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## Laboratory

### Responsibilities.

#### Laboratory Head

- Review and formulate infection control policies.
- Enforce applicable command, federal, and state regulations
- Assure proper quality of equipment for handling infectious material.

#### Division Heads

- Ensure annual recertification of infection control policies through command annual training sessions.
- Assure adequate supplies of detergents, disinfectants, and paper supplies for environmental sanitation.
- Ensure compliance with infection control requirements.

#### Department and Division Training Officers

- Maintain records of staff participation in appropriate infection control education programs.

#### Laboratory Safety Officer

- Periodically inspects the Laboratory for potential infectious hazards.
- Assists in review of all infection control policies.
- Assures Laboratory accidents are reported to the Occupational Health Department.

#### Microbiology Branch

- Report communicable diseases to the Preventive Medicine Department.
- Report significant cultures to Infection Control Department (i.e., MRSA, VRE).
- Assist in preparing and presenting continuing education programs in infection control for the Laboratory Department.

### Employee Health.

- Enlisted and Officer personnel will comply with naval and command Occupational Health regulations regarding physical fitness and examinations.
- Significant illnesses are to be reported to the appropriate Branch/Section head by the affected individuals, and referral made to Occupational Health as appropriate.
- If an individual suffers a needlestick/sharps injury accident where exposure to blood and body fluids is possible, report the incident to the supervisor immediately and go straight to the Designated Emergency Department. Follow up with your local Occupational Health clinic within two business days of the incident.
- All healthcare workers will be immunized against hepatitis B, influenza, measles, mumps, rubella, and varicella (unless known to be immune) in accordance with hospital policy.

### Management of Laboratory Accidents.

#### Skin puncture or contamination:

- Think FAST, and follow NAVMEDCENPTSVAINST 6260.5F or latest version:
  - Flush the site: wash skin with soap and water. Flush mucous membranes with water.
  - Alert supervisor/acting supervisor immediately.
  - Straight to the closest Designated Emergency Department (ER, Acute Care Clinic).
  - Treatment time less than two hours.

- Complete Incident Report.
- Complete Quality Care Report NMCP 6320/12.
- Make an appointment with Designated Occupational Health Clinic ASAP.

### **Exposure to Tuberculosis.**

- Upon possible exposure to *M. tuberculosis* from infected patients, body fluid excrements, body tissues, or any source, a PPD is performed to establish a baseline and repeated in 6-12 weeks.

### **Viral Bloodborne Pathogens.**

The epidemic spread of AIDS has focused attention on the risk of laboratory-acquired infection with human immunodeficiency virus (HIV), the causative agent of AIDS. HIV, hepatitis B (HBV), and hepatitis C (HCV) are transmitted by blood or other infected body fluids. In addition, there are other viruses of concern to the laboratory worker including equine encephalomyelitis virus, the herpes virus, rabies virus, pox viruses, and many others. Precautions aimed at HIV, HBV, and HCV are generally sufficient to protect against all of these viruses. In addition to HIV, other primary or opportunistic pathogenic agents may be present in the body fluids and tissues of persons who are antibody positive or have AIDS-related complex (ARC) or full-blown AIDS.

- Laboratory-acquired AIDS or hepatitis:
  - Needlestick injuries are the most common route of laboratory-acquired infections. The risk of seroconversion following a needlestick is as low as 0.4% to 0.9% for HIV, but may be as high as 30% for HBV. Therefore, the risk of bloodborne transmission from inadvertent exposure is considerably less for HIV than for hepatitis B virus infection. Additionally, the HBV is able to survive on environmental surfaces for much longer periods of time than HIV, making it more likely to acquire this infection from spilled blood on the counter-top.
  - Hepatitis B is currently the most frequently occurring laboratory-associated infection. The incidence in some categories of laboratory workers is seven times greater than that of the general population. Hepatitis C is also known as a common pathogen in this risk population.
- Pregnancy:
  - Pregnant women are not known to be at greater risk of contracting bloodborne infections than other laboratory workers. However, if HIV infection develops during pregnancy, the infant is at risk of infection by perinatal transmission. Therefore, pregnant laboratory workers should be especially aware of “Universal/Standard Precautions” for handling patient specimens.
- Modes of transmission of Hepatitis B/C and HIV:
  - HBV can be present in very high concentrations in blood (about 1 billion tissue culture infectious doses [TCID/ml]); in contrast, HIV is usually found in low concentrations of up to 100 TCID/ml. HBV is therefore the worst-case condition in terms of efficiency of transmission. The efficiency of HCV transmission is lower compared with hepatitis B, because of a lower viral total in the blood.
  - HIV has been isolated from blood, semen, vaginal secretions, saliva, tears, breast milk, cerebrospinal fluid, and urine. It is likely that HIV is present in other body fluids, secretions, and excretions. However, only blood, semen, vaginal secretions, and possibly breast milk have been implicated in transmission of HIV to date.

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- HBV, HCV, and HIV may be transmitted in the laboratory directly by infectious blood, plasma, or serum inoculation due to needlesticks, scalpel cuts, skin punctures, or by contact with preexisting scratches, abrasions or skin lesions, or by contact with exposed mucous membranes via splashing or contact.
  - HBV can be transmitted indirectly from such common environmental surfaces as laboratory benches, test tubes, laboratory instruments, and other surfaces contaminated with infected blood et. al. It has been estimated that as little as 0.0004 ml of blood contaminated with HBV can transmit the disease. HBV can be transferred to the skin or mucous membranes by hand contact. The AIDS virus may be similarly transmitted, but no environmentally mediated transmission has been documented.
  - The fecal-oral route does not appear to be effective in transmitting either hepatitis B, hepatitis C, or HIV. Routine precautions used in the handling of feces should prevent transmission. However, fecal-oral infection may pose a hazard for hepatitis A virus (HAV) infection. Laboratory-associated infection with HAV does not appear to be an important occupational risk among laboratory personnel.
  - Airborne transmission of HBV, HCV, or HIV by inhalation of aerosol particles has not been documented. However, splashing, splattering, centrifuge accidents, or removal of rubber stoppers from blood tubes can produce droplet transfer into the mouth, eyes, and mucous membranes. This is not airborne transmission by aerosol, but rather transmission by direct droplet contact.
  - Although HBV may be stable in dried blood and blood products at 25° C for up to 7 days, the AIDS virus is less stable in the dried state. Drying causes a rapid reduction in HIV concentration. When highly concentrated HIV samples were dried at room temperature, approximately 90% of the virus was inactivated every 9 hours. In this study, HIV could be detected for only 1-3 days after drying. Cell-free HIV in tissue culture at room temperature could be detected for up to 15 days; cell-associated HIV could be detected only for 1 day. HIV is stable for a long period of time in the frozen or lyophilized state, and for extended periods at 4° C.
  - Survival of HIV in cadavers: Autopsies on AIDS patients should be delayed for 24 hours or more while the cadaver is refrigerated post-mortem as this has been shown to limit viral recovery in recent studies.

