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FEATURE ARTICLE

SAFETY IN THE FORENSIC IMMUNOLOGY LABORATORY

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This paper addresses the safety concerns of personnel such as those working in a forensic science laboratory where it is common to encounter on a daily basis potentially hazardous biologic material in either moist or dried states, for example, blood, semen, saliva or items stained by these fluids. Of the bloodborne diseases, two having the highest levels of concern today are viral hepatitis B and acquired immunodeficiency syndrome (AIDS). Since hepatitis B virus (HBV), like "AIDS virus," is a bloodborne virus and is present in much higher titer and is also more stable to physical or chemical stresses than "AIDS virus," it serves as a "worst case" scenario with respect to recommendations for preventing transmission of either infectious agent. Current safety recommendations for "AIDS virus" are virtually identical to those for HBV (Centers for Disease Control 1982, 1985). The majority of this paper is excerpted from a 1982 publication I authored pertaining to general as well as hepatitis B safety in a clinical laboratory (Bond 1982). The reader is also encouraged to make extensive use of the referenced material for more detailed information.

It is well recognized that viral hepatitis type B is an occupational risk among personnel working in health care fields, especially those who are employed in clinical and forensic laboratories. Hepatitis B is the most commonly reported laboratory-acquired infection, and laboratorians who frequently handle blood or blood-contaminated bodily products are at higher risk than the general population for acquiring infection (Maynard 1978a; Pike 1979; Levy et al. 1977). Although non A/non B hepatitis has not been reported as a major laboratory-acquired infection, its epidemiology appears to be very similar to type B hepatitis in that it is a bloodborne disease (Francis and Maynard 1979); specific information on high-risk groups is not available because of the lack of a serologic test. It is reasonable to assume, however, that like hepatitis B, non A/non B hepatitis constitutes a significant risk among workers in forensic and clinical laboratories, and the following text should apply accordingly.

The basic reservoir of hepatitis B virus (HBV) is the human chronic or transient carrier of hepatitis B surface antigen (HBsAg). In addition to its presence in the blood of these individuals, HBsAg has also been detected in other body fluids, excretions and secretions. These include urine, feces, saliva, nasopharyngeal washings, breast milk, bile; semen, synovial fluid, sweat, tears, peritoneal fluid and cerebrospinal fluid. Since these substances contain detectable HBsAg, it has been hypothesized that they may be infectious. There is general agreement, however, that a fecal-oral route of hepatitis B transmission does not exist (Favero et al. 1979; Maynard 1978b). Transmission by these other fluids may be possible; however, blood is acknowledged to be the most commonly effective vehicle of HBV transmission.

The efficiency of the various mechanisms of hepatitis B transmission within a laboratory environment is related significantly, if not solely, to the extraordinary amounts of circulating HBV in the blood of infected individuals. Blood diluted to such an extent that HBV is present in relatively small inocula or on laboratory environmental surfaces in the absence of visible or even chemically detectable blood can still be infectious. It has been shown, for example, that human serum containing both HBsAg and hepatitis B e antigen (HBeAg-a serologic marker closely associated with infectivity) can be diluted to 10^{-8} and still produce hepatitis B infection when injected into susceptible chimpanzees (Shikata et al. 1977). It has also been shown that HBV in plasma will survive and cause infection after being dried and then stored at 25°C and 42 percent relative humidity for 1 week (Bond et al. 1981).

ROUTES AND MECHANISMS OF HEPATITIS TRANSMISSION IN LABORATORIES

The following are modes of hepatitis B transmission that can occur in a variety of epidemiologic settings including laboratories and are listed in the probable order of efficiency of disease transmission.

Direct Contact

1. Direct percutaneous inoculation of contaminated serum or plasma such as occurs by accidental sticks or cuts by needles or other objects.

2. Percutaneous transfer of infective serum or plasma in the absence of overt puncture, such as contamination of minute scratches, abrasions, burns, or any other lesions.

3. Contamination of mucosal surfaces by infective serum or plasma or infective secretions or excretions such as occurs with accidents associated with mouth pipetting, label licking, splashes or splatterings or other means of skin-to--mouth or skin-to-eye contact. In a recent study (Bond et al. 1982) we showed that a chimpanzee was infected 63 days after inoculation of its corneal surfaces with 50 ul of plasma known to contain HBV.

