Review Paper

Volume - 12 | Issue - 10 | October - 2022 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Forensic Medicine

SAFE AUTOPSY PRACTICES, UNIVERSAL PRECAUTION, AND HOSPITAL INFECTION CONTROL TO PREVENT INFECTIONS DURING THE AUTOPSY

Vinod Ashok Chaudhari*	M.B.B.S., M.D., MBA (HCS). Additional Professor, Department of Forensic Medicine and Toxicology, Jawaharlal Institute of Postgraduate Medical Education & Research, Pondicherry, India, 605006. *Corresponding Author
Jamshid P	M.B.B.S., M.D. Assistant Professor, Department of Forensic Medicine and Toxicology, MES Medical College, Perinthalamanna, Kerala, India, 679321.
Ambika Prasad Patra	M.B.B.S., M.D. Additional Professor, Department of Forensic Medicine and Toxicology, Jawaharlal Institute of Postgraduate Medical Education & Research, Pondicherry, India, 605006.
Rakesh Singh	Professor, Department of Microbiology, Jawaharlal Institute of Postgraduate Medical Education & Research, Pondicherry, India, 605006.
Siddhartha Das	Professor, Department of Microbiology, Jawaharlal Institute of Postgraduate Medical Education & Research, Pondicherry, India, 605006.
Rahul Dhodapkar	Professor, Department of Microbiology, Jawaharlal Institute of Postgraduate Medical Education & Research, Pondicherry, India, 605006.

ABSTRACT The concept of safety regulations in autopsy practice, such as universal precautions, was emphasized following the appearance of the Human Immunodeficiency Virus as a health problem. Contaminated sharps and needles, blood and body fluids, and contaminated aerosols are all potential sources for transmitting infectious agents during the postmortem examination. Hepatitis B Virus and Hepatitis C Virus are matters of concern for the health care worker handling the dead bodies, especially when the infectious status is unknown. The recent outbreak of the covid-19 pandemic and handling of such infected bodies puts the autopsy practice into a high-risk job, even with the advent of guidelines and protective measures. The hazard groups, risk of infections, prevention methods, universal precautions, safe autopsy practices, and proper biomedical waste management are discussed in detail, emphasizing Human Immunodeficiency Virus, Hepatitis B Virus, Hepatitis C Virus, and Covid-19.

KEYWORDS : Human Immunodeficiency Virus, Hepatitis B Virus, Hepatitis C Virus, Covid-19, autopsy practice, universal precaution, infection control

INTRODUCTION

Blood-borne infections are often a critical health hazard for health professionals. The appearance of Human Immunodeficiency Virus (HIV) as a health problem in 1980 emphasized autopsy safety by establishing "Universal precautions" and various safety regulations.[1,2] The main categories of potential risk during postmortem examination are mechanical injuries (sharps and needle stick), electrical shock, chemical or toxins (formaldehyde), radiations, and infections.[3] Transmission of infection depends on the source, the extent of injury sustained, and the personnel's health status. The infectious load in the patient's body and the immunologic status of the health worker plays a critical role during exposure to infection.[4] Blood, saliva, cerebrospinal fluid (CSF), vaginal secretions, semen, breast milk, exudates, and amniotic fluid are potentially infectious for HIV and Hepatitis B virus (HBV). Hepatitis C virus (HCV) is not known to be present in saliva, vaginal fluid, or semen. Urine and feces may contain significant quantities of these viruses if they get contaminated with blood. High-level disinfectants can kill both HBV and HIV. HIV survives only for a short time outside the body at room temperature, but HBV can survive up to one week in an outside environment.[5] Recently, a Covid-19 virus outbreak reportedly originated in Wuhan, China. Various guidelines have been issued for handling the Covid-19 bodies and performing their autopsies.[6,7] The autopsy practice in some developing countries is not always done as per the guidelines due to huge caseload, lack of resources, administrative apathy, low funds, and lack of practical knowledge and skill in safe autopsy practice.[8] We are discussing the risk of infections, prevention of infections, universal precautions, and safe autopsy practices during autopsy.