### **Bacteriologic Hazards.**

- The laboratory director and supervisors are responsible for bacteriologic hazards from the time a specimen is collected until it is removed for processing.
- Infections may be spread by several routes. The actual occurrence of an infection depends on both the virulence of the infecting agent and the susceptibility of the host.
  - Airborne: Droplets and aerosols may be formed by simply removing caps or cotton plugs or swabs from tubes. Heating liquids or needles too rapidly may also create an aerosol.
  - Ingestion: May occur through mouth pipeting, failing to wash hands after handling specimens, cultures prior to eating or smoking (all of which are forbidden in the laboratory).
  - Direct inoculation: Scratches, needles, broken glass, or other sharp contaminated objects may permit direct inoculation.
  - Skin contact: Some virulent organisms can enter through small cuts or scratches in the skin or through conjunctiva of the eye.

### **Universal/Standard Precautions.**

- Laboratory personnel must regard each specimen as a potential health hazard. Because the potential for infectivity of any patient's blood or body fluids cannot be known, "Universal/Standard Precautions" recommended by the Centers for Disease Control and Prevention (CDC) should be adhered to for all patients and for all specimens submitted to the laboratory. All blood, body fluids, tissue, secretions, and excretions must be handled as infectious specimens.
- "Universal/Standard Precautions" as enunciated by the CDC consist of the following points:
  - Routinely use barrier protection to prevent skin and mucous membrane contamination with blood or body fluids of all patients and specimens.
  - Wear gloves when:
    - Having contact with blood and body fluids, routine laboratory work, and phlebotomy.
    - Touching all laboratory specimens and tissues
    - Touching mucous membranes and non-intact skin of all patients.
    - Handling items contaminated with blood or body fluids, including specimen containers, laboratory instruments, counter-tops, etc.
    - Performing venipuncture, arterial puncture, skin puncture, and other vascular access procedures
  - Change gloves and wash hands between each patient.
  - Wear a mask and eye covering, or preferably a face shield, during procedures that are likely to generate droplets of blood or body fluids to prevent exposure of the mucous membranes of the mouth, nose, and eyes.
  - Wear a gown, apron, or other covering when there is a potential for splashing or spraying or body fluids.
  - Wash hands or other skin surfaces thoroughly and immediately if contaminated with blood or body fluids.
  - Wash hands immediately after gloves are removed.
  - Take extraordinary care to avoid accidental injuries caused by needles, scalpel blades, laboratory instruments, etc. when performing procedures, cleaning instruments, handling sharp instruments, and disposing of used needles.
  - Place used needles, skin lances, scalpel blades, and other sharp items into a puncture-resistant biohazard container for disposal. The container should be located as close as possible to the work area. Phlebotomists should carry puncture-resistant containers with them.
  - To prevent needlestick injuries, needles should not be recapped, purposely bent, cut, broken, removed from disposable syringes, or otherwise manipulated by hand.
  - Place large-bore reusable needles (i.e., bone-marrow needles, and biopsy needles) and other reusable sharps into a puncture-resistant container for transport to the reprocessing area.
  - Minimize the need for mouth-to-mouth emergency resuscitation procedures. Mouth pieces, resuscitation bags, or other ventilation devices should be used routinely.
  - Take care to minimize the formation of droplets, spatters, splashes, and spills of blood or body fluids.

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- Clean all surfaces exposed to blood and body fluids with a detergent solution followed by decontamination with an appropriate EPA-approved chemical germicide or a 1:10 bleach solution.

### **Handwashing.**

- Frequent handwashing is an important infection control measure. Hands must be washed:
  - Before patient contact.
  - After completing work and before leaving the laboratory.
  - After removing gloves.
  - Before eating, drinking, smoking, applying makeup, changing contact lenses, or using the lavatory.
  - Before all other activities which entail hand contact with mucous membranes or breaks in the skin.
  - Immediately after accidental skin contact with blood, body fluids, or tissues, hands or other skin areas should be thoroughly washed. If the contact occurs through breaks in gloves, remove the gloves immediately and wash the hands thoroughly.
- Washing with soap and water is recommended; however, any standard detergent product may be used. Follow NMCP policy for use of antibacterial hand sanitizer.
- No additional benefit has been established for washing with antiseptic soaps or antiseptics. Products that may disrupt skin integrity should be avoided. Using a moisturizing hand cream approved by NMCP may reduce skin irritation caused by frequent handwashing.

### **Gloves.**

- Gloves are to be worn by:
  - All phlebotomists while procuring specimens or blood units. Phlebotomists must change gloves between each patient, and immediately if the gloves become visibly contaminated with blood.
  - All laboratory personnel who come in contact with blood, serum, urine, cerebrospinal fluid, vaginal secretions, bronchopulmonary washings, body fluids, feces, or any material contaminated with any such substance.
- Wear disposable gloves and change them frequently. Change gloves whenever they become visibly contaminated with blood or body fluids, if physical damage occurs, and between each patient or donor. HBV, HCV, and HIV can be transferred from gloves to laboratory surfaces and then to hands. Remove gloves before handling telephones, computers, doorknobs, lab equipment, etc.
- Double gloving:
  - Wearing two pairs of gloves (double gloving) is recommended during autopsies and in other situations where large amounts of blood may be present.
  - In double gloving, the glove next to the skin may preferably be made of vinyl or polyethylene, both of which are durable; the external glove may preferably be made of latex, which is less likely to slip.
  - When latex gloves are worn for long periods of time defects through which blood seeps commonly develop. Various reports state that the failure rate of latex gloves may be approximately 1%.

- If the probability of a single latex glove failing is 0.01, that is 1 chance in 100, then the probability of both double gloves failing simultaneously is 0.0001, or 1 in 10,000.
- Concern has been expressed over wearing gloves during phlebotomy and other procedures because gloved hands are less sensitive. However, thin disposable polyethylene gloves that preserve sensitivity are available, and the risk of performing these procedures with uncovered hands is too great to assume. Therefore, gloves must be worn.
- Computer terminals are labeled as clean or contaminated. Do not wear gloves while working on a “clean” computer.

### **Facial Protection.**

- Facial barrier protection will be used if there is a potential for splashing or spraying of blood or body fluids. Splashing is usually accidental, but it may be unavoidable under some circumstances.
- When removing rubber stoppers from specimen tubes, minimize spattering of blood or serum by covering the tube with a gauze pad while removing the stopper. Discard the gauze pad into the biohazard waste whenever it becomes grossly contaminated with blood.
- Wear masks and/or facial protection if mucous membrane contact with blood or body fluid is anticipated. Bench-top protective shields are in place in areas where the potential for spattering blood exists. Work behind these shields or under a hood whenever possible.
  - Full-face shields made of lightweight plastic (similar to those worn by welders) are the preferred personal protective equipment for facial protection. They offer excellent protection of the entire face and neck region. They are easily decontaminated.
  - A surgical mask offers protection of the nose and mouth. Either soft or preformed masks are effective.
  - Ordinary prescription glasses are not adequate eye protection. Better protection is afforded by plastic, wrap-around safety glasses that fit over regular glasses. If there is a substantial hazard of spattering, goggles with a plastic cushion seal are preferred.
- Surgical caps may be worn if extreme spattering is anticipated. However, such events are rare in the lab.
- Biological safety cabinets (class I or II) or other primary containment devices (i.e., centrifuge safety cups) should be used whenever there is a high potential to produce droplets of infectious materials. This includes blending, sonicating, vigorous mixing (vortexing), and homogenization.