Indirect contact. Hepatitis B transmission can occur by indirect means via common environmental surfaces in a laboratory such as test tubes, laboratory benches, laboratory accessories and other surfaces contaminated with infectious blood, serum, secretions, or excretions which can be transferred to the skin or mucous membranes. The probability of disease transmission with a single event in this category may be remote, but frequency of such events makes this mechanism of transmission potentially an efficient one over a long period of time. Activities in laboratories such as nail biting, smoking, eating and a variety of hand-to-nose, -mouth and -eye actions, may contribute to indirect transmission.

Airborne transmission. Although hepatitis B transmission by means of the airborne route has been hypothesized, it has never been documented. We have performed two studies, the results of which show true airborne transmission of hepatitis B from infectious blood or saliva is not likely. In one study (Petersen et al. 1976), a filter-rinse technique capable of detecting low levels of aerosolized airborne HBsAg was devised, evaluated and used in a hemodialysis center serving a patient population with a high prevalence of HBsAg seropositivity and one in which conditions favored the production of aerosols; HBsAg was not detected in any of 60 air samples collected. In the second study (Petersen et al. 1979), air samples were collected in a dental operatory at an institution for the mentally retarded where residents had a high incidence of HBsAg seropositivity. Although gingival swab samples from nearly all of patients showed the presence of HBsAg, air samples collected during procedures of scaling, extraction, high-speed drilling and other procedures favoring aerosol production were likewise uniformly negative for HBsAg. However, in a separate study concentrating on HBsAg contamination of environmental surfaces in and around hemodialysis centers, 15 percent of frequently touched surfaces were shown to be contaminated when a swab/rinse sampling technique (Bond et al. 1977) was used. Consequently, true aerosols, that is, particles less than 100 um in diameter, appear to be less significant hazards than contaminated surfaces. It should be pointed out, however, that events such as splashing, centrifuge accidents, or removal of rubber stoppers from tubes can account for disease transmission by means of large droplet transfer into the mouth, eyes, minor cuts or scratches, or onto abraded skin. This is not true airborne (aerosol) transmission, but rather transmission by direct droplet contact.

SPECIFIC PRECAUTIONS FOR PREVENTING LABORATORY-ACQUIRED VIRAL HEPATITIS

The primary strategy that should be used in preventing laboratory-acquired viral hepatitis B is the consistent practice of

blood precautions. This is true not only in laboratories where blood, serum and other specimens are processed from patients who are known to be infected with hepatitis but in all clinical laboratories involved in the biochemical, hematologic and microbiologic assay of blood and blood products. The prevalence of HBsAg in sera of patients whose blood is being assayed varies with the population being served by the laboratory. However, one can assume that this prevalence would be approximately 1 percent in the total population, while in specific high-risk groups such as hemodialysis patients, parenteral drug abusers, or male homosexuals the HBSAg carrier rate may be significantly higher. Consequently, laboratories that process hundreds to thousands of blood samples per day will, without doubt, handle a blood specimen that contains HBV but is not labeled as such. It is common practice to prominently identify specimens and specimen containers with a "hepatitis" label when dealing with known hepatitis patients. Unfortunately, two sets of blood precautions are sometimes practiced in the laboratory: very careful ones with those tubes labeled "hepatitis" and fairly lax ones with unlabeled specimens from other patients. It is emphasized that blood precautions should be employed at all times in the laboratory environment.

The following guidelines are designed and presented specifically for the prevention of laboratory-acquired viral hepatitis B but could be considered applicable in routine laboratory practices to limit the acquisition of other infectious diseases as well.

Safety officer. The responsibility for laboratory safety resides ultimately with the director of the laboratory; however, from an operational standpoint a safety officer who is familiar with laboratory practices and biohazards should be appointed from among the laboratory staff. The laboratory officer should be responsible for giving advice and consultation to the laboratory staff in matters of biohazards, instructing new members in safety procedures, procuring protective equipment and supplies, developing and maintaining a laboratory accident reporting system, periodically reviewing and updating safety procedures and monitoring serologic surveillance data for the laboratory staff if such data are collected.

Reporting of accidents. Accidents such as cuts, needle sticks, and skin abrasions with instruments possibly contaminated with blood, and soiling of broken skin, or contamination of the eyes or mouth must be reported promptly to the safety officer who should maintain records and make sure that proper medical consultation and treatment, if necessary, are available. Spills of high-risk specimens such as documented or suspected HBsAg-positive blood, even if not associated with personnel contamination, should also be reported to the safety officer.

