents have been
associated with side effects. However, studies of adverse events have been reported primarily for persons with
advanced disease (or longer treatment courses) and therefore may not reflect the experience of persons with less
advanced disease or those who are uninfected. Side effects associated with many of the NRTIs (e.g., ZDV or ddI)
are generally gastrointestinal (e.g., nausea or diarrhea), and in general the incidence of adverse effects has not been
greater when these agents are used in combination.

All of the approved PI may have potentially serious drug interactions
when used with certain other drugs, requiring careful evaluation of
concomitant medications being used by an HCW before prescribing a PI
and close monitoring for toxicity when an HCW is receiving one of
these drugs. PIs may inhibit the metabolism of neuroleptics and other hepatically metabolized drugs.

NRTIs and nonnucleosides may increase the clearance of certain drugs, including oral contraceptives (requiring alternative
or additional contraceptive measures for women taking these drugs). The use of PIs also has been associated with
new onset of diabetes mellitus, hyperglycemia, diabetic ketoacidosis, and exacerbation of pre-existing diabetes
mellitus. Nephrolithiasis has been associated with IDV use (including in HCWs using the drug for PEP); however,
the incidence of the potential complications may be limited by drinking at least 4-1.5 L of fluid per 24-hour period
(e.g., six 8 oz glasses of water throughout the day). Rare cases of hemolytic anemia also have been associated
with the use of IDV. Nelfinavir, and natafavitin have been associated with the development of diarrhea;
however, this side effect usually responds to treatment with antidiarrheal agents that can be prescribed for use, if
necessary, at the time any one of these drugs is prescribed for PEP. The manufacturer’s package insert should always
be consulted for questions about potential drug interactions.

Among HCWs receiving ZDV PEP, usually at doses of 1,000-1,200 mg per day (i.e., higher than the currently
recommended dose), 50%-85% reported one or more subjective complaints and approximately 30% discontinued
the drug because of symptoms. Common symptoms included nausea, vomiting, malaise or fatigue, headache, or
insomnia.

Mild decreases in hemoglobin and absolute neutrophil count also were observed. All side effects were reversed when
PEP was discontinued. Resistance should be suspected in source patients when there is clinical progression of
disease or a persistently increasing viral load and/or a decline in CD4+ cell count despite therapy, or a lack of
virologic response to a change in therapy. Nevertheless, in this situation it is unknown whether a modification in the
PEP regimen is necessary or will influence the outcome of an occupational exposure.

Antiretroviral Drugs in Pregnancy:

Considerations for the use of antiretroviral drugs in pregnancy include their potential effect on the pregnant woman
and on her fetus or neonate. The pharmacokinetics of antiretroviral drugs has not been completely studied in
pregnant women. Some of the antiretroviral drugs are known to cross the placenta, but data for humans are not yet
available for others (particularly the PIs). In addition, data are limited on the potential effects of antiretroviral drugs on the developing fetus or neonate. Decisions on the use of specific drugs in pregnancy also are influenced by whether a drug has specific adverse effects or might further exacerbate conditions associated with pregnancy, (e.g., drugs that cause nausea may be less tolerated when
superimposed on the nausea normally associated with pregnancy).

Treatment of an Exposure Site:

Wounds and skin areas that have been in contact with blood or body fluids should be washed with soap and water,
mucous membranes should be flushed with water. There is no evidence that the use of antisepsis for wound care or expressing fluid by squeezing the wound further reduces the risk for HIV transmission.
However, the use of antisepsis is not recommended. The application of caustic agents (e.g., bleach) on the injection of antisepsis or disinfectants into the wound is not recommended.

Assessment of Infection Risk:

After occupational exposure, the source person and the exposed HCW should be evaluated to determine the need
for HIV PEP. Follow up for hepatitis B virus and hepatitis C virus infections also should be conducted in
accordance with previously published CDC recommendations.