### **Laboratory Coats and Gowns.**

- While in the laboratory and working with or near specimens, wear a disposable long-sleeved lab coat with a closed front or a long-sleeve gown. Personnel who wish to wear a lab coat on the wards for ancillary testing should wear a clean one. Lab coats may not be taken home to launder.
- Remove the lab coat before leaving the laboratory (i.e., for breaks, lunch, etc.)
- Change gowns and lab coats immediately if grossly contaminated with blood or body fluids. This will prevent blood seeping through and contaminating street clothes or uniforms or skin. Change at appropriate intervals to ensure cleanliness.
- Wear disposable plastic aprons over your lab coat if there is a significant probability that blood or body fluids may be splashed on yourself. At the completion of the task being performed, discard the apron into a biohazard container.

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**Environmental Controls.**

- Areas where body fluids are collected, centrifuged, transferred, and handled will be considered hazardous areas.
- Food and beverages will not be stored in refrigerators containing chemistry/biological agents/samples or blood or blood components. Food may be stored only in refrigerators designated for that purpose (staff lounge).
- Only authorized personnel should be allowed in the laboratory, casual visitors should not be admitted. Non-laboratory personnel should be closely supervised and instructed to use personal protective equipment if near specimen handling areas to ensure their protection and that they do not cause a hazard for lab staff.
- Decontaminate work surfaces at the end of each shift or completion of procedures or when overtly contaminated.
- Eating, drinking, applying cosmetics, and smoking are not permitted in the work area. Nail biting, smoking, eating, and other hand-to-nose, hand-to-mouth, and hand-to-eye actions may introduce pathogens or other hazards to your body.
- Housekeeping:
  - Bench tops are wiped down on each shift with an EPA-approved hospital disinfectant (*e.g.* Sani-Wipes) and allowed to dry.
  - All incubators are cleaned at least monthly.
  - All floors are mopped with an EPA-approved hospital disinfectant weekly or more often as needed.
  - Cabinets and walls shall be washed or wet dusted with disinfectant solution as often as needed.
  - Centrifuges will be cleaned with disinfectant when soiled or contaminated.
- Biohazardous waste disposal:
  - All biological wastes are discarded into red biohazard bags in accordance with the hospital Regulated Medical Waste Policy.
  - All biologically contaminated material and wastes are autoclaved to sterilize prior to disposal. Autoclaves must be monitored for appropriate temperature and pressure control.
  - After use, needles and syringes are to be discarded into large red impervious sharps containers. Close the container when about 1/2 to 2/3 full, then seal it and autoclave it.

**Disinfection.**

- Procedures and products:
  - Sterilization and disinfection procedures generally used in hospitals are able to disinfect medical devices and instruments contaminated with blood or other body fluids.
  - HBV and HIV can be inactivated by several intermediate to high-level disinfectants. HAV and HCV may be more resistant to physical and chemical agents than most viruses. Conventional sterilization and disinfection processes that use a tuberculocidal and virucidal hospital disinfectant can be relied upon to inactivate HBV.
- Decontamination of blood or body fluid spills:
  - Warn others of the hazard, and isolate the spill.
  - If clothing is significantly contaminated, remove it and place it in a biohazard bag for destruction.

- Wear gloves and a gown for the cleanup.
- Absorb the blood with disposable towels and remove all visible contamination.
- Wipe down the spill site with disposable towels soaked in a dilution of household bleach (1:10). Sodium hypochlorite can be used to decontaminate laboratory work surfaces; it can also be used to decontaminate many lab instruments.
- Place all towels and sponges used to decontaminate the spill into a biohazard container. Handle the material in the same manner as infectious waste.
- Decontamination of spills in microbiology:
  - All spills of microbial contaminants are first flooded with disinfectant, covered with paper towels, and let stand 30 minutes. Then, wipe up the spill with paper towels followed by another disinfectant wipe of the involved area. Autoclave all waste materials.
  - **Note on bleach concentration:** The concentration of disinfectant used depends on the nature of the contaminated surface. If the surface is porous and cannot adequately be cleaned before disinfection, 5.25% sodium hypochlorite (5,000mg/L of free available chlorine) may be used (1:10). If the surface is hard and smooth and has been cleaned, 0.05% sodium hypochlorite (500mg/L of free available chlorine) is sufficient (1:100).
- Household bleach is used as an intermediate-level disinfectant. The commercial product is usually a 5.25% solution of sodium hypochlorite (50,000mg/L of free available chlorine). Therefore, commercial bleach may be used at a 1:10 (5,000mg/L) or 1:100 (500mg/L) dilution according to the type of surface.
- All dilutions of bleach should be made up daily with tap water to prevent loss of germicidal action.
- Time of exposure to decontaminant/disinfectant:
  - The time of exposure to the diluted bleach solution may be brief. A 1:10 dilution inactivates HBV in 10 minutes and HIV in 2 minutes.
  - Bleach solutions are less effective in the presence of high concentrations of protein. Therefore, first remove as much liquid blood or serum as possible before decontamination.
  - If a surface or medical device is contaminated with dried blood, remove all of it before disinfection. The dried blood should be wet and softened with diluted bleach before being scraped off to prevent scattering potentially infectious material and to facilitate complete removal. If complete removal is not possible, expose the surface to diluted bleach for a longer time (20-30 minutes may be necessary).
  - For large spills of cultured or concentrated infectious agents, the spill should first be flooded with disinfectant, and then allowed to stand for 20 minutes before further decontamination.

### Collection of Blood Specimens.

- Isolation procedures. Follow hospital policy found in Chapter 1 of the Infection Control Manual.
  - “Universal/Standard Precautions”
  - CDC Transmission Based Precautions
- Personnel with acute infections may not have direct patient contact.
- Regard all blood specimens as potentially infectious.

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- Take care not to spill or splash blood on environmental surfaces, the patient, or yourself. Any environmental contamination which results should be decontaminated immediately.
  - Non-adsorbent paper may be used to cover environmental surfaces and is discarded after use.
  - Special diligence should be paid to avoid self-inflicted needlesticks/sharps injuries.
  - Gloves and a laboratory coat/gown must be worn when collecting blood specimens.
  - Use of syringes, needles, and other sharp instruments should be avoided if possible. Discard used needles and other sharp objects into the puncture-resistant sharps containers provided.
  - Do not recap needles. Needles must not be re-sheathed, purposefully bent, broken, removed from disposable syringes, or otherwise manipulated by hand.
  - Fill evacuated tubes by their internal vacuum only. If a syringe has been used, the blood can be transferred to an evacuated tube by puncturing the diaphragm of the rubber stopper and allowing the correct amount of blood to flow slowly into an evacuated tube do not exert pressure on the syringe plunger. This may cause the tube stopper to pop off, spraying blood.
  - When using a syringe to inoculate culture bottles, do not force blood into the bottle.
  - Phlebotomy and arterial puncture are frequently accompanied by the leakage of blood from the puncture site. Press dry gauze square onto the puncture site until the bleeding stops. Then, clean the skin with an antiseptic such as alcohol or povidone-iodine and cover it with an adhesive bandage.
  - Skin puncture, of necessity, causes the contamination of the skin surface and poses a potential hazard to the lab worker. The patient is frequently a newborn or infant who is moving about, and accidental fingersticks are commonly self-inflicted by the lab worker. Extreme care is warranted.
  - After sample collection, pressure is usually applied with a dry gauze pad until bleeding stops. Then, clean the skin with an antiseptic such as alcohol or povidone-iodine and cover with an adhesive bandage if necessary or requested (skin punctures in infants less than 2 years old should not be covered with an adhesive bandage).
  - Collection devices (i.e., capillary tubes) are frequently contaminated on the outside. Place these into a secondary container (i.e., a screw-top test tube) before transporting to the lab. Filter paper used to collect blood must also be placed into a secondary container.