Handwashing. Frequent handwashing is an important safety precaution that should be practiced after contact with specimens and laboratory procedures, especially those associated with blood or blood products. Hands should always be washed before eating, drinking, or smoking and after completing analytical work. Frequent handwashing should be performed even if gloves are used for particular procedures. Handwashing facilities should be conveniently located for frequent use, and a handwashing product that is widely acceptable to personnel is desirable. Liquid or granule soaps are preferable to bar soaps.

Gloves. All laboratorians who have direct or indirect contact with blood or articles contaminated with blood should wear gloves. It should be realized, however, that gloves can become contaminated in use and should not contact surfaces such as telephones, door knobs, marking pens, laboratory equipment, etc., frequently touched by other ungloved laboratorians. Disposable single-use, nonsterile gloves are preferred because they can be changed frequently.

Protective clothing. A gown with a closed front, a coat with an overlapping front, or a disposable plastic apron should be worn in any laboratory area. Disposable gloves should be used when opening or processing specimens. Gowns, apron, and gloves must be removed, and hands should be washed before a staff member leaves the laboratory for any purpose. Disposable gloves and

aprons should be worn only once and in an impervious bag for safe disposal. Gowns and coats should be placed in a laundry bag at the end of each appropriate period of work. If the gown or coat is accidentally contaminated, it should be discarded in the laundry bag at once and a fresh one obtained. A face shield or protective eyeglasses and mask should be worn when it is anticipated that there is a potential for blood and other types of specimens being spattered into the laboratorian's face (Bond et al. 1982).

Personal hygiene. Smoking, eating and drinking in the laboratory should be prohibited. Care should be taken not to put fingers, pencils, or other objects into the mouth, specimen tube labels must not be licked, and hands should be washed after every procedure in which they may have become contaminated.

Pipetting. Mouth pipetting should be prohibited; automatic pipettes with disposable plastic tips are recommended. If disposable pipette tips are used, they should be employed as such and discarded after pipetting each specimen, for example, they should not be rinsed several times in water between each specimen. Other pipettes should be used with rubber bulbs or an automatic suction device, and fluids should never be drawn up to the top of pipette. Contaminated pipettes must not be placed on the laboratory bench; they should be placed gently in a flat discard pan and later completely submerged in disinfectant. Any rubber bulb that may have become contaminated internally during use should be placed into disinfectant and subsequently discarded.

Receipt of specimens. Incoming blood specimens should be received in a designated area of the laboratory and examined closely to be sure they have been properly packed. Soiled or leaking containers should be brought to the attention of the safety officer to decide whether or not they should be autoclaved and discarded without being unpacked. Disposable gloves should be worn during the unpacking procedure.

Labeling, processing and storage of blood tubes. Blood, serum and biologic specimens from patients who are known to be infected with hepatitis or for whom hepatitis B or serum enzyme tests are being performed should be identified with special labels marked "hepatitis". It should be re-emphasized, however, that precautions employed by laboratorians when handling these types of high-risk specimens should be no different when handling specimens that are not labeled as such. Because blood tubes may be contaminated on the outside (Centers for Disease Control 1980) as well as contain infectious blood, they must be handled and stored with care. If blood tubes must be refrigerated, they should be capped and placed in a designated refrigerator or in a designated portion of a refrigerator. Blood tubes should never be kept in a refrigerator that contains food or beverages.

Needles and syringes. Special precautions should be taken with needles and syringes which are blood contaminated. Disposable needles and syringes should be used and should then be discarded after a single use. Used needles should not be recapped; they should be placed in permanently labeled, leak and puncture-resistant containers designed for this purpose. Needle nippers should not be used and needles should not be purposely bent or broken by hand since accidental needle punctures are likely to occur during this procedure. Used syringes should be placed in a leak-resistant bag, and all containers or needles or syringes should be either incinerated or autoclaved before discarding.

Disposal of waste specimens and contaminated material. All blood and most biologic specimens from humans or from primates used in hepatitis research must be viewed as potentially infectious. Accordingly, when these materials become waste, they must be disposed of in a safe manner. Each laboratory should have special receptacles for these wastes. Preferably, the wastes should be autoclaved in the laboratory or transported in double impervious bags for terminal processing in an autoclave or approved incinerator. Where it

is not feasible to autoclave blood or other potentially infectious fluids, they may be poured down a single sink drain designated for this purpose. Gloves should be worn during the procedure and care should be taken to prevent splashing onto the walls of the sink. After a sink drain is used for fluid disposal, it should be thoroughly flushed with water (minimizing splashing) and the sink and drain should be treated with an appropriate liquid disinfectant.

