SEVEN

SAFE PRACTICES IN THE OPERATING ROOM

KEY CONCEPTS you will learn in this chapter include:

- Why the operating room is so risky for patients and staff
- Which instruments cause most injuries in the operating room and why
- How to avoid injuries from sharps
- How to manage exposure to blood and potentially contaminated body fluids

BACKGROUND

> **"The operating room is clearly one of the most hazardous environments in the healthcare delivery system. By definition, surgery is invasive. Instruments that are designed to penetrate patients' tissue can just as easily injure the provider. Blood is everywhere. Speed is essential. Emergencies can occur at any time and interrupt routines. Preventing injuries and exposures [to infectious agents] under these circumstances is indeed challenging!"**
>
> **—Julie Louise Gerberding, MD, MPH**
> ***Advanced Precautions for Today's OR*** **(Davis 2001a)**

In the past decade, awareness of the risk of exposure to blood and body fluids containing HIV, HBV and most recently HCV have created a new era in surgical infection prevention practices. Just as patients must be protected from wound contamination and infections, so must providers be protected from intraoperative injuries and exposure to patients' blood and other body fluids.

Preventing infections following an operation is a complex process that begins in the operating room by preparing and maintaining a safe environment for performing the surgery. Surgical aseptic techniques are designed to create such an environment by controlling the four main sources of infectious organisms: the patient, surgical staff, equipment and the operating room environment. Although the patient is often the source of surgical infections, the other three sources are important and should not be overlooked (see **Chapter 6**).

The science of safety in the surgical unit, whether it is located in a large specialty hospital or freestanding primary healthcare clinic, has not kept pace with the urgent need for prevention strategies. Although some of the

specific recommendations presented in this chapter have not been evaluated in clinical trials, they have been found over time to be worthwhile and merit further consideration. Fortunately, the effectiveness of many of these recommendations—HBV immunization, use of appropriate personal protective equipment when indicated (see **Chapter 5**), double gloving, sharps management and the use of blunt needles for suturing—is well-supported by data.

Specific techniques required to establish and maintain surgical asepsis and make the surgical environment safer include the following:

- **Patient considerations**: skin cleaning pre-operatively, skin antisepsis and wound covering (**Chapters 6** and **23**)
- **Surgical staff considerations**: hand hygiene (handwashing and/or handrub and handrubbing with waterless, alcohol-based antiseptic agents); use and removal of gloves and gowns (**Chapters 3 and 5**)
- **Equipment and room preparation considerations**: traffic flow and activity patterns as well as housekeeping practices (**Chapters 15** and **16**) and decontamination, cleaning and either sterilization or high-level disinfection of instruments, gloves and other items (**Chapters 10–12**)
- **Environmental considerations**: maintaining an aseptic operating field and using safer operating practices and techniques (**Chapter 7 and 15**)

Because traffic flow, equipment processing and room preparation requirements are discussed in other chapters, the focus of this chapter will be on improving the surgical environment (operating room), especially the practices and techniques that make surgery safer for both the patient and staff.

DEFINITIONS

- **Antisepsis**. Process of reducing the number of microorganisms on skin, mucous membranes or other body tissue by applying an antimicrobial (antiseptic) agent.
- **Asepsis** and **aseptic technique**: Combination of efforts made to prevent entry of microorganisms into any area of the body where they are likely to cause infection. The goal of asepsis is to **reduce to a safe level** or **eliminate** the number of microorganisms on both animate (living) surfaces (skin and tissue) and inanimate objects (surgical instruments and other items).
- **Surgical asepsis**. Preparation and maintenance of a reduced (safe) level of microorganisms during an operation by controlling four main sources of infectious organisms: the patient, personnel, equipment and the environment.

THE SURGICAL ENVIRONMENT

The operating room has special characteristics that increase the chance of accidents. For example, staff often use and pass sharp instruments without looking or letting the other person know what they are doing. The workspace is confined and the ability to see what is going on in the operative field for some members of the team (scrub nurse or assistant) may be poor. There is, moreover, the need for speed and the added stress of anxiety, fatigue, frustration and occasionally even anger. Finally, there is the fact that exposure to blood often occurs without the person's knowledge, usually not until the gloves are removed at the end of the procedure, which prolongs the duration of exposure. The fact that fingers are frequently the site of minor scratches and cuts further increases the risk of infection with bloodborne pathogens.