### Handling of Specimens.

- Handling infectious specimens (including HBV, HCV, and HIV)
  - “Universal/Standard Precautions” will be followed for the handling of all specimens.
  - Submit all specimens in a leak-proof secondary container (i.e., Zip-Lock plastic bag). Do not use metal clips to secure the bag.
- Collection:
  - Upon being obtained from the patient, place the specimen into a leak-proof primary container with a secure closure. Snap-top closures may produce a spray when opened and their use should be avoided. Care should be taken not to contaminate the outside of the primary container.
  - Protect laboratory requisition slips from contamination, and, if necessary, separate them from the primary container.
  - Bronchopulmonary specimens are frequently collected from patients with AIDS to demonstrate the presence of acid-fast bacilli or *Pneumocystis carinii*. If the primary

container is contaminated on the outside, it should be decontaminated and placed into a secondary container before being transported to the lab. However, all containers of bronchopulmonary washings or sputum should be handled as if they are contaminated on the outside.

- Place urine specimens into a securely sealed primary container (screw-top containers are preferred).
- Place cerebrospinal fluid and other body fluids into screw-top containers.
- Transportation:
  - Place all specimens into a sealed leak-proof primary container as appropriate for the specimen. Place it into a leak-proof secondary container (i.e., a Zip-Lock plastic bag) along with the request form.
  - Personnel who transport specimens should be trained in safe handling practices and in decontamination procedures in case of a spill.
- Receipt in the laboratory:
  - Examine all specimens for visible contamination or breakage.
  - Do not accept specimens with gross external contamination. If left at the lab, decontaminate the container before sending it to the work areas for testing.
  - Discard and replace visibly contaminated lab requisitions.
  - No specimen will be accepted by the lab that contains a needle, whether capped or not.
  - If specimens must be centrifuged, a sealed cap to prevent aerosol formation must cover them.
- Storage of specimens:
  - Store specimens in a secure, well-organized, and separate area with restricted access. Do not store specimens with reagents. Do not store food or drink with the specimens. Mark the container, refrigerator, or freezer as containing a biohazard.
  - Specimens to be frozen should be placed into containers designed for low-temperature storage and then into a secondary container. If a tube breaks in a freezer, it should be discarded. If the specimen must be salvaged, and is not in a secondary container, the frozen specimen should be placed into a secondary container, be allowed to thaw, and then transferred to a new container and refrozen.

### **Procedures for Specialty Divisions/Branches/Sections.**

#### **Accessioning/Blood Collection**

- Lab personnel are responsible for the collection of blood specimens for outpatients.
- Routine venipuncture should be done, preferably on an arm vein, using proper aseptic technique and disposable materials.
- Arms for venipuncture are prepared in the standard fashion.
- Vacutainer holders are discarded with needle after each patient.
- Tourniquets are discarded if visibly contaminated.
- Remove gloves and wash hands immediately if contaminated. Wash hands often during a shift.
- Contaminated materials are discarded into biohazard bags and autoclaved. Never recap needles. Used needles and syringes are placed into a puncture-resistant container that is then sealed and autoclaved.

- Venipuncture chairs are cleaned with disinfectant solution at least once a day and whenever contamination has occurred.

#### Blood Bank

- All blood and blood products are handled as if they are contaminated and infectious.
- A patient will not receive blood or blood products before it has been completely tested for all pathogens.
- All reported cases of post-transfusion hepatitis occurring within six months of transfusion are thoroughly investigated. The work-up includes investigation of blood donors whose products were transfused.
- Blood bags from transfusion reactions due to possible contamination of the blood unit are cultured and Gram stained to rule out contamination as clinically indicated.
- Wear gloves when drawing blood or performing fingersticks from volunteer donors. All phlebotomies are performed in accordance with AABB, FDA, and CAP regulations for both blood mobile and pheresis center operations.
- All waste blood components derived from pheresis procedures along with disposable equipment are autoclaved or incinerated.
- Blood bank workers who draw blood from patients for therapeutic purposes or from patients for autologous transfusion must wear gloves and a lab coat/gown.
- Refrigerators used for blood storage contain only blood samples, blood products, and reagents for blood typing.
- Blood is collected into a sterile closed system container.
- Sterile disposable items (i.e., cell washer bowls and harness) are properly stored and discarded after use.
- All donor blood sample are screened for HBsAg, HbcAb, HTLV I/II, syphilis, HIV 1/2, Anti-HCV, T.cruzi, West Nile Virus, HIV-1 RNA, HCV RNA, HBV DNA, unexpected RBC antibody and CMV for selected units.
- All blood product containers must be returned to the Blood Bank in the event of a transfusion reaction. After investigation is complete these are then autoclaved.
- Blood bank workers should be especially careful when handling returned units of blood, which are often contaminated externally with blood from the patient and the blood bag. The blood bag should be placed into a secondary container (i.e., a Zip-Lock plastic bag or insulated bag) on the ward before being returned to the Blood Bank. The needle must be removed on the ward, by clamping or tying the tubing, and disposed of into a needle container. The blood bag must be secured to prevent leakage of contents during transit to the Blood Bank.
- All patient specimens are discarded after the required storage period and are incinerated.
- All expired blood products are incinerated.
- Mechanical pipetting devices are used for all liquids in the laboratory. Mouth pipetting is prohibited.
- Make all transfer of fluids with pipettes or other mechanical devices; do not decant.

#### Chemistry

- In addition to the requirement for wearing gloves when working with patient samples, gloves must be worn when changing dialyzer membranes for sample tubing on autoanalyzers.
- Autoclave all rubber stoppers, serum tubes, sample cups, serum, and other fluids except urine, and other disposable equipment that contact patient specimens, before disposal.

- Decontaminate spills of clinical material as soon as possible.
- Urines for routine analysis or for other chemical analysis are flushed into the hospital sewage disposal system with copious amounts of water.
- Diagnostic serum specimens or controls carry a risk of infectious hepatitis, and possibly AIDS and Creutzfeld-Jakob disease. They will be handled in a manner to prevent them from contacting the skin and mucous membranes.

#### Hematology

- Disposable analyzer trays, specimen cups, pipette tips, and other contaminated materials are autoclaved as biohazardous waste prior to disposal.
- Patient specimens are re-stoppered after analysis, stored for seven (7) days, and are then autoclaved and discarded.
- Clay slabs used to seal microhematocrit tubes become contaminated with blood and possibly small fragments of glass. Do not recycle them; that is, the clay slabs should not be reformed to extend their life. Instead, replace them at appropriate intervals.
- Pay special attention to frequent decontamination of sedimentation tube racks.

#### Immunology/HIV Testing

- Hepatitis and HIV testing is performed in the Infectious Disease Department.