Centrifuging. Specimens containing blood should be centrifuged with tubes tightly capped. If a tube breaks in the centrifuge, the bucket containing the spilled blood and broken glass should be placed gently in a pan of disinfectant; the surfaces of the centrifuge head, bowl, trunnions, and remaining buckets should be swabbed with an appropriate disinfectant; alternately, the trunnions and buckets can be autoclaved. Micro-hematocrit centrifuges and bloodbank serofuges should be cleaned daily.

Automated equipment. Automated equipment capable of performing a number of biochemical assays simultaneously are becoming commonplace in clinical laboratories. However, it is not evident that any instrument or class of instruments pose significant risks of hepatitis transmission due to external or internal design. Rather, the potential risks of hepatitis transmission are associated with procedures involving specimen handling, specimen preparation, and delivery of the specimen to the automated equipment. Gloves should be worn by operators of this equipment at all times. If blood or serum ultimately is collected in a reservoir which is not piped into the sewer system, the contents of the reservoir should be autoclaved before disposal. If this is not feasible, the contents should be poured into a designated sink drain as described previously for fluid wastes.

Care of laboratory bench tops. Each working area should be supplied with a wash bottle containing an appropriate disinfectant. The disinfectant solution should be mixed and renewed according to the direction on the manufacturer's label, and the bench surface must be cleaned and wiped with disinfectant at the beginning and end of each day or more frequently as spills or contamination occur. Since accidents and errors are most likely to happen when the laboratory work area is crowded with equipment and materials, care should be taken to keep the laboratory work area tidy. Tubes and other containers should be placed only in the appropriate rack or tray, never directly on the bench. Disposable, absorbent, plastic-backed pads can be used to protect laboratory bench tops where spattering or spills are common or anticipated.

IMMUNE PROPHYLAXIS

The Advisory Committee on Immunization Practices (ACIP) of the U.S. Public Health Service periodically publishes recommendations and strategies for use of the hepatitis B vaccine as well as immune globulins for protection against several types of viral hepatitis (Recommendation of the Public Health ACIP 1981). These recommendations are updated periodically in the Centers for Disease Control's Morbidity and Mortality Weekly Report.

The hepatitis B virus vaccine licensed for use in 1982 is currently available for both pre- and post-exposure prevention of hepatitis B. The vaccine, given in a three-dose series, is over 90 percent effective in preventing HBV infection, has minimal side effects, and is recommended for the pre-exposure prevention of hepatitis B. Laboratorians, especially those who frequently handle human or primate blood, are at high to moderate risk of hepatitis B infection and should consider receiving hepatitis B vaccine. There are no vaccines available for other hepatitis viruses.

Immune globulins (IG) are sterile solutions of antibodies prepared from large pools of human plasma, and IG (formerly referred to as "immune serum globulin," ISG, or "gamma globulin") produced in the United States since 1977 contains relatively stable amounts of antibodies against HBV and HAV. Hepatitis B immune globulin (HBIG) is prepared from plasma pre-selected for high titer of hepatitis B antibodies, and the cost

of HBIG on a per-dose basis in approximately 20 times that of IG.

Personnel who frequently handle blood should be considered as candidates for the HBV vaccine. Post-exposure prophylaxis may be warranted in the event of percutaneous or permucosal exposure to blood or body fluids known or thought to contain HBV. The final decision to provide prophylaxis must take into account 1) whether the source of the blood or fluids is known or unknown, 2) whether the HBsAg status of the blood or fluids is known or unknown, and 3) the anti-HBs or HBV vaccination status of the exposed person. If post-exposure prophylaxis is to be given, it should be done as soon as possible after exposure (no later than 7 days). The reader is referred to the complete ACIP guidelines for details (Recommendation of the Public Health ACIP 1981).

It is important to recognize, however, that after the use of a vaccine, a natural immunity to hepatitis B or any other disease for that matter should never be considered as a substitute or replacement for proper techniques (asepsis, cleaning, disinfection or sterilization) in the laboratory.