Which Instruments Cause Injuries

The vast majority of sharps injuries in hospitals occur in the operating room, and most are due to scalpel and suture-needle injuries, which is not surprising given that these are the two most frequently used sharps during operations. Many other items can also cause sharps injuries and glove tears resulting in exposure to blood. Some of the most important are:

- Hypodermic needles
- Wire sutures
- Laparoscopy and surgical drain trocars
- Orthopedic drill bits, screws, pins, wires and saws
- Needle point cautery tips
- Skin hooks and towel clips
- Sharp-pointed scissors and sharp-tipped mosquito forceps
- Dissecting forceps
- Sharp-toothed tenaculi

When Do Injuries Occur

Scalpel injuries most often occur when:

- Putting on and taking off the disposable blade
- Passing the scalpel hand to hand between team members
- Cutting (e.g., in using fingers to hold or spread tissue or cutting toward the fingers of the surgeon or assistant)
- Before and after using the scalpel: leaving it on the operative field, dropping it on your own or the assistant's foot, and reaching for scalpels sliding off the drapes
- Placing the scalpel in an over-filled sharps container or a poorly located container

Suture needle injuries most often occur when:

- Loading or repositioning it in the needle holder
- Passing the needle hand to hand between team members
- Suturing: using fingers to hold tissue or to guide the needle, sewing toward the surgeon or assistant and holding back other tissues by the surgeon or assistant
- Tying with the needle still attached or left on the operative field
- Before and after using the needle: leaving it on the operative field, dropping it on your own or the assistant's foot, and reaching for suture needles or needles loaded in the needle holder sliding off the drapes
- Placing needles in an over-filled sharps container or a poorly located container

Not surprisingly, almost all of these injuries can be easily avoided and with little expense. For example:

- Use a small Mayo forceps (not fingers) when holding the scalpel blade, when putting it on or taking it off or loading the suture needle. (Alternatively, use disposable scalpels with a permanent blade that cannot be removed.)
- Always use tissue forceps, not fingers, to hold tissue when using a scalpel or suturing.
- Use a "hands-free" technique to pass or transfer sharps (scalpel, needles and sharp-tipped scissors) by establishing a Safe or Neutral Zone in the operative field (see below).
- Always remove sharps from the field immediately after use.
- Make sure that sharps containers are replaced when they are only three-quarters full and place containers as close to where sharps are being used as conveniently possible (i.e., within arm's reach).

The "Hands-Free" Technique for Passing Surgical Instruments

A safer method of passing sharp instruments (scalpels, suture needles and sharp scissors) during surgery, called the "hands-free" technique, has recently been recommended. This technique for sharps is inexpensive, simple to use, and ensures that the surgeon, assistant or scrub nurse **never** touches the same instrument at the same time (Bessinger 1988; Fox 1992).

Instruments passed with the hands-free technique (besides those listed above) include anything sharp enough to puncture a glove (e.g., trocars, sharp-tipped mosquito forceps and loaded needle holders). Using the hands-free technique, the assistant or scrub nurse places a sterile or high-level disinfected kidney basin, or other suitable small container, on the operative field between her/himself and the surgeon. The container is designated as the Safe or Neutral Zone in which sharps are placed before

and immediately after use.[1] For example, the assistant or scrub nurse alerts the surgeon that a sharp instrument has been placed in or on the Safe Zone, with the handle pointing toward the surgeon, by saying "scalpel" or "sharp" while placing it there. The surgeon then picks up the instrument and returns it to the container after use, this time with the handle pointing away from her/him.

Note: To avoid dulling scalpel blades, use a plastic container or place a sterile cloth in a metal container.

Another way to do this is to have the assistant or scrub nurse place the instrument in a container and pass it to the surgeon. The surgeon lifts the instrument out of the container, which is left on the field until the surgeon returns the instrument to it. The assistant or scrub nurse then picks up the container and returns it to the Mayo stand.