#### Microbiology

*All cultures are potential pathogens – use careful techniques at all times.*

- Bacteriology:
  - Large numbers of plates should be handled in baskets. Test tube racks or trays are required for tubed cultures. Do not place tubes in glasses or paper cups.
  - Needles and loops should be sterilized so as not to cause spattering of material on heating.
  - Benches are disinfected in the morning before work has begun, at the end of each shift, and when contaminated.
  - All discarded specimens and cultures are autoclaved. Urines are poured into the hospital sewage disposal system and are flushed with copious amounts of water.
  - Fresh tissue submitted for culture is ground in a Class II (or better) biological safety cabinet.
  - All sputa specimens are plated inside the biological safety cabinet.
  - Cultures with suspected mold growth or tuberculosis are referred to the Mycology Lab and sent there sealed and unopened.
  - In addition to the requirement for wearing gloves when working with patient samples, gloves are to be used during manipulations in the biological safety cabinet or while cleaning spills or other contaminated material.
  - Tissue grinders are disposed of after use.
  - Take special care when entering bottles of media with a syringe, because a positive differential pressure may exist between the contents of the bottle and the atmosphere; spraying of the contents may result. Such procedures should be carried out in a biological safety cabinet.
  - Place needles and syringes used for blood cultures into a puncture-resistant container and decontaminate by autoclaving before discarding.
- Mycology, Mycobacteriology, and Serology:

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- All manipulations of clinical specimens for fungal or mycobacterial diagnosis are performed in a biological safety hood.
  - Mask, gloves, and lab coat/gown are worn whenever using the biological safety cabinet, centrifuging clinical specimens, staining smears, or examining cultures.
  - Centrifugations are carried out with shielded specimen cups for diagnosis of acid-fast specimens.
  - All discarded cultures, clinical specimens, blood tubes, sera, and disposable garments are placed in double autoclave bags and autoclaved before disposal into the general waste.
  - Parasitology:
    - Vector 10 only – no further Parasitology is performed at NMCP.
  - Virology and Chlamydia:
    - Work only in the Class II biological safety laminar flow hood.
    - Wear gloves for all manipulations of open culture tubes and clinical material.
    - Cell lines of non-human origin may harbor potentially virulent pathogens. Exercise caution when handling them.
    - Discard all waste into the designated reservoir to which 5% hypochlorite solution is added to maintain a basic pH. As this smaller reservoir fills, pour its contents into the larger reservoir. Autoclave both at least once a week and discard effluent into the hospital sewage disposal system.
    - Decontaminate the hood with an appropriate disinfectant after each use.
    - Cover any spill with hypochlorite 5% solution and paper towels. Allow it to sit for 30 minutes before wiping up.

#### Anatomic Pathology

- Cytology:
  - Gloves will be worn at all times when all specimens are being processed.
- Necropsy Pathology:
  - The clinical record should be reviewed for evidence of infectious disease or possible radiation contamination of the deceased.
  - Cleanliness and care in performing the autopsy is essential. Spills should be cleaned when the necropsy is completed.
  - Prosectors will wear the appropriate Personal Protective Equipment as required by the OSHA bloodborne pathogens standard (i.e., gloves, waterproof aprons and gowns, goggles or protective eyewear, face shields, masks, and hair cover if needed). Shoes or shoe covers specifically for use during autopsies should be maintained in the morgue. Do not leave clothing used during the autopsy in the morgue.
  - Never handle autopsy material with bare hands. Use adequate glove coverage and, if damaged, change gloves.
  - Personal clean-up should be done after completion of the autopsy. Instruments and surfaces contaminated during post-mortem procedures will be decontaminated with appropriate chemical germicide.
  - There is to be no eating, drinking, smoking, insertion of contact lenses, or application of cosmetics in the morgue work area.
- Surgical Pathology:

- All personnel who handle surgical specimens should wear gowns, aprons, and gloves. Wear eye protection if there is a chance of splattering from specimens.
- With the exceptions of tissue for frozen section diagnosis, special diagnostic techniques, or for culture requiring division of the specimen, all other specimens are to be submitted in 10% neutral buffered formalin.
- Routine specimens should be fixed as soon as possible. If unfixed specimens are to be retained they should be placed into double-sealed plastic bags and refrigerated or frozen, with “biohazard” labeling. Consider the exterior of all specimen containers to be contaminated.
- Specimens received fresh will be manipulated using gloves. Granulomas or other specimens possibly harboring infectious agents will be examined in the bacteriology biological safety cabinet using sterile instruments.
- Handling specimens: Specimens, including placentas, should be placed into sealable leak-proof containers, sealable plastic bags, or fixative in the operating room. The primary container, including bottles of fixed tissue, should be placed into a secondary outer sealed container before transport to the lab. The lab requisition should be protected from contamination, preferably in a plastic bag. If the requisition becomes contaminated, it should be discarded and replaced.
- Frozen sections pose a high-risk because accidents are common. Freezing tissue does not inactivate most infectious agents. Freezing propellants under pressure should not be used for frozen sections as they may cause the spattering of droplets of infectious material. A face shield and gloves should be worn during frozen sections. The contents of the cryostat should be considered to be contaminated and should be decontaminated at regular intervals. The trimmings and sections of tissue that accumulate in the cryostat should be considered to be contaminated. Be extremely careful handling microtome knives. Wear stainless steel mesh gloves when changing knife blades. Solutions for staining frozen sections should be considered to be contaminated.
- Should a contaminated tissue specimen be processed in the cryostat, the cryostat will be closed until decontaminated. First, defrost the cryostat, disassemble the mechanism and soak it in Cidex. Wash the interior with a suitable disinfectant. Wear gloves during this cleaning process.
- Imprints, cytological smears, bone marrow preps, and body fluid smears should be considered to be contaminated until fixed with formalin or alcohol, or until stained and covered. Air-dried slides are infectious for a period of time after preparation.
- Body fluids used to prepare smears or cell blocks are extremely hazardous. While decanting, fractioning, or centrifuging large quantities of fluid, workers should wear double gloves, lab coat/gowns, aprons, and facial protection. If the risk of droplet dispersal is high, the procedure should be done in the biological safety cabinet.
- Teeth, calculi, implants, and foreign bodies should be handled as tissue. If they cannot be fixed, they should be stored in a double-sealed leak-proof container and labeled as a biohazard.
- The surgical dissecting area should be decontaminated in the same manner as the autopsy area. The outside of all containers used to store fixed surgical specimens should be considered to be contaminated. Paraffin blocks and covered slides are not considered infectious.

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- After a diagnosis has been rendered in a given case, the tissue container is placed into double plastic bags which are put in the red wheeled carts and labeled as pathology specimens for incineration.
  - Instruments used to examine unfixed tissue will be placed in Cidex between uses.
  - Used scalpel and other blades will be collected in a marked container which is periodically autoclaved.