DISINFECTION, STERILIZATION AND DECONTAMINATION

Since hepatitis B virus cannot be propagated in tissue culture, comparative virucidal testing has not been performed as it has been for other types of viruses that can be conveniently cultured and tested in the laboratory. Consequently, there is little known about the precise inactivation kinetics of HBV by physical and chemical agents, and this situation has led many experts to recommend nothing less than a sterilizing treatment when dealing with contamination by this virus. Unfortunately, this type of recommendation has fostered the concept that HBV is some sort of a "super virus" in terms of its resistance to chemical and physical agents. Bond, Petersen, and Favero (1977) have pointed out that although HBV may be comparatively more resistant to a variety of physical and chemical agents than most viruses, it is unreasonable to assume that the resistance level is equivalent to that of bacterial endospores. Until additional data become available, they proposed that the resistance of the human hepatitis viruses should be considered to be greater than that of the tubercle bacillus but less than that of bacterial spores and probably closer to the former. They further pointed out that conventional sterilization treatments will inactivate HBV. With disinfection processes, however, one must rely on empirical observations. The HBV is not more resistant nor does it approach the resistance levels of bacterial spores; this is known because boiling for two minutes inactivates HBV in serum. Therefore, a physical or chemical treatment known to exhibit sporicidal activity should also be virucidal for HBV. Furthermore, because of the exhibited high stability of the HBsAg, a treatment that fully or partially inactivates the immunologic reactivity of this antigen should also inactivate HBV. This rationale and strategy are reviewed at length by Bond et al. (1977) and are beyond the scope of this article. However, they did recommend that environmental HBV contamination be dealt with using chemicals, concentrations, and contact times capable of producing at least an intermediate level of disinfectant action. Table 1 lists a number of chemical germicides which, if used correctly, can be considered effective for the inactivation of the hepatitis B virus The liquid chemicals, as will be mentioned below, are used primarily for purposes of decontamination for spills of known HBsAg-positive blood. They are not generally recommended for routine housekeeping purposes.

Note: Since the original publication of this paper, it has been shown that the resistance level of hepatitis B virus to liquid disinfectant chemicals is not as high as once believed (Bond et al. 1983; Kobayashi et al. 1984).

In fact, even the intermediate-level disinfectants listed in Table 1 (iodophors, hypochlorite) in addition to 70 percent isopropyl or ethyl alcohol have been shown effective in killing large numbers of HBV in plasma or serum. Alcohols are still not recommended for general disinfecting purposes, since effective contact times are difficult to achieve due to rapid evaporation.

Table 1. Germicidal Chemicals Recommended for Hepatitis B Virus Decontamination*

Chemical	Concentration	Activity Level
Ethylene oxide gas[1]	450-800 mg/L	High
Glutaraldehyde, aqueous (acid to alkaline)	2 %	High
Stabilized hydrogen peroxide	6-10 %	High
Formaldehyde[2]	3-8 %	Intermediate to high
Hypochlorite[3]	500-5000 mg/L available chlorine	Intermediate
Iodophors[4]	70-150 mg/L available iodine	Intermediate

*Except for ethylene oxide (a sterilizing treatment), contact times should be 10-30 minutes. Quaternary ammonium compounds are not recommended for specific site decontamination since these compounds are not broad spectrum in germicidal activity and their effects on HBV or "AIDS virus" are unknown. Although alcohols (ethyl and isopropyl) are known to inactivate HBV and "AIDS virus," they are not generally recommended since rapid evaporation prohibits effective exposure times. Chemicals listed as "high activity level" are used primarily for total immersion of instruments or objects. In addition to the chemicals listed above, heat in the form of boiling water (98-100° C) for 10-30 minutes is an effective high-level disinfecting treatment for heat-stable materials.

[1]In autoclave-type equipment at 55 to 60° C according to manufacturer's instructions.

[2]Because of the ongoing controversy of the role of formaldehyde as a potential carcinogen, its use is recommended only in limited circumstances under carefully controlled conditions, that is, fixation of tissue specimens or disinfection of "closed systems" such as fluid pathways of hemodialysis systems.

[3]Use 500 to 5000 mg/L depending upon the cleanliness of the surface being treated. These concentrations are easily prepared by diluting sodium hypochlorite (household bleach) 1:100 or 1:10, respectively, in tap water. Ideally, the solution should be made fresh daily. Hypochlorite solutions are corrosive to some metals, especially aluminum.

[4]Use only those iodophors registered with the EPA as disinfectants. Follow manufacturer's directions closely regarding dilution. Antiseptic iodophors (commonly povidone-iodine) should NOT be used as disinfectants. See Favero (1982) for details of the current iodophor controversy.