Evaluation of exposure:

The exposure should be evaluated for potential to transmit HIV based on the type of body substance involved and the route and severity of the exposure. Exposure to blood, fluid containing visible blood, or other potentially infectious fluid (including semen, vaginal secretions, and cerebrospinal, synovial, pleural, peritoneal, pericardial, and amniotic fluids) or tissue through a puncture or non-puncturing sharp-related event (e.g., needlestick or other perforating sharp-related event) or through contact with a mucous membrane are situations that pose a risk for bloodborne transmission and require further evaluation. In addition, any direct contact (i.e., personal protective equipment was not used or was ineffective in protecting skin or mucous membranes) with concentrated HIV in a research laboratory or production facility is considered an exposure that requires clinical evaluation to assess the need for PEP.

For this exposure, follow-up is indicated if it involves direct contact with a body fluid listed above and there is evidence of compromised skin integrity (e.g., dermatitis, abrasion, or open wound). However, if the contact is prolonged or involves a large area of intact skin, post-exposure follow-up may be considered on an individual basis as requested by the provider. For human bites, the clinical evaluation must consider possible exposure of both the bite recipient and the person who inflicted the bite. HIV transmission only rarely has been reported by the route. If a bite results in blood exposure to either person involved, post-exposure follow-up, including consideration of PEP, should be provided.

Evaluation and testing of an exposure source. The person whose blood or body fluids are the source of an occupational exposure should be evaluated for HIV infection. Information available in the medical record at the time of exposure (e.g., laboratory test results, admitting diagnosis, or past medical history) or from the source person may suggest or rule out possible HIV infection. Examples of information to consider when evaluating an exposure source for possible HIV infection include laboratory information (e.g., prior HIV testing results or results of immunologic testing [e.g., CD4+ count], clinical symptoms [e.g., acute symptomatic or undiagnosed immunodeficiency syndrome]), and history of possible HIV exposure (e.g., injection drug use, sexual contact with a known HIV-positive partner, unprotected sexual contact with multiple partners [heterosexual and/or homosexual], or receipt of blood or blood products).

If the source is known to have HIV infection, sexual transmission of the disease must be considered a possibility for PEP. If the source is asymptomatic, sexual transmission of the disease may be considered. In the case of a person who is HIV-negative, sexual transmission of the disease may be considered. In the case of a person who is HIV-positive, sexual transmission of the disease may be considered.

If the source is HIV-negative and has no clinical evidence of acquired immunodeficiency syndrome (AIDS) or symptoms of HIV infection, no further testing of the source is indicated. It is unclear whether follow-up testing of a source who is HIV positive for HIV transmission, is useful in post-exposure management of HCWs. HCWs who become infected generally do not report testing of a source would normally be performed.

If the exposure source is unknown, information about where and under what circumstances the exposure occurred should be assessed epidemiologically for risk for transmission of HIV. Certain situations, as well as the type of exposure, may suggest an increased or decreased risk, an important consideration is the prevalence of HIV in the population group (i.e., institution or community) from which the contaminated source material is derived. For example, an exposure that occurs in a geographic area where drug use is prevalent or on an AIDS unit in a healthcare facility would be considered epidemiologically to have a higher risk for transmission than one that occurs in a nursing home for the elderly who is unknown HIV-
infected residents are present. In addition, exposure to a blood-filled hollow needle or visibly bloody device suggests a higher-risk exposure than exposure to a needle that was most likely used for giving an injection. Decisions regarding appropriate management should be individualized based on the risk assessment.

HIV testing of needles or other sharp instruments associated with an exposure, regardless of whether the source is known or unknown, is not recommended. The reliability and interpretation of findings in such circumstances are unknown.

**Clinical Evaluation and Baseline Testing of Exposed HCWs:**
Exposed HCWs should be evaluated for susceptibility to bloodborne pathogen infections. Baseline testing (i.e., testing to establish serostatus at the time of exposure) for HIV antibody should be performed. If the source person is seronegative for HIV, baseline testing or further follow-up of the HCW normally is not necessary. If the source person has recently engaged in behaviors that are associated with a risk for HIV transmission, baseline and follow-up HIV-serology testing (e.g., 3 and/or 6 months postexposure) of the HCW should be considered. Serologic testing should be made available to all HCWs who are concerned that they may have been exposed to HIV.

For purposes of considering HIV PEP, the evaluation also should include information about medications the HCW may be taking and any current or underlying medical conditions or circumstances (e.g., pregnancy, breast feeding or radon or hepatic disease) that may influence drug selection. Pregnancy testing should be offered to all nonpregnant women of childbearing age whose pregnancy status is unknown.