### **Biological Safety Cabinets.**

- Class II biological safety cabinets, when used in conjunction with good microbiological techniques, provide an effective partial containment system for safe manipulation of moderate to high-risk microorganisms. Personal protection provided by Class II cabinets is dependent on the inward airflow. The Class II vertical laminar-flow biological cabinet is an open-fronted, ventilated cabinet with an average face velocity at the work opening of at least 75 feet per minute. This cabinet provides a HEPA-filtered, recirculated mass airflow within the workspace. HEPA filters also filter the exhaust air from the cabinet. It protects the laboratory environment from infectious aerosols generated within the cabinet.
- The use of these cabinets alone, however, is not appropriate for containment of highest-risk infectious agents because aerosols may accidentally escape through the open front.
- The use of a Class II cabinet in the Microbiology section offers the additional capability and advantage of protecting materials contained within it from extraneous airborne contaminants. This capability is provided by the HEPA-filtered, recirculated mass airflow within the workspace.
- Biological safety cabinets or other appropriate personal protective or physical containment devices are used whenever:
  - Procedures with a high potential for creating infectious aerosols are conducted. These may include centrifuging, grinding, blending, vigorous shaking or mixing, sonic disruption, opening containers of infectious materials whose internal pressures may be different from ambient pressures.
  - High concentrations or large volumes of infectious agents are used. Such materials may be centrifuged in the open laboratory if sealed heads or centrifuge safety cups are used and if they are opened only in a biological safety cabinet.
- It is imperative that Class I and II biological safety cabinets are tested and certified in situ at the time of installation within the lab, at any time the BSC is moved, and at least annually thereafter.
- As with any other piece of laboratory equipment, personnel must be trained in the proper use of the biological safety cabinets. Of particular note are activities which may disrupt the inward directional airflow through the work opening of Class I and II cabinets. Repeated insertion and withdrawal of the workers' arms in and from the work chamber, opening and closing doors to the laboratory or isolation cubicle, improper placement or operation of materials, equipment while it is in use are demonstrated causes of the escape of aerosolized particles from within the cabinet. Strict adherence to recommended practices for the use of biological safety cabinets is as important in attaining the maximum containment capability of the equipment as is the mechanical performance of the equipment itself.

### **Analytical Instruments and Procedures.**

Centrifuges:

- Centrifuges used in the lab are relatively safe to operate. In normal use, when there is no tube breakage, airborne particles (aerosol or droplets) are not generated.
- Use plastic centrifuge tubes with seal-forming screw tops whenever possible.
- Inspect all glass specimen tubes before being used; cracked or scratched tubes should not be used.
- If defective tubes or excessive speeds are used, a tube may break causing the release of sample, droplets, and possibly aerosol into the centrifuge bowl. The release of these potentially hazardous materials can be mitigated by using covers or specially designed sealed containers in which tubes are held during centrifugation. This is standard practice in TB laboratories.
- The centrifuge covers are not opened until the specimens have ceased spinning.
- Should a tube containing a specimen break in the centrifuge:
  - Stop the centrifuge as soon as possible.
  - Leave the centrifuge cover closed for a few minutes after motion has ceased.
  - Using gloves, remove all unbroken tubes, wipe them with disinfectant and transfer the contents to new tubes.
  - Remove the centrifuge cup with the broken tube.
  - Carefully remove the broken glass with forceps or hemostat.
  - Place the pieces into a glass disposal box prior to autoclaving.
  - Wipe the non-removable centrifuge surfaces with 10% bleach, let stand for 30 minutes, then remove the bleach by wiping with distilled water.
- To avoid spills, do not overfill the tubes. Tubes should be capped.
- Centrifuges should not be placed into a biological safety cabinet if the motor produces strong air currents because the air turbulence generated may disrupt the laminar airflow.

#### Automated Analyzers:

- Sample probes, which move rapidly or deliver fluid rapidly, may generate a fine spray of sample. Examine the surface of the analyzer for visible contamination and decontaminate if necessary. Shields may be needed around the probe to contain any spray.
- Wiping sample probes after sampling must be done with extreme caution. Gloves should be worn. Gauze pads should be used and discarded frequently to avoid their being soaked through with blood or serum.
- Handle sample trays which contain a number of plastic or glass sample cups or tubes with caution to prevent spillage of specimens. Fill sample cups with mechanical devices (i.e., Pasteur pipettes). Do not decant samples.

#### Tissue Homogenizers and Pulverizers:

*These instruments, used with frozen tissues, should be operated within a biological safety cabinet, or the worker should use appropriate face and body personal protective equipment.*

#### Service and Maintenance:

- Carry out all service and maintenance activities under “Universal/Standard Precautions”. The effluent from lab devices may be hazardous. Take special care in opening fluid lines under pressure to avoid spraying droplets. Decontaminate instrument components before reusing.
- Outside service personnel must wear gloves and other personal protective equipment to provide appropriate barrier protection if potentially exposed to blood and body fluids.

Instruments used by service personnel to maintain or repair equipment should be decontaminated.

- Instruments or components returned to vendors or to Medical Repair for service must have all dried blood or body fluids removed and must be decontaminated before leaving the laboratory.

## Autopsy Protocol for AIDS and Other High-Risk Potentially Infectious Cases

### **General Considerations.**

Whenever possible, the autopsy should be carried out during usual working hours and with adequate staff. Autopsies should not be rushed as this may increase the likelihood of an accident. If multiple autopsies are to be carried out sequentially, those with the greatest infectious risk should be done last.

The prosector should not be fatigued at the time of the autopsy. If more than one autopsy table is in the morgue, the table with the lowest traffic should be used for high-risk autopsies.

Note: All autopsies should be considered to be infectious regardless of the patient's diagnosis. The entire autopsy suite and its contents should be considered to be a biohazard. The door to the autopsy suite should be posted with a biohazard sign.

It is prudent to consider all autopsies high-risk because acquired hepatitis B has been documented from inoculation at an autopsy. Ten percent formalin (3.7% formaldehyde), which is present in at least 10 times the volume of tissue and which has adequately permeated the tissue, will inactivate all important infectious agents except the agent of Creutzfeldt-Jacob disease. Embalming fluid containing glutaraldehyde is similarly effective.

The performance of autopsies on patients diagnosed with Acquired Immunodeficiency Syndrome (AIDS), viral hepatitis, Creutzfeldt-Jakob disease, tuberculosis, and other infectious diseases with a risk of transmission to laboratory personnel requires great care. Although no cases have been reported of the HIV virus having been transmitted as the result of an autopsy, the experience with AIDS is not sufficiently thorough to exclude the possibility of autopsy related transmission: autopsy precautions for pathologists and morgue personnel are those recommended for other high-risk or potentially high-risk autopsies. It should be remembered that occasionally persons infected with HIV might die of other causes before they develop AIDS.

The following recommendations will be followed:

- The performance of the autopsy must be approved by the Head, Laboratory Medicine Department in accordance with NAVMEDCENPTSVAINST 6510.2E, 23AUG85.
- The pathologist will establish the goals of the autopsy with input from the attending clinician. The extent of the examination and dissection will be kept to that which is essential for the individual case under study.
- Autopsies should be performed by at least three people, two with direct involvement in the dissection (prosector and morgue attendant) and a third person to act primarily as a circulator. The two persons directly involved in the dissection should remain at the autopsy table and avoid contamination of the surrounding area. Briefly, the circulator should assist in obtaining instruments and containers, and should function to avoid contamination of the areas outside the immediate dissection area.
- Observers will be kept to an absolute minimum.
- Autopsies on AIDS patients should be delayed for 24 hours or more while the body is refrigerated post-mortem as this has been shown to limit viral recovery.