DESIGNING SAFER OPERATIONS

Using the least dangerous instrument or device that will effectively accomplish the task, while at the same time minimizing risks to the patient and surgical team, should be a goal of any operation. Simple things, such as a brief pre-op discussion of how sharps will be handled by the surgeon, assistant or scrub nurse, can be very helpful. Better still is for the surgical team to review how to make each step in the operation safer, from securing the towel drapes around the proposed incision with nonperforating towel clips to using blunt-tipped needles for closure of all layers except the skin (CDC 1997; Dauleh et al. 1994). Other examples of instruments or devices that protect the surgical team without sacrificing patient safety or staff performance are shown in **Table 7-1**.

In addition, the use of hand-held **straight suture needles** to close skin incisions is especially dangerous, with a reported injury rate of 17%, much higher than with curved needles carried in a needle holder (Davis 2001b). Anesthesiologists, radiologists and others who close small incisions after placement of vascular catheters or cut-downs should be made aware of this hazard.

The risk associated with assisting or being the scrub nurse in surgery may be reduced by anticipating (preferably knowing) the needs of the surgeon for each step of the operation in advance. Where procedures are short (30 minutes or less) and/or the surgical steps are straightforward such as a D&C or cesarean section, this can be accomplished by developing checklists that lay out each step (or task) in the operation or procedure in the sequence in which they usually will be performed (i.e., from skin incision to closure). Reviewing the checklist with the surgical team just before starting the case and pointing out where deviations may be necessary will make the planned surgery go more smoothly and with less

[1] Various items, such as basins, mats or trays, including part of a sterile instrument stand or a designated area on the operative field, have been used as the Safe Zone.

risk of injury. An additional advantage of this review is that it can help protect patients from injury or increased blood loss.

Table 7-1. Reducing the Risk of Exposure

FUNCTION	SAFER	LESS SAFE	LEAST SAFE[1]
Skin incision	cautery	disposable scalpel	scalpel with removable blade
Cutting	scissors, blunt tip or cautery probe	scissors, sharp tip	scalpel
Hemostasis	blunt suture needles staples or cautery	sharp suture needles	wire sutures
Sponging with gauze while using a scalpel	surgeon does sponging; assistant only retracts	assistant sponges but only by request	assistant sponges spontaneously (no communication)
Retraction	blunt retractor	sharp retractor	fingers or hands
Sharps transfer	Neutral Zone	hand-to-hand (communication)	hand to hand (no communication)
Surgical gloves	double gloving	single pair of gloves or double gloving with reprocessed gloves	single pair of reprocessed gloves,
Closing peritoneum (small, 2–3 cm incision)	do not close	purse-string closure using tissue forceps to grasp needle	purse-string closure using fingers to grasp needle

[1] Should be avoided if at all possible.

Blunt Needles for Suturing

The range of "bluntness" in commercially available blunt-tipped needles varies from minimal (no extra effort needed to use them) to very blunt (does not penetrate tissue such as fascia and requires conscious effort). **Minimally blunt needles** can be used for closure of all layers from fascia to skin. **Intermediate blunt needles** require some additional conscious effort to close fascia, but are safer to use. **Very blunt needles** are seldom used except when operating deep in the pelvis where the needle absolutely must be retrieved with fingers. The technique for using blunt needles is as follows:

STEP 1: Use a strong needle holder and lock it fully.

STEP 2: Position the needle in the mid-curve, rather than three-quarters of the way back to prevent slippage or bending the needle. (This usually is not necessary when using minimally blunt needles.)

STEP 3: Grasp and hold the tissue to be sutured with a tissue forceps to make it easier for the needle to go through the tissue being sutured.

In general, the blunter the tip, the more important it is to follow these three steps.

Double Gloving

The transmission of HBV and HCV from surgeon to patient and vice versa has occurred in the absence of breaks in technique and with apparently intact gloves (Davis 2001c). Even the best quality, new latex rubber surgical gloves may leak up to 4% of the time.[2] Moreover, latex gloves, especially when exposed to fat in wounds, gradually become weaker and lose their integrity.

Although double gloving is of little benefit in preventing blood exposure if needlesticks or other injuries occur, it may decrease the risk of blood-hand contact. For example, one recent study showed that surgeons wearing single gloves had a blood-hand contact rate of 14% while surgeons wearing double gloves had only a rate of 5% (Tokars et al 1995; Tokars et al 1992). Based on this study, the following are reasonable guidelines for when to **double glove**:

- The procedure involves coming in contact with large amounts of blood or other body fluids (e.g., vaginal deliveries and cesarean sections).
- Orthopedic procedures in which sharp bone fragments, wire sutures and other sharps are likely to be encountered.
- Surgical gloves are reused. (The possibility of inapparent holes or perforations in any type of reprocessed glove is higher than with new gloves.)

