

Autopsy in Infectious Diseases

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Introduction

Every postmortem room is a potential source of infection to the autopsy surgeon, assistants, those handling the body after an autopsy, and visitors to the mortuary. These infections can be acquired by inhalation of infectious aerosols, needle stick injury, wound from an object contaminated with blood or body fluid, a splash of blood or body fluid onto an open wound, entry of the pathogen through a pre-existing break, or contamination of the mucosal surface such as the eyes, nose, and mouth.¹

It is not possible to know the medical status of every deceased person brought to mortuary for postmortem examination. Hence, it is essential to consider all dead bodies as potential carriers of infection and follow universal precautions while conducting an autopsy. Entry to the postmortem examination room should be restricted, *except* for the experts and workers who are trained in handling the infected material, apart from the postmortem room staff.¹ Proper assessment of the case, following universal precautions, appropriate autopsy procedure, prevention of injury, periodic training, and education of staff can significantly reduce the risk of transmission of infection in the autopsy room. A standard operating procedure should be prepared, in consultation with infection control experts, that includes procedure of washing the room, cleaning of the instruments with a 10% bleaching powder solution, hepatitis B immunization, chest X-ray, and injection tetanus toxoid every 6 months for all the personnel working in the mortuary. Apart from the same, one should be aware of the guidelines for needle prick/sharp cut injury for preventing HIV infection.²

Classification of Biological Agents

The advisory committee on dangerous pathogens (ACDP) has categorized infectious agents into four hazard groups (HG) based on their pathogenicity, transmissibility, ability to cause epidemics, preventability, and treatability.³ HG 2 is commonly encountered in clinical practice while HG 3 and 4 are common in mortuary workers (Table 14.1).

Table 14.1: Classification of biological agents (ACDP)		
HG	Features	Examples
HG 1	Organisms unlikely to cause human disease	—
HG 2	Can cause human disease and maybe a hazard to employees. Unlikely to spread to the community Effective prophylaxis or treatment is available,	<i>Actinomyces</i> , <i>Bacteroides</i> spp., <i>Bordetella</i> , <i>Clostridium</i> spp., <i>Enterobacter</i> spp., <i>H. pylori</i> , <i>Klebsiella</i> spp., <i>Shigella</i> , <i>Candida</i> spp., <i>Aspergillus</i> spp., measles virus, influenza virus type A, B and C
HG 3	Can cause severe human disease and maybe a serious hazard to employees May spread to the community Effective prophylaxis or treatment is available	<i>Mycobacterium tuberculosis</i> , hepatitis B virus, hepatitis C virus, HIV, human T lymphotropic virus
HG 4	Causes severe human disease and is a serious hazard to employees Likely to spread to the community and does not have effective prophylaxis or treatment	Viral hemorrhagic fever (Ebola, Marburg, Lassa fever, Congo Crimean hemorrhagic fever), smallpox

Categorization of the Dead Body and Safety Precautions to be Followed⁴

All dead bodies are potentially infectious and 'standard precautions' should be implemented while conducting an autopsy for every case. Based on the risk of infection, mode of transmission of different diseases and precautions to be taken, dead bodies can be classified into three categories (Table 14.2).

Table 14.2: Categorization of dead bodies and personal protective equipment to be used while conducting autopsy	
Category	Precautions to be observed
Category 1 (signified by a blue label) – All dead bodies other than those with known infectious diseases	Standard precautions (gloves, water repellent gown, surgical mask, goggles, or face shield to protect eyes)
Category 2 (signified by a yellow label) – Dead bodies with known HIV, HBV, HCV, Creutzfeldt-Jacob disease (CJD) without necropsy	Standard precautions and a plastic apron over the water repellent gown
Category 3 (signified by a red label) – Dead bodies with known tuberculosis, anthrax, plague, rabies, viral hemorrhagic fever and CJD with necropsy	Water resistant gown, surgical mask, eye protection (goggles or face shield), double gloves, shoe covers/boots

Other important measures recommended to be followed:

- Observe strict personal hygiene
- Do not smoke, drink, eat or touch your eyes, mouth, or nose
- Avoid sharp's injury during an autopsy, while disposing waste and decontamination

- Remove personal protective equipment after handling the dead body and wash hands with liquid soap and water immediately

What to do in case of accidental exposure to blood or body fluids

In case of percutaneous injury or mucocutaneous exposure to blood or body fluids of the dead body, the injured or exposed area should be washed with copious amount of water. All incidents of percutaneous or mucocutaneous exposure should be reported to the competent authority. The injured person should immediately seek medical advice for proper wound care and postexposure management.