- Use of the “downdraft” autopsy table is highly recommended for any high-risk potentially infectious autopsy case. This special table design virtually eliminates the potential of aerosolization of infectious particles.
- Autopsies on cases suspicious for or those diagnosed with Creutzfeldt-Jacob Disease should not be performed at this institution. These autopsies require special procedures and decontamination of which the risks involved greatly outweigh the foreseeable benefits. The unconventional properties of the spongiform encephalopathy agents combined with their extreme resistance to decontamination make these autopsies and all the tissues extremely hazardous.

### **Bedside Preparation.**

- Preparation of the body should follow general recommendations utilizing “Universal/Standard Precautions”.
  - All intravenous lines, nasogastric tubes, endotracheal tubes, catheters, electrical impulse devices, soiled bandages, and clothing should be removed and discarded at the bedside, if no post-mortem is required.
  - All open lesions, cutdowns, and all unnatural openings in the skin should be freshly bandaged.
  - The genitals should be covered with a sanitary napkin if oozing is present.
  - The penis may be ligated if appropriate.
  - If rectal sphincter tone has relaxed, the anus should be covered with a sanitary napkin.
  - The body should be placed in a leak proof body bag for transportation to the morgue.
- If a post-mortem exam is to be performed, it may be desirable to leave IVs, catheters, etc. inserted in the body to allow full clinical appreciation of the therapeutic measures in use at the time of death. In such a case, the lines should be clamped or tied at the bedside before transporting the body to the morgue. Morgue personnel should be extremely cautious when removing these devices.

### **Morgue Personnel.**

- Personnel present during an autopsy should be limited to a prosector, an assistant (if desired), and a circulator. Immunosuppressed individuals or persons with uncovered wounds or dermatitis should not actively be engaged in the autopsy. Pregnant women should not participate in autopsies. This is based on the risk to the fetus should the woman be infected with HIV and concern over the massive exposure to cytomegalovirus commonly present in patients with AIDS. “Universal/Standard Precautions” and good laboratory practices should be followed.
- The circulator is a trained individual who remains “clean”, avoiding direct contact with contaminated tissues and body fluids, assists the prosector, and generally facilitates the performance of the autopsy, while limiting any contamination of the autopsy room, equipment, and containers. The circulator will wear protective clothing including a gown and gloves. If these become contaminated, they should be changed immediately. The circulator’s tasks may be outlined as follows:
  - The circulator prepares the room and equipment for autopsy.
  - The circulator prepares fresh sodium hypochlorite solution from commercial bleach solution (diluted 1:10) and has this available in bottles (empty plastic one-gallon containers can be stored for this purpose) for swabbing surfaces or soaking instruments.

- Prepares the impervious bags for bagging soiled linens from the stretcher as well as for the gowns and scrub suits which are deposited in impervious bags after the autopsy procedure is completed. Also prepares double bags for regulated medical waste disposal. Regulated medical waste is disposed of in accordance with hospital policy.
- Assists in the collection of all culture materials, such as heart, blood, swabs, body fluids, and tissue samples by bringing clean containers to the table in which material can be deposited and helping the pathologist with the inoculation of blood culture bottles. Lights the propane gas cylinder for the searing spatula. The pathologist flames his knife before cutting into the tissue from which cultures have to be collected after the outer surface has been seared with the spatula. The circulator can then stab the swabs into the tissue and place them into clean vials. He takes care of all the paperwork associated with the collection of the specimens. In this way the pathologist will not contaminate the outside of culture tubes and containers, and the specimens can be transported to the microbiology lab without presenting a danger to the staff in handling them.
- The circulator hands any instruments, supplies, etc., to the pathologist so that door handles and cabinet surfaces are not contaminated during the necropsy procedure.
- He records the organ weights on the protocol or on the blackboard and takes care of dictating equipment distant from the autopsy table. He should be prepared to take descriptive notes. He takes pictures, if necessary.
- He can adjust the head lamp and microphone over the autopsy table without contaminating these structures.
- At the completion of the autopsy he holds up the linen bags to receive contaminated scrub suits and gowns and collects any regulated medical waste. Liquid waste around the autopsy table, and bits of tissue left in drains at the autopsy table are mopped up.
- He handles the container in which tissues for fixation are to be dropped. He holds this out to the pathologist so that the latter does not have to touch the outer surface of the container. He also receives processed organs in a large, heavy gauge double plastic bag for later disposition.
- Any drops of blood or fluid that fall on the floor around the autopsy table can be wiped up immediately by the circulator with paper towels and 1:10 bleach solution, thus minimizing soiling of the autopsy room floor.
- He acts as communicator with physicians, nursing supervisors, funeral directors, etc., so that the prosector does not have to hold the telephone receiver during the autopsy procedure.
- In the manner described above, using an extra person as a circulator during the autopsy, contamination of inanimate surfaces by blood or fluid from an infected body will be limited to the autopsy table and can be prevented in the remaining areas of the autopsy suite. This will simplify post-mortem clean up. It will also prevent accidental exposure of personnel, other than those directly involved in the autopsy, to contaminated materials.

### **Barrier Protection.**

- Barriers are especially important during an autopsy because of the exposure of personnel to large amounts of blood and the high frequency of accidents. During autopsy, prevent contact of skin, conjunctivae, and other mucous membranes with blood and other body fluids. The following protective devices, all of which should be disposable or easily decontaminated, are recommended:

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- Caps or hoods that completely cover the hair.
  - A plastic face shield covering the entire face and neck region, or safety goggles which have a cushion seal. Wrap-around safety glasses, which fit over ordinary prescription glasses, may be worn, but do not fully protect the eyes. Ordinary glasses do not offer adequate protection.
  - Surgical masks (in conjunction with goggles) to cover the mouth and nose (if a plastic face shield is not worn).
  - Water-impermeable garb. A long-sleeved jump suit that covers the body from neck to feet is preferred; a long-sleeved surgical scrub shirt and pants are adequate. The circulator and observers may wear a surgical gown.
  - A plastic apron worn over the protective garb by all those present at the autopsy table and circulator.
  - Double gloves. The outer glove should cover the cuff of the sleeve and be latex to afford slip resistance. The inner glove may be latex, or preferably plastic, to afford durability. Polyethylene gloves of elbow and shoulder length are available. The use of shoulder-length plastic gloves adds additional protection to the arms from gross blood contamination. Plastic sleeve covers are available and offer similar additional protection. The circulator may wear single gloves. In the interest of safety, gloves that resist accidental puncture may be worn as the outer glove. Although tactile sensitivity is decreased, the added safety provided is substantial. Heavy neoprene, latex, nitrile, or butyl gloves intended to protect the hands from corrosive acids are available from chemical supply houses and vendors of laboratory safety supplies. Similar gloves may be obtained in stores that sell supplies for home cleaning and dish washing.
  - Stainless steel mesh gloves during hazardous portions of the autopsy such as blind removal of the larynx, rectum, and pelvic contents; removal of the rib cage, vertebrae, or clavarium; or other tissue when saws, chisels, or bone cutters are used.
  - Water-impermeable shoe covers.
  - These items should be removed prior to leaving the autopsy suite and placed in an impervious biohazard container.