In general, for surgical procedures that are short (30 minutes or less) and involve minimal exposure to blood or mucous secretions (e.g., laparoscopy or minilaparotomy), double gloving is probably not necessary. Whether or not the surgeon, assistant or nurse should double glove should be considered carefully, especially where gloves are reused and in areas where the risk of contracting bloodborne pathogens, such as HIV, is high (>5% prevalence).

Elbow-length Gloves for Obstetrical Procedures

Blood contact with the skin and mucous membranes of providers occurs in 25% of vaginal deliveries and 35% of cesarean sections (Davis 2001d). In addition, large volumes of amniotic fluid contaminated with blood are routine in obstetrics. For skilled birth attendants doing home deliveries, wearing clean examination gloves and avoiding contact with the vaginal area as much as possible is recommended, especially after the membranes have ruptured. Also, changing gloves and washing hands if gloved hands become heavily contaminated with blood or amniotic fluid can minimize the risk of exposure.

[2] The "acceptable" leak rate for new surgical and examination gloves designated by regulatory agencies is up to 4% (Davis 2001c).

Where the hand and forearm need to be inserted into the vagina (manual removal of a retained placenta) or deep into the uterus to deliver the infant's head (cesarean section), elbow-length, so-called "gauntlet" gloves, help protect the provider from significant blood and amniotic fluid contamination. Moreover, by wearing gauntlet gloves, the mother will be protected as well.

If gauntlet gloves are not available, an inexpensive, effective alternative can be easily made from previously used surgical gloves that have been decontaminated, cleaned and dried.[3] The steps for making them are:

STEP 1: Cut the four fingers completely off each glove just below where all the fingers join the glove (**Figure 7-1**).

STEP 2: Sterilize or high-level disinfect 2–3 pairs of cut-off (fingerless) gloves according to the recommended process for each method (**Appendix C**) and store the gloves after final processing in a sterile or high-level disinfected container until needed.

Figure 7-1. Creating Gauntlet Gloves from Previously Used Surgical Gloves

Note: If the need for protection of the forearm(s) occurs **during** a procedure (e.g., removal of a retained placenta), first remove the surgical glove from one or both hands using the technique described in **Chapter 3**. Next, put on a fingerless sterile or high-level disinfected glove(s) and pull up onto the forearm(s). Finally, put a new sterile or high-level disinfected surgical glove on one or both hands.

If it is anticipated that the forearms need to be protected **before** starting the procedure (e.g., cesarean section with presenting part deep in the pelvis), the steps are:

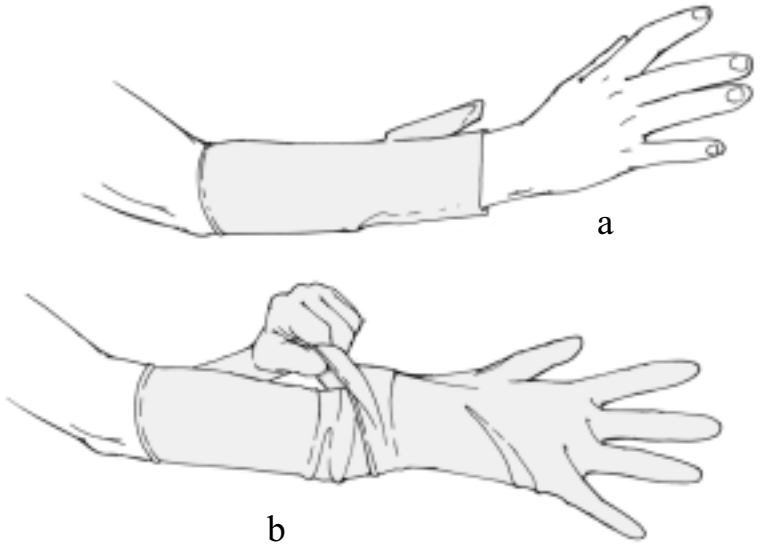
STEP 1: Perform surgical handscrub, including the forearms up to the elbows, as detailed in **Chapter 3** using an alcohol-based antiseptic agent.