Guidelines for autopsy published by the Royal College of Pathologists, London for all autopsies performed on cadavers known or suspected to be infected⁵

As per the above guidelines:

- All the staff should be vaccinated against tetanus, polio, poliomyelitis, tuberculosis, and hepatitis B.
- Preautopsy testing should be considered in cases where it is suspected that the body may be infected with a previously undetected category 3 pathogen.
- Cap covering the hair; eye protection, mask to prevent inhalation of aerosols, face shield to protect the mucous membranes of the eyes, nose, and mouth from exposure to splash, surgical shirt and trousers, waterproof boots, full-length gown, a waterproof apron that is long enough to reach below the tops of the boots and at least one pair of gloves must be used.
- Reduce aerosol formation by using a HEPA filter/suction system and avoiding the use of power saws and high-pressure water sprays.
- The infected body should be eviscerated organ by organ, rather than en-bloc.
- Equipment used to perform autopsy should be kept to a minimum.
- Scalpels and scissors with pointed ends should not be used and instruments should never be passed from hand-to-hand.
- Needles should not be recapped, and all sharps should be placed in puncture-resistant containers.
- Autopsy surfaces and tools should be decontaminated with a bleach solution (1:10 to 1:100 dilution depending on the extent of contamination).
- Disposable instruments should be used for autopsies on patients where transmissible spongiform encephalopathy is suspected.
- The staff should be adequately trained and kept to a minimum. They should include only the autopsy surgeon, technician (if available), and an assistant till the case is finished and organs are fixed in formalin.
- The assistant avoids contact with potentially infected or contaminated tissues, fluids, and surfaces. His role includes paperwork, labelling specimen containers, recording organ weights, etc.
- Sutures should not be used for closing the infected body. It is closed by staples, tissue adhesives, or even left unreconstructed and sealed in a leak-proof body bag.

High-risk Autopsies

'High-risk autopsies,' are those postmortem examinations where the deceased person had or is likely to have had a serious infectious disease that can be transmitted to

those present at the autopsy, thereby causing serious illness and/or premature death. In all cases of highly infectious deaths, the pathologist has no reason to deny postmortem examination but needs to take extra-precautionary measures during and after postmortem examination.⁶

HBV, HCV, and HIV are major blood borne HG3 pathogens that can be determined with accuracy in post mortem blood samples. In case of high-risk infection, evisceration and dissection should be carried out without scalpel and sectioning postponed till the dissected organs are fixed in 10% formalin. In these cases, microbiologic cultures are not possible and other disadvantages include autolysis of the tissue and delay of histopathology reports.

Biological Risks Faced by Mortuary Workers

The principal biological risks faced by mortuary workers include tuberculosis, blood-borne hepatitis, and HIV. All these pathogens retain their infectivity after death.⁶

1. Tuberculosis

Clinically undiagnosed tuberculosis makes up a significant proportion of active tuberculosis cases diagnosed at autopsy. With an increasing incidence of HIV-associated TB, many cases present at extrapulmonary sites with atypical symptoms and non-specific chest X-ray findings. It is seen that even brief exposure to tuberculosis during autopsy poses a serious threat to postmortem room workers. Tubercle bacilli have been isolated from glass plates held 10 cm above lungs sliced at autopsy and from various sites in the autopsy room up to 24 hours after autopsy (Table 14.3).⁷

Table 14.3: Guidelines to prevent transmission of tuberculosis during autopsy⁸

Risk assessment	<ul style="list-style-type: none"> History of tuberculosis Identify high risk groups such as HIV positive and immunosuppressed individuals Early recognition of gross lesions and lesions at extra-pulmonary sites
Minimize aerosol formation	<ul style="list-style-type: none"> Single table autopsy room to be used preferably Downdraft ventilation tables and negative pressure Use disposable instruments Minimize dissection if gross lesion is suspected Organs to be removed individually and fixed by immersion Avoid spray and splashing of water while washing organs
Protection of personnel	<ul style="list-style-type: none"> Minimal staff to be present while performing autopsy Precautions in addition to standard protection include N95 or N99 mask, cap, plastic apron over water repellent gown, double gloves (latex and neoprene cut resistant gloves) and boots Body closed by staples or adhesive (not sutures) and sealed in a leakproof bag
Monitor health of personnel	<ul style="list-style-type: none"> Mantoux testing followed by BCG in case Mantoux is negative Chest imaging
Public health	<ul style="list-style-type: none"> Contact tracing

2. Human Immunodeficiency Virus Infection

An autopsy is an important investigation in patients who have died from AIDS as it permits clinicopathologic follow-up, assessment of drug efficacy, toxicity, epidemiology of the disease and provides sample for research and medical education.⁷ It can also be present in a previously undetected case, dying either from a disease or trauma.