### **Autopsy Procedures.**

- Routine procedures may be modified as needed to diminish risks of contamination.
  - Exercise extraordinary care to avoid injury from sharp instruments, aerosolization, and splattering of body fluids.
  - Decontaminate the outside of the body and the autopsy table simultaneously while turning the body on one side and then the other.
  - Evisceration may be modified to avoid splashing of blood, blind, or dangerous dissections. For example, if a Rokitansky evisceration is used, the trachea may be transected and blind removal of the larynx omitted if the risk is considered too high. If blind evisceration of the pelvis and neck is practiced, stainless steel mesh gloves should be worn. A Virchow evisceration with removal of individual organs may offer less opportunity for an accident or splashing of blood.
  - All tissues and contaminated instruments should be retained on the autopsy table. Any tissue that must be removed from the autopsy table should be placed into a tray for transport within the morgue or placed into a container for storage or disposal.

- Stainless steel mesh gloves should be worn when working with bone. Bone saws should be fitted with a vacuum attachment to minimize dispersal of droplets. The saw may be wrapped in plastic with only the blade exposed in an effort to prevent the dispersal of bone dust by exhausting air from the motor. Bone surfaces should be wet with water prior to being cut to minimize dispersal of bone dust.
- The head will be opened only when essential to the case. The skull should be opened at the end of the autopsy to minimize exposure to airborne droplets. In an effort to contain bone dust and spray, enclose the entire head in a large, clear, plastic bag during the use of a bone saw to open the skull. The bag is fitted over the head and hands are introduced through a large hole made in the bottom of the bag. Hand saws may be used rather than electric bone saws.
- Use bone cutters and hand saw instead of a Stryker's saw to reduce aerosolization where practical. Hand cutters should be used on the costal cartilages, near the costochondral junction, to remove the sternum. The cut ends of the rib cage should be covered with towels during the autopsy to prevent accidental scratches or cuts.
- Bone marrow specimens should be taken by crushing the cut end of a rib and expressing the marrow contents. Vertebral marrow should not be obtained unless the clinical information warrants it, since the opportunity for accident is great.
- The spinal cord should be removed from above with a spinal cord extractor, whenever possible, to minimize the remove of vertebral bodies.
- Sharps: A single scalpel should be the only sharp instrument present on the autopsy table. Only the prosector is allowed to use the scalpel. If it is necessary to change the scalpel blade during the autopsy, stainless steel mesh gloves should be worn. A dissecting knife may be used after using a scalpel for the skin incision or, if possible, use blunt tipped scissors. If specimens must be collected with a needle and syringe, such as a cardiac puncture for blood culture, discard the needle and attached syringe immediately after use. It should not be permitted to remain on the autopsy table. Routine precautions for needles should be followed. Culture bottles and toxicology containers should not be hand-held while introducing the specimen.
- Instruments should not be passed by hand during the autopsy. All instruments should be placed on the table, picked up only by the prosector, and returned to the table after being used. The prosector should announce in advance any movements which involve repositioning a sharp instrument.
- Tissue specimens should be placed into fixative on the autopsy table. The outside of all specimen containers should be decontaminated before being removed from the autopsy table.
- Frozen sections should not be cut unless there is a pressing need for an early diagnosis, because adequate decontamination of the cryostat is difficult. If frozen sections are cut, the cryostat should be decontaminated immediately after use. This should include removal of all tissue sections and trimmings.
- Photography should be carried out with great care. Organs to be photographed should be placed into a pan for transport to the photo stand. The prosector, or his/her assistant, should cover the hands with a towel before leaving the autopsy table to arrange the organs in order to avoid dropping blood on the floor or fixtures. The camera should be handled only by the circulator to prevent contamination. When photography is completed, the organs should be returned to the autopsy table or fixed. Photographs may

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- be taken at the autopsy table using a hand-held camera or the tissue may be fixed before being photographed to avoid removing unfixed tissues from the autopsy table. Kaiserling's solution may be used as a fixative to preserve tissue color.
- Large specimens (organs) should be “bread-loafed” before fixation to ensure adequate permeation of fixative. Dissect the organ block in the usual manner and follow by fixation of individual organs prior to further study (fixation of the block in its entirety is inadequate to neutralize many infectious agents including the AIDS virus, M. tuberculosis, and hepatitis B virus). If pulmonary disease is suspected, it may be desirable to inflate the lungs with formalin. Organs and tissues that will be retained unfixed should be minimized. These should be placed into sealed, leak-proof containers or sealable plastic bags. These, in turn, should be placed into a secondary sealable leak-proof container. All unfixed retained material should be conspicuously labeled as a biohazard. When retained tissues have served their purpose, they should be disposed of in accordance with hospital regulated medical waste policy. Organs which are not retained should be placed into a plastic bag and returned to the body cavity at the end of the autopsy.
  - At the end of the autopsy, the body should, preferably, be closed with a metal stapler. Suturing the body closed should be avoided if possible or done with great care.
  - The closed body should be washed with a detergent solution, followed by an antiseptic solution or diluted household bleach, and rinsed with water before being placed into a leak-proof body bag. Label both the body tag and the body bag with a biohazard label to alert the mortician to the potential biohazard. When “high-risk” autopsies are done, the mortician should be notified directly.
  - At the conclusion of the autopsy, the circulator may perform duties which bring him/her into contact with blood or contaminated surfaces. Under these circumstances, the circulator should utilize the barrier protection recommended for the prosector during the autopsy.
  - Wash hands before leaving the area and after gloves are removed.
  - Review of autopsy organs may, preferably, be done on fixed organs to minimize exposure to contaminated blood and tissues. Any review of unfixed autopsy specimens should be carried out using all of the recommended precautions as if a full autopsy were being performed.
  - **Accidental Needlestick or Cut:**
    - An individual who suffers a needlestick or cut should disengage from the autopsy immediately, allow the wound to bleed freely, wash the wound with soap and water, and apply a disinfectant solution to the wound. Report the accident immediately to the supervisor and report to Occupational Health for evaluation and follow-up.

### **Decontamination.**

- Wash the table and all pans, trays, buckets, etc. with a detergent solution, rinse with water, wipe thoroughly with paper (or cloth) towels soaked with a 1:10 dilution of household bleach or other suitable chemical germicide and finally rinse with water.
- Decontaminate all instruments, specimen containers, and work areas with a 1:10 dilution of 5.25% sodium hypochlorite (bleach) solution. Soak instruments in decontamination solution for 15-30 minutes prior to routine washing. Aluminum and stainless steel instruments may require 2% aqueous glutaraldehyde, because sodium hypochlorite damages these materials. Scalpels with blades attached should be decontaminated before removing and disposing of

the blade. Longer periods of decontamination may corrode instruments. Autoclave instruments for at least 45 minutes at temperatures of at least 121° C and pressures of at least 20 pounds per square inch.

- Care should be taken at all times not to splash water, blood, or body fluids from the autopsy table. All drains, breakers, and vacuum lines should be clear to prevent backup of liquids.
- All contaminated disposable clothing and supplies should be placed into a biohazard container for subsequent disposal in accordance with hospital policy. If reusable clothing, towels, etc. have been used, they should be placed into an impervious linen bag and sent to the laundry.
- All surfaces adjacent to work areas should be cleaned with a detergent solution, decontaminated, and flushed with water at the conclusion of the autopsy. This should include the floor and areas surrounding the autopsy table, the photography stand (and camera if contaminated), and areas used to change clothing.
- After the body has been removed by the mortician, the morgue cooler tray should be decontaminated.

**Questions.**

Any questions should be directed to the Head, Laboratory Department or the Head, Autopsy Branch.