STEP 2: Put fingerless sterile or high-level disinfected gloves on both hands and pull up onto the forearm(s) (as shown in **Figure 7-2a**).

STEP 3: Put intact sterile or high-level disinfected surgical gloves on both hands so that the distal (lower) end of the fingerless glove is completely covered (**Figure 7-2b**).

[3] Latex rubber surgical gloves are preferred over examination gloves or even nitrile surgical gloves because they have longer cuffs, are more elastic, fit tighter on the forearm and are more durable.

Figure 7-2a and b. Putting on Fingerless and Surgical Gloves



SAFE HANDLING OF HYPODERMIC NEEDLES AND SYRINGES

In the operating room, scalpels and suture needles are the leading source of penetrating injuries. Hypodermic (hollow bore) needles, however, cause the most injuries to health workers at all levels. Consider:

- Surgeons and assistants are most often stuck by hypodermic needles during procedures.
- Cleaning staff are most often stuck by needles when washing soiled instruments.
- Housekeeping staff are most often stuck by needles when disposing of infectious waste material.

Safety Tips for Using Hypodermic Needles and Syringes

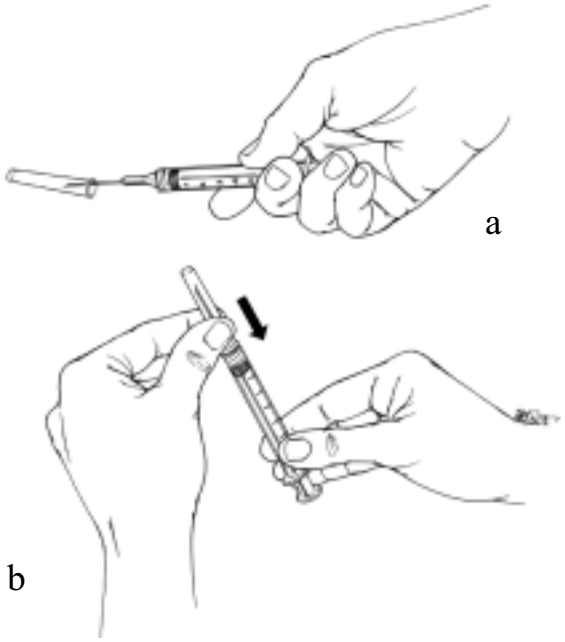
- Use each needle and syringe only once.[4]
- Do **not** disassemble the needle and syringe after use.
- Do **not** recap, bend or break needles prior to disposal.
- Decontaminate the needle and syringe prior to disposal.
- Dispose of the needle and syringe in a puncture-resistant container.

[4] Several studies have documented that unsafe injection practices, such as using the same needle, syringe or both for more than one injection or improperly processed syringes and needles, are responsible for transmitting HIV, HBV and HCV (Drucker, Alcabes and Marx 200l; Simonsen et al 1999). Therefore, after each use, the assembled needle and syringe should either be decontaminated and placed in a sharps container for disposal, or reprocessed using recommended infection prevention practices (see **Chapter 14** and **Appendix E**).

If the needle must be recapped, use the "one-handed" recap method:

- First, place the needle cap on a firm, flat surface; then remove hand.
- Next, with one hand holding the syringe, use the needle to "scoop" up the cap (**Figure 7-3a**).
- With the cap now covering the needle tip, turn the syringe upright (vertical) so the needle and syringe are pointing toward the ceiling.
- Finally, using the forefinger and thumb of your other hand, grasp the cap just above its open end (**Figure 7-3b**) and push the cap firmly down onto the hub (the place where the needle joins the syringe under the cap).

Figure 7-3a and b. One-Handed Recap Method



Safety Tip for Using a Needle and Syringe for Multiple Injections in the Operating Room

If a hypodermic needle must be used for multiple injections during a surgical procedure, one option for preventing accidents between uses is as follows:

- Roll a sterile towel into a tube shape.
- Stick the needle into the towel between uses.

How to Withdraw Medication from a Sterile Multidose Bottle

Note: Do not leave a needle inserted in the rubber stopper of a multidose bottle. This practice provides a direct route for microorganisms, including HIV, to enter the bottle and contaminate the fluid between each use.