**HIV PEP:**

The following recommendations apply to situations where an HCW has had an exposure to a source person with HIV or where information suggests that there is a likelihood that the source person is HIV-infected. These recommendations are based on the risk for HIV infection after different types of exposure and limited data regarding efficacy and toxicity of PEP. Because most occupational HIV exposures do not result in the transmission of HIV, potential toxicity must be carefully considered when prescribing PEP. When possible, these recommendations should be implemented in consultation with persons having expertise in antiretroviral therapy and HIV transmission.

Explaining PEP to HCWs:

Recommendations for chemoprophylaxis should be explained to HCWs who have sustained occupational HIV exposures. For exposures for which PEP is considered appropriate, HCWs should be informed that: a) knowledge about the efficacy and toxicity of drugs used for PEP are limited; b) only ZDV has been shown to prevent HIV transmission in humans; c) there are no data to address whether adding other antiretroviral drugs provides any additional benefit for PEP, but experts recommend combination drug regimens because of increased potency and concerns about drug-resistant virus; d) data regarding toxicity of antiretroviral drugs in persons without HIV infection or in pregnant women are limited for ZDV and not known regarding other antiretroviral drugs; and e) any or all drugs for PEP may be declined by the HCW. HCWs who have HIV occupational exposures for which PEP is not recommended should be informed that the potential side effects and toxicity of taking PEP outweigh the negligible risk of transmission posited by the type of exposure.

**Factors in Selection of a PEP Regimen:**

Selection of the PEP regimen should consider the comparative risk represented by the exposure and information about the exposure source, including history of and response to antiretroviral therapy based on clinical response, CD4 T-lymphocyte counts, viral load measurements, and current disease stage. Most HIV exposures will warrant only a two-drug regimen, using two NRTIs, usually ZDV and 3TC. The addition of a third drug, usually a PI (i.e., IDV or NVP), should be considered for exposures that pose an increased risk for transmission or where resistance to the other drugs used for PEP is known or suspected.

**Timing of PEP Initiation:**

PEP should be initiated as soon as possible. The interval within which PEP should be started for optimal efficacy is not known. Animal studies have demonstrated the importance of starting PEP within hours after an exposure. To assure timely access to PEP, occupational exposure should be regarded as an urgent medical concern and PEP started as soon as possible after the exposure (i.e., within a few hours rather than days). If there is a question about which antiretroviral drugs to use, or whether to use two or three drugs, it is probably better to start ZDV and 3TC.
immediately than to delay PEP administration. Although animal studies suggest that PEP probably is not effective when started later than 24-36 hours post exposure, the interval after which there is no benefit from PEP for humans is undefined. Therefore, if appropriate for the exposure, PEP should be started even when the interval since exposure exceeds 36 hours. Initial therapy after a longer interval (e.g., 1-2 weeks) may be considered for exposures that represent an increased risk for transmission; even if infection is not prevented, early treatment of acute HIV infection may be beneficial. The optimal duration of PEP is unknown. Because 4 weeks of ZDV appeared protective in HOCWs, PEP probably should be administered for 4 weeks, if tolerated. PEP if Exposure Source is Unknown:

If the source person's HIV serostatus is unknown at the time of exposure (including when the source is HIV negative but may have had a recent HIV exposure), use of PEP should be decided on a case-by-case basis, after considering the type of exposure and the clinical and/or epidemiologic likelihood of HIV infection in the source. If these considerations suggest a possibility for HIV transmission and HIV testing of the source is pending, it is reasonable to initiate a two-drug PEP regimen until laboratory results have been obtained and later modify or discontinue the regimen accordingly.

If the exposure source is unknown, use of PEP should be decided on a case-by-case basis. Consideration should include the severity of the exposure and the epidemiologic likelihood that the HCW was exposed to HIV.

PEP for Pregnant HCWs:

If the HCW is pregnant, the evaluation of risk and need for PEP should be approached as with any other HCW who has had an HIV exposure. However, the decision to use any antiretroviral drug during pregnancy should involve discussion between the woman and her health-care provider regarding the potential benefits and potential risks to her and her fetus.