Postmortem samples have reported HIV-positive individuals 6% by Li, et al., 1993 and 15% by Plessis et al., 1991. HIV has low infectivity and 99.7% of health care workers exposed to HIV are not infected. The overall risk of seroconversion after contact with HIV-positive blood is 0–0.42%. Most documented cases of HIV seroconversion after occupational exposure occurred due to needlestick injuries (Table 14.4).⁹

Table 14.4: Factors which determine the risk of seroconversion

• Viral load and CD4 count in the deceased
• Terminal stage of illness
• Premortem antiviral therapy
• Depth of injury and volume of fluid inoculated/ingested
• Susceptibility of the healthcare professional
• Post-exposure prophylaxis with zidovudine

In addition to blood, potentially infectious body fluids include semen, vaginal secretion, CSF, synovial, pleural, peritoneal, pericardial, and amniotic fluid.¹⁰ Postponement of the autopsy of HIV positive patient does not reduce the risk of transmission (Table 14.5). Studies have shown HIV remains viable at room temperature in the blood for at least 16 days and spleen for at least 14 days after death. HIV can be isolated from cranial bone, brain, cerebrospinal fluid, lymph node, spleen, and blood for up to 5 days after death when stored at 6°C. Outside the body, the virus is inactivated by drying and disinfectants like 0.5% sodium hypochlorite, 4% buffered formaldehyde, 50% ethyl alcohol, 1% glutaraldehyde, 3% hydrogen peroxide, and phenolic compounds.

Table 14.5: Rational approach to the safe conduct of AIDS autopsies¹⁰

• Experienced and well-trained personnel should conduct the autopsy. They should be aware of the risks involved and care should be taken to avoid cuts and punctures
• Individuals having wounds/dermatitis and immunosuppressed individuals should not perform the autopsy
• Personnel precautions include using cut resistant gloves, face shield or goggles, mask, hair cover, waterproof apron, long-sleeved surgical clothing with water-repellent sleeves, protective shoes with water-impermeable shoe covers. After autopsy, they should be washed and chemically disinfected (e.g. with 0.5% sodium hypochlorite)
• Non-pointed scissors and rounded scalpel blades should be used, and blades should not be passed from one prosector to another
• Towels should be placed over sharp bony projections
• Lighting and ventilation must be adequate. Equipment and contaminated surfaces should be promptly cleansed, treated with disinfectant
• HIV does not spread by aerosols. However, as there is an increased incidence of tuberculosis in AIDS patient's care must be taken to avoid creation of aerosols that can transmit TB
• In case of exposure, an infectious disease specialist must be consulted at the earliest

3. Hepatitis B and Hepatitis C Infection

Hepatitis B virus (HBV) is a highly infectious virus (100 times more transmissible than HIV). HBV infection can be transmitted by aerosols due to the small size of the virus and following exposure to an extremely small volume of infected blood and body fluids. The risk of occupational acquisition of HBV is low due to routine pre-exposure vaccination among health workers. Hepatitis B vaccine is recommended to all health-care workers exposed to blood and body fluids. Staff who are not been vaccinated against HBV should not engage in postmortem work.

Hepatitis C virus (HCV) infection is responsible for most parenterally transmitted cases of non-A, non-B hepatitis. Transmission of the hepatitis C virus is associated with direct percutaneous exposure to blood. HCV is less infectious compared to HBV. Mortuary staff who sustain needle stick injury during postmortem examination are at an increased risk of acquiring hepatitis C infection with the rate of transmission being 2.7–10%. There is no vaccine for HCV.⁷

Other Hazards

Transmissible Spongiform Encephalopathies (TSE)

The risk of acquiring TSE including Creutzfeldt-Jakob disease (CJD) is less. These agents are resistant to routine methods of physical and chemical decontamination. Variant—CJD can be transmitted from formalin-fixed, paraffin wax-embedded tissues and can survive reduction to ash at 360°C. Decontamination requires disinfection with sodium hypochlorite (20,000 parts per million chlorine for at least 1 hour), 1–2 M sodium hydroxide, or steam autoclaving at 134°C for at least 18 minutes.⁹

Hazard Group 4 Risk Pathogens

Autopsy on patients with hazard group 4 pathogens should be performed only where absolutely necessary.⁹ The use of high-efficiency particulate air (HEPA) masks should be considered for these 'high risk' autopsies.

Miscellaneous infections

The cadaver is a potential source of infection with other organisms like *Streptococcus pyogenes*, hepatitis A, *Neisseria meningitides* which cause curable illness having considerable morbidity. Methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant *Enterococcus faecium* (VREF), and other multidrug-resistant bacteria which form the normal flora do not commonly cause illness in those performing an autopsy. To prevent the spread of these agents, protective garments should be removed before leaving the autopsy room.

“Quid quid agis, prudenter agas, et respice finem.”
(Whatever you do, do cautiously, and look to the end)

Anon

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