- Wipe the top of the bottle with a cotton swab soaked in 60–90% alcohol or other locally available disinfectant. Allow it to dry.
- If using a new disposable needle and syringe, open the sterile pack.
- If using a sterile or high-level disinfected syringe, remove it from the covered container using dry, sterile or high-level disinfected forceps.
- Attach the needle to the syringe.
- Remove the needle cap and insert the needle tip until it touches the bottom of the bottle.
- After filling the syringe, withdraw both the needle and syringe from the bottle.[5]

How to Withdraw Medication Using an Autodisable Syringe

In seeking to improve injection safety, several years ago WHO recommended that all immunizations be given using autodisable syringes. Since then they have been widely used in both campaign and routine immunization settings. Although there are many types of autodisable syringes, the key feature of all of them is that they only permit the syringe to be filled and emptied once. In 2002, USAID began providing the SoloShot FX™ autodisable syringe for use in giving the injectable contraceptive DMPA (Depo Provera®).

The SoloShot FX syringe is a single-use, disposable syringe with a metal clip that locks the plunger after a single use (i.e., it can not be pulled back a second time). The syringe is packaged with a detachable needle, which cannot be attached to any other type of syringes, in a sterile package.

Although autodisable syringes and needles are similar to conventional ones, most health workers will require practice in learning to correctly fill them to avoid wasting medication, syringes and needles (i.e., if air is drawn up into the syringe instead of the prescribed amount of medication, the syringe cannot be refilled). Moreover, it is anticipated that with time use of autodisable syringes for giving other types of injections will increase; therefore, clinicians need to be familiar with using autodisable syringes.

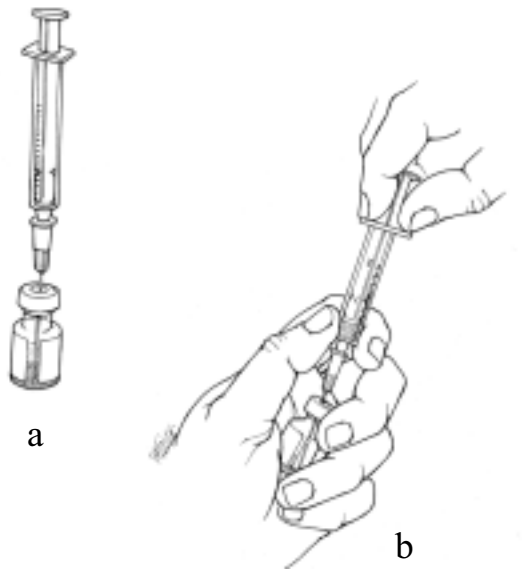
The following instructions are specific for the SoloShot FX syringe and needle:

- Open the sterile pack containing the needle and syringe and attach the needle firmly.
- Remove the needle cap and insert the needle tip until it touches the bottom of the bottle as shown in **Figure 7-4a**. (To avoid drawing air into the syringe, be sure the needle tip stays below the fluid level in the bottle.)

[5] Store opened multidose bottles in a separate, covered container to avoid contamination. Also, mark the date of the first withdrawal. Discard if unused after 30 days or if contaminated at any time.

- While holding the bottle with one hand, slowly pull back on the plunger of the syringe and draw up fluid to just above the "fill line" mark (**Figure 7-4b**).[6]

Figure 7-4a and b. Withdrawing Medication Using an Autodisable Syringe (SoloShot FX™)



- Withdraw the needle and syringe from the bottle and hold the syringe upright (needle pointing to the ceiling) to see if any air is in the syringe.
- If there are air bubbles, slowly push the plunger in, but only until the "fill line" mark is reached.
- Check to be sure the fluid level in the syringe is at or slightly above the "fill line" mark. If it is below the fill line mark, there may not be enough medication to be effective and the injection should not be administered. In this situation, either inject the medication back into the single dose bottle and draw up the medication again using a new autodisable syringe and needle, or discard the partially filled syringe and use a new bottle and autodisable syringe and needle.

SHARPS CONTAINERS: DOs AND DON'Ts

Sharps containers are a key component in minimizing injuries from disposable sharps—such as hypodermic needles, scalpels and suture needles—that are used at all levels of the healthcare system. Other operating room-specific sharps that require similar disposal include: surgical drain trocars, needle point cautery tips, wire sutures, orthopedic drill bits and a range of hollow injection needles used by radiologists and

[6] For the SoloShot FX syringes used with DMPA, the "fill line" mark is at 1 mL.

anesthesiologists for various medical invasive procedures. Disposal of these items after their use requires careful planning and action on the part of the healthcare team to avoid injury to the housekeeping and maintenance staff that ultimately will be removing them.