DISCUSSION

Hazard group, risk of infections, and autopsy practices

Infectious agents can be transmitted in autopsy rooms in one or more of the following ways. a) accidental wounds from contaminated sharps and needles, b) blood or body fluid splashing into an open wound and mucous membrane, and c) inhalation and ingestion of contaminated aerosols. The bone sawing involved in the postmortem examination is a potential source for generating infectious aerosols raising concerns over the health of the personnel working in the mortuary. One study found that around 8% of gloves were punctured during postmortem examination and 31% of these glove punctures went unnoticed.[9,10] HIV, HBV, and HCV are significant sources of public health concern since they share similar modes of transmission.[11] In the mortuary, Covid-19 may spread through inhalation and skin contact.[12] The essential conditions required for any infectious agent to get transmitted to an individual during postmortem examination are[13]:

A) The infectious agent should be present and viable in the dead body even after death.
B) A potential transmission route, such as skin or mucosal contact, inoculation, and aerosol particles, should be present.
C) The host should be susceptible to the infectious agent.

The hazard groups of biological agents are classified into four major types based on their virulence, transmissibility, preventability, and treatability. Hazard group (HG) 1 causes hardly any human disease. Whereas HG 2 can cause disease in humans, spreading an infection to the community is unlikely, and treatment and prevention are available for the same. HG 2 includes *Staphylococcus aureus* and Methicillin-resistant *Staphylococcus aureus*. It also has Vancomycin-resistant enterococci, *Neisseria meningitidis*, and *Clostridium difficile*. HG 3 causes severe forms of human diseases that may spread to the community. *Mycobacterium tuberculosis*, HIV, HBV, HCV, and Covid-19 are HG 3 agents. Effective treatment and prophylaxis are available for HG 3, while in HG 4, no effective treatment or prophylaxis is available like Viral hemorrhagic fevers (VHF), Ebola, Marburg, and Lassa fever.[6,14,15]

Risk of infection is high in autopsy during the evisceration procedure. Lettule's method includes the removal of the entire organ block, which is bulky. Virchow's method employs the removal of organs one at a time. In the Rokitansky method, in situ dissection, organ block removal, and examination are done. Ghon's method involves the removal of the thoracic and cervical block, abdominal block, and urogenital system separately.[15-17] Most injuries occur due to scalpel blades and sharp edges of bones. These injuries occur mainly over the non-dominant hand while holding and retracting. Studies have shown around 8% of glove punctures occur during the postmortem

examination, and one-third go unnoticed. Autopsies performed by residents have a higher chance of injuries than experienced pathologists, and most injuries are cuts rather than punctures.[10,18,19] A sponge should stabilize new organs before slicing, and needles should be kept in sharps bins.[6]

At an average of 250 autopsies per year over a 30-year career, a forensic pathologist can sustain 142 percutaneous or cut injuries. The theoretical risk of acquiring blood-borne infections for an average practicing forensic pathologist without wearing cut-resistant mesh under gloves is 2.4% for HIV and 39% for HCV, based on a study population in Maryland, United States.[20]

Tuberculosis is still a significant concern for its potential risk of infecting the personnel working in postmortem rooms and laboratories. The emergence of multi-drug resistance and tuberculosis in HIV-infected individuals makes the scenario even more dangerous.[21] During postmortem examination, an inoculation of tubercle bacilli into the skin can cause primary cutaneous tuberculosis or 'prosector's wart'. It is a painless erythematous papule and later ulcerated.[22-24]

Prevention, universal precautions, and safe autopsy practices

Awareness to the individuals regarding infectious hazards in the autopsy room will minimize the transmission of infections. The suitable design of the facility allowing free movement without overcrowding and safe working practices under adequate supervision can safeguard the health and the safety of the personnel who work in the autopsy room.[15,25] Autopsy of HG3 infected body requires risk assessment and underlying pathology assessment. It also includes universal standard precautions and standard operating procedures. Mortuary workers should perform risk assessments by control of substances hazardous to health (COSHH) for their safety.[6]