Follow-up of HCWs Exposed to HIV:

Postexposure Testing:

HCWs with occupational exposure to HIV should receive follow-up counseling, postexposure testing, and medical evaluation regardless of whether they receive PEP. HIV antibody testing should be performed for at least 6 months postexposure (e.g., at 6 weeks, 12 weeks, and 6 months). It is unclear whether an extended follow-up period (e.g., 12 months) is indicated in certain circumstances. Although rare instances of delayed HIV seroconversion have been reported, the infrequency of this occurrence does not warrant adding an additional follow-up period to HCWs' anxiety by routinely extending the duration of postexposure follow-up. Circumstances for which extending the duration of follow-up have been suggested include the use of highly potent antiretroviral regimens (i.e., more than two drugs) because of theoretical concerns that HIV seroconversion could be delayed, or simultaneous exposure to HCV. Data are insufficient for making a general recommendation in these situations. However, this should not preclude a decision to extend follow-up in an individual situation based on the clinical judgement of the HCW's health-care provider. HIV testing should be performed on any HCW who has an illness that is compatible with an acute retroviral syndrome, regardless of the interval since exposure. HIV-antibody testing using EIA should be used to monitor for seroconversion. The routine use of direct virus assays (e.g., HIV p24 antigen EIA or polymerase chain reaction for HIV RNA) to detect infection in exposed HCWs generally is not recommended. Although direct virus assays may detect HIV infection a few days earlier than HIA, the infrequency of HCW seroconversion and increased costs of these tests do not warrant their routine use in this setting. Also, HIV RNA is approved for use in established HIV infection, its reliability in detecting very early infection has not been determined.

Monitoring and Management of PEP Toxicity:

If PEP is used, drug-toxicity monitoring should be performed at baseline and again 2 weeks after starting PEP. Clinical judgement based on medical conditions that may exist in the HCW and any toxicity associated with drugs included in the PEP regimen, should determine the type of testing. Minimally these should include a complete blood count and renal and hepatic chemist function tests. Monitoring for evidence of hyperglycemia should be included for HCWs whose regimen include any PIs if the HCW is receiving IDV, monitoring for crystalluria,
hematuria, hemolytic anemia, and hepatitis also should be included. If toxicity is noted, modification of the regimen should be considered after expert consultation; further diagnostic studies may be indicated.

HCWs who fail to complete the recommended regimen often do so because of the side effects they experience (e.g., nausea and diarrhea). These symptoms often can be managed without changing the regimen by prescribing antihistamines and anticholinergic agents or other medications that target the specific symptoms. In other situations, modifying the dose interval (i.e., administering a lower dose of drug more frequently throughout the day, as recommended by the manufacturer), may help promote adherence to the regimen.

**Counseling and Education:**

Although HIV infection following an occupational exposure occurs infrequently, the emotional impact of the exposure often is substantial. In addition, HCWs are given seemingly conflicting information. Although HCWs are told that there is a low risk for HIV transmission, a 4-week regimen of PEP is recommended and they are asked to commit to behavioral measures (i.e., sexual abstinence or condom use) to prevent secondary transmission, all of which influence their lives for several weeks to months.

Therefore, access to persons who are knowledgeable about occupational HIV transmission and who can deal with the many concerns an HIV exposure may raise for the HCW is an important element of postexposure management. HIV-exposed HCWs should be advised to use the following measures to prevent secondary transmission during the follow-up period, especially during the first 6-12 weeks after the exposure when most HIV-infected persons are expected to seroconvert: use sexual abstinence or condoms to prevent sexual transmission and to avoid pregnancy, and refrain from donating blood, plasma, organs, tissue, or semen. If the exposed HCW is breastfeeding, she should be contacted about the risks for HIV transmission in human breast milk, and discontinuation of breastfeeding should be considered, especially following high-risk exposures. If the HCW chooses to continue breastfeeding, temporary discontinuation of breastfeeding while she is taking PEP should be considered to avoid exposing the infant to these agents. NRTIs are known to pass into breast milk, but it is not known whether the same is true for PIs.