Note: Educating staff on the safe handling of sharps reduces the risk of injury (Managan et al 2001).

In the US and other developed countries, a whole industry has grown up to meet the increasing demand for sharps containers. Today, sharps containers of all sizes and shapes are available, either disposable or reusable. Most manufactured containers are designed to be wall mounted or attached to a surface and come with special mounting brackets. A few, however, are still designed to be freestanding (ECRI 1993). In most developing countries, these manufactured items are a luxury. As a result, health workers throughout the world have cleverly developed sharps containers from readily available "throw away" items, such as metal food containers made of aluminum, tin or heavy plastic (e.g., cooking oil bottles and cans), heavy-duty cardboard boxes and even the used plastic drinking water bottles with caps that litter the streets and countryside. Although some are safer than others, they all provide a no-cost, sustainable source of disposable sharps containers for use in small clinics, polyclinics and district-level hospitals with limited budgets. Rather than discouraging practitioners from using these items in favor of manufactured products, they should be given help in developing better, safer containers from existing materials (e.g., advised on which items are more appropriate to use).

When using sharps containers, either commercial or locally produced, here are some DOs and DON'Ts to consider:

- **DO** put sharps containers as close to the point of use as possible and practical, ideally within arm's reach. Also, they should be easy to see, recognize and use.
- **DO** attach containers to walls or other surfaces if at all possible.
- **DO** mark them clearly so that people will not unknowingly use them as a garbage container or for discarding cigarettes.
- **DO** place them at a convenient height so staff can use and replace them easily.
- **DO** mark the fill line at the three quarters full level.
- **DON'T** shake a container to settle its contents and make room for more sharps.
- **DON'T** place containers in high traffic areas (corridors outside patient rooms or procedure rooms) where people could bump into them or be stuck by someone carrying sharps to be disposed of.
- **DON'T** place containers on the floor or anywhere they could be knocked over or easily reached by a child.
- **DON'T** place containers near light switches, overhead fans or thermostat controls where people might accidentally put their hand into them.

MANAGING EXPOSURE TO BLOOD AND BODY FLUIDS

Healthcare professionals (physicians, nurses and midwives) who work in high-risk areas such as surgical and obstetrical units should know what to do in the event of a possible blood exposure to themselves or another health worker. Preventing accidents (needlesticks) and other blood or body fluid exposures are the primary means of preventing work-related transmission of HIV or HCV. For HBV, however, an effective vaccine has been available for nearly 20 years. Unfortunately, in many countries, even health professionals have not been immunized against this serious bloodborne disease. Although only about 5% of people who contract hepatitis B die from the disease, a high percentage become chronic carriers or are disabled and cannot work because of permanent damage to the liver (cirrhosis). In addition, hepatitis B infection is a necessary precursor for hepatitis D (HDV) and primary liver cancer.[7] Being vaccinated protects not only the individual, but also fellow workers, other patients and the individual's family.

Hepatitis B Post-Exposure Guidelines

Several studies have demonstrated that, in susceptible persons (i.e., negative hepatitis B surface antigen [HBsAG] test and no history of receiving immune serum globulin), giving hepatitis B immune globulin (HBIG) is better than conventional immune serum globulin (ISG) (or by inference doing nothing) in preventing acute hepatitis B and seroconversion (Desmyter et al 1975; Grady and Lee 1975). For example, in the study by Seeff et al (1975), a randomized clinical trial comparing HBIG to ISG, only 1.4% compared to 5.9% of susceptible individuals developed acute hepatitis, and only 5.6% compared to 20.7 % seroconverted. Both results were statistically significant at the $P < 0.01$ level, and the findings persisted for up to 1 year. In this trial, the first dose of HBIG (5 mL intramuscularly) was given within 7 days of exposure; with the second dose approximately 1 month later. Only brief and mild side effects were noted with either HBIG (3%) or ISG (3.2%). Unfortunately, the availability of HBIG is limited in many countries, but if accidental exposure is reported promptly, there may be time to procure the HBIG and still give it within 7 days of exposure. Whether ISG provides any protection is not known.