DECONTAMINATION

In high-risk areas such as laboratories, one is confronted with the problem of decontaminating large and small blood spills on large, smooth surfaces such as floors or bench tops. Also, frequently touched surfaces, for example, instrument control knobs, racks, or precision pipettes, may play a role in environmentally mediated hepatitis if they are manipulated in an improper manner. The strategies for applying the principles of hepatitis B virus inactivation vary according to the item or surface being considered, its potential role in the risk of hepatitis B transmission, and to a certain extent, the thermal and chemical lability of the surface or instrument. For example, if a blood spill occurred on the floor or a counter top in a laboratory, the objective of the procedure to inactivate the hepatitis B virus would be one of decontamination or disinfection and not sterilization. Consequently, in such an instance it is recommended that gloves be worn and the spill be absorbed with disposable towels. The spill site should first be cleaned of all visible contamination and then the area should be wiped down with clean towels wetted with an appropriate high-level or intermediate-level disinfectant (Favero 1980), for example, a dilution of commercially available household bleach (sodium hypochlorite). All soiled towels should be placed in a container which can either be placed with the infectious waste of that particular department or, since it is sometime easier, autoclaved. The concentration of disinfectant used will depend primarily on the type of surface that is involved. For example, in the case of a direct spill on a porous surface that cannot be physically cleaned prior to disinfection, 0.5% sodium hypochlorite (5000 mg available chlorine/liter) should be used. Conversely, if the surface is hard and smooth and has been cleaned appropriately, then 0.05% sodium hypochlorite (500 mg available chlorine/liter) is sufficient.

For purposes of illustration, if an item in question is a medical instrument that is classified as semi-critical (Favero 1980), such as a flexible fiberoptic endoscope (Bond and Moncada 1978), it is extremely important that meticulous physical cleaning precede the sterilization or high-level disinfection procedure. This would be true whether or not ethylene oxide gas sterilization is employed or a high-level chemical disinfection procedure with a contact time of 10-30 min is used.

There are other types of frequently touched environmental surfaces which could be classified as intermediate between non-critical and semi-critical (Favero 1980) such as control knobs on hemodialysis systems. Ideally, in these types of environments, gloves should be worn to avoid "finger painting" of blood contamination and to avoid percutaneous exposure. Further, these surfaces should be routinely cleaned and disinfected using cloths or, if necessary, swabs. In any case, the objective is to reduce the level of hepatitis B virus contamination to such an extent that disease transmission is remote. In a practical sense, this could mean that, after cleaning, a cloth soaked in either 0.05% sodium hypochlorite or a disinfectant-detergent can be used. In this context, the element of physical cleaning is as important as, if not more important than, the choice of the disinfectant. It obviously would not be cost effective or in many cases even feasible to attempt to achieve sterilization or high-level disinfection in all instances.

GENERAL HOUSEKEEPING PROCEDURES

As a common rule, routine daily cleaning procedures that are used for general microbiologic laboratories can be used for laboratories where blood specimens are processed. Obviously, special attention should be given to visibly contaminated areas or items. Further, cleaning personnel must be alerted to the potential hazards associated with such contamination. Floors and other environmental surfaces contaminated in this manner should be thoroughly cleaned with a germicide-disinfectant registered with the U.S. Environmental Protection Agency as a "hospital disinfectant" that is

mycobactericidal. Germicides that are mycobactericidal are preferred because mycobacteria represent one of the most resistant groups of microorganisms; therefore, germicides that are effective against mycobacteria will be effective against most other bacterial, fungal and viral pathogens as well. Gloves should be worn by cleaning personnel doing these duties. However, in the case of large blood spills as mentioned above, this type of procedure may have to be augmented by specific site decontamination using a more effective chemical agent.

SUMMARY

Type B hepatitis is one of the most frequently reported laboratory-associated infections, and clinical laboratorians involved with handling blood or serum are at increased risk of acquiring this disease. The primary modes of transmission are direct contact with blood and serum specimens or by indirect contact with contaminated environmental surfaces. The presence of even small amounts of blood or serum on hands, whether from direct or indirect sources, can result in the hepatitis B virus gaining access to the vascular system by needle sticks, cuts and abrasions, or via nasal, oral, or ocular exposure. Infection control strategies should stress proper techniques for handling blood and containers, appropriate use of gloves, protective clothing and eye protection, frequent handwashing, good personal hygienic practices and the effective use of cleaning, disinfecting and sterilization techniques.

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NOTE: The Centers for Disease Control references, Morbidity Mort. Weekly Rep., are available from the U. S. Government Printing Office. The address is in the Editorial Column on page 3.