There is no need to modify the HCW's patient-care responsibilities to prevent transmission to patients based solely on an HIV exposure. If HIV serocconversion is detected, the HCW should be evaluated according to published recommendations for HIV-infected HCWs.

Exposed HCWs should be advised to seek medical evaluation for any acute illness that occurs during the follow-up period. Such an illness, particularly if characterized by fever, rash, malaise, nausea, and abdominal pain, may be indicative of acute HIV infection but also may be due to a drug reaction or another medical condition. Exposed HCWs who choose to take PEP should be advised of the importance of completing the prescribed regimen. Information should be provided about potential drug interactions and the drugs that should not be taken with PEP, the side effects of the drugs that have been prescribed, measures to minimize these effects, and the methods of clinical monitoring for toxicity during the follow-up period. They should be advised that the evaluation of certain symptoms should not be delayed (e.g., back or abdominal pain, pain on urination or blood in the urine, or symptoms of hyperglycemia [i.e., increased thirst and/or frequent urination]).
### Basic and expanded postexposure prophylaxis regimens

<table>
<thead>
<tr>
<th>Regimen category</th>
<th>Application</th>
<th>Drug regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>Occupational HIV exposures for which there is a recognized transmission risk</td>
<td>4 weeks (28 days) of both zidovudine 600 mg every day in divided doses (i.e., 300 mg twice a day, 200 mg three times a day, or 100 mg every 4 hours) and lamivudine 150 mg twice a day.</td>
</tr>
<tr>
<td>Expanded</td>
<td>Occupational HIV exposures that pose an increased risk for transmission (e.g., volume of blood and/or higher virus titer in blood)</td>
<td>Basic regimen plus either indinavir 800 mg every 8 hours or nevirapine 750 mg three times a day.*</td>
</tr>
</tbody>
</table>

*Indinavir should be taken on an empty stomach (i.e., without food or with a light meal) and with increased fluid consumption (i.e., drinking six 8oz glasses of water throughout the day); nevirapine should be taken with meals.
Step 1: Determine the exposure code (EC)

Is the source material blood, bloody fluid, other potentially infectious material, or an instrument contaminated with one of these substances?

If No — No PEP
If yes — What type of exposure has occurred?
  If intact skin — No PEP.
  If mucous membrane or skin integrity compromised — check volume.
  If Volume is small e.g. few drops, short duration — (EC1)
  If Volume large (e.g. several drops, major blood splash and for longer duration i.e. for several minutes or more) — (EC2)

  If percutaneous exposure check severity.
  If less severe (e.g. solid needle, superficial scratch) — (EC2)
  If more severe (e.g. large bore hollow needle, deep puncture, visible blood on device or needle used in source patient’s artery or vein) — (EC3)

Step 2: Determine the HIV status code (SC)

What is the HIV status of the exposed source?

If HIV -ve — NO PEP
If HIV +ve, what is the titre of exposure?

  If lower titre exposure (e.g. asymptomatic and high CD4 count) — (HIV SC1)
  If higher titre exposure (e.g. advanced AIDS and primary HIV infection, high or increasing viral load or low CD4 count) — (HIV SC2)
  If HIV status is unknown or source is unknown — (HIV SC unknown)
### Step 3: Determine PEP recommendation

<table>
<thead>
<tr>
<th>BC</th>
<th>HIV SC</th>
<th>PEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>PEP may not be warranted. Exposure type does not pose known risk for HIV transmission. Whether the risk for drug toxicity outweighs the benefit of PEP should be decided by exposed HCW and the treating clinician.</td>
</tr>
<tr>
<td>2</td>
<td>Consider basic regimen. Exposure type poses a negligible risk for HIV transmission. A high HIV titre in the source may justify consideration of PEP. Whether the risk for drug toxicity outweighs the benefit of PEP should be decided by exposed HCW and the treating clinician.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Recommend basic regimen. Exposure means increased HIV transmission rate.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Recommend expanded regimen. Exposure means increased HIV transmission rate.</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>If the source or in the case of unknown source, the setting where the exposure occurred suggests a possible risk for HIV exposure and the BC is 2 or 3 consider PEP basic regimen.</td>
<td></td>
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</tbody>
</table>


19. Percutaneous injuries during surgical procedures.