The suggested steps for managing an injury is as follows[8]:

STEP 1: Treat the exposure site if appropriate (e.g., an open wound or cut).

STEP 2: If tetanus immunization or boosters are indicated (>10 years since immunization), give it.

[7] HDV is an incomplete virus that is unable to replicate (make more virus particles) in humans without binding to HBV (Davis 2001e).

[8] If exposure is limited to contact with blood or body fluids on intact skin (hands), wash affected areas with soap and water as soon as possible. For contact with mucous membranes (eyes, nose or mouth), rinse with clean water at least two times.

STEP 3: Assess the risk of HBV exposure and determine the immune status of the patient (i.e., history of jaundice, hepatitis or previous immunization with hepatitis B vaccine). If status is unknown, continue assessment.

STEP 4: Collect a specimen from the source person (i.e., the carrier or person suspected of being infected) if possible and from the patient for HBsAGg testing. If testing is not possible, base the HBV status of the infected person on clinical history and clinical findings.

STEP 5: Give HBIG (5mL IM) as soon as possible and within 7 days of exposure, and also give the first dose of hepatitis B vaccine, which should be repeated at 1 and 6 months. If active immunization with hepatitis B vaccine is not possible, a second dose of HBIG should be given 1 month later (Chin 2000).

HIV Post-Exposure Prophylaxis Guidelines

The plan for assessing the risk of accidental exposure to HIV is similar to that for HBV. Because there is no vaccine for passive or active immunization against HIV, post-exposure prophylaxis (PEP) is much more complicated; therefore, the decision to recommend it needs to be based on a careful assessment of the injury. For example, although the risk of HIV seroconversion after all types of work-related percutaneous (breaks the skin) exposure is only about 0.3% (Tokars et al 1993), the risk for deep injuries (extends into the muscle), including deep needlesticks, is 15 times greater than for superficial injuries (CDC 1995; Cardo et al 1997).

If the assessment is positive for a high risk of HIV exposure (i.e., deep injury or needlestick), consider giving treatment with antiretroviral agents (zidovudine [ZDV] plus lamivudine [3TC] has been shown to prevent HIV transmission) (CDC 2001).[9] Determining whether or not PEP should be initiated for a potentially HIV-exposed individual is more difficult than for HBV for three reasons. First, treatment should be initiated as soon as possible and at least within hours after exposure to HIV. Second, a physician or other health professional with knowledge and experience in managing patients with HIV should do the assessment of risk. And third, treatment with antiretroviral agents has considerable side effects, even for prophylaxis, and the long-term safety is not known. Whether or not health workers with exposure to HIV are given PEP, they should receive followup counseling, post-exposure testing and a medical evaluation.

Hepatitis C Post-Exposure Guidelines

There is no post-exposure vaccine or drug prophylaxis for hepatitis C (immune globulin is ineffective). Prevention of exposure, therefore, is the only effective strategy for prevention of HCV.

[9] For the most recent information on post-exposure prophylaxis, go to http://www.cdc.gov/ncidod/hip/guide/phspep.htm.

The CDC (1998) has recommended the following guidelines that institutions should consider for followup of health workers exposed to HCV-positive blood or other body fluids:

- Baseline testing of the source patient (if available and a consent form is signed) for anti-HCV antibody (if the test is available).
- Baseline and 6-month followup testing of exposed health worker for anti-HCV antibody and liver function screen.
- If available, treatment of early HCV infection with pegylated interferon alfa before significant liver damage has occurred.[10]

Where possible, all positive anti-HCV results should be confirmed by supplemental, accurate anti-HCV antibody testing.

MAKING THE SURGICAL ENVIRONMENT SAFER

The responsibility for making today's operating rooms safer extends beyond concern for the well-being of the patient to all healthcare staff who together form the surgical team. The approaches to making operations safer outlined in this chapter are simple, practical and have been documented over a 10-year period. The key to success is to apply the principles and practices in an integrated and consistent manner, with daily attention to detail and, above all, with support at all levels of the healthcare system.

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[10] Adding polyethylene glycol (PEG) to the interferon molecule increases the half-life of the drug, allowing for less frequent dosing (from three to once a week), but the cost of treatment per month is still nearly USD $2000 (Pharmacology Watch 2002).

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