Universal standard precautions should be followed by forensic surgeons irrespective of the body's status on which the examination is performed. Even though these precautions are initially devised to prevent HIV and hepatitis infections, they can also partially protect against other diseases such as tuberculosis and prion diseases.[25] Universal precautions apply to blood and other body fluids. We should follow standard operating procedures for managing high-risk infection cases. The WHO and the United States CDC recommend different biosafety levels. These range from one to four to protect the personnel and environment while handling contagious agents in biomedical and microbiological laboratories. These guidelines also apply to mortuaries, especially while dealing with HG3 organisms such as HIV, HBV, and HCV. The autopsy room should have restricted entry to experts, trained workers, and personnel aware of infections and safety measures. Individuals with open wounds or dermatitis should not be allowed to perform an autopsy.[15,25-29]

A Biosafety level 2 is essential in a mortuary to protect against most blood-borne pathogens. Specialized training and supervision of personnel working in the morgue in the different procedures, identify potential risks and hazards. Immunization for the personnel should be available for tetanus, hepatitis B, and other medical services. A display of hazard signs and controlled access to the workplace should be there. Eating, drinking, and smoking in the autopsy area should be restricted. Specific equipment controls chemical fumes and aerosols. Following preventive measures are essential like hand washing, instruments and surface decontamination, waste processing and safe disposal, and proper labeling of the samples. Specific personnel training is required to handle potentially pathogenic and lethal agents under the supervision of competent experts in the field. Appropriate personal protective equipment (PPE) such as a surgical scrub suite with clean visors, hat, respiratory protection with a surgical mask or particle-filtering half mask or fine particle masks (FFP3), waterproof gowns and plastic aprons, rubber boots, double gloves with kevlar or neoprene under-gloves, access to showers, medical services and surveillance programs should be available. PPE and universal precaution are essential for the autopsy and handling of Covid-19 bodies.[6,15,25,28-30] In a developing country like India, the biosafety level recommendations for autopsy rooms are not strictly followed due to many reasons such as financial constraints, lack of awareness, and lack of appropriate supervision.

Developed countries follow testing for infections in high-risk autopsy cases before the procedure. However, in developing countries, where the resources are limited, a system for pre-autopsy screening of cases is not always strictly followed. Adhering to the universal precautions, HBV vaccination, along with the implementation of safety guidelines and standard operating procedures, can minimize the risk of spreading infections.[28-30] Infection control protocols were crucial during dead body management of Covid-19 in mortuaries. Adherence to such protocol and guidelines and proper biomedical waste management is critical to limiting the spread of infection.[31] A nasopharyngeal swab should be collected and tested for Covid-19 before keeping the dead body in the mortuary. Suspected or positive cases of Covid-19 bodies should be kept in waterproof body bags following the three-layered packing method. The autopsy may be waived off if the clinical team gives a cause of death in Covid-19 medicolegal cases as per the 174 Criminal Procedure Code (CrPC). It is advisable to use non-invasive techniques for autopsy by fulfilling the legal requirement.[7] As per WHO recommendation, the Covid-19 body should be minimally manipulated and not be sprayed, washed, or embalmed.[32] ICMR also advocates Covid-19 body should not be embalmed.[7] The step-wise approach should be followed for handling the Covid-19 body from ward or home to the funeral site with environmental cleaning and biomedical waste management.[7,33]

Practicing safe autopsy procedures can reduce the risk of infections. Scalpels, suture needles, and other sharp instruments should be carefully used to avoid any injuries. Immediately after the use, sharp objects such as scalpels and needles are discarded into metal containers. A one-hand scoop method or a needle sheath can be used to recap any needles. Thorough washing should be carried out soon after the completion of the procedure, irrespective of the occurrence of any skin contamination during the procedure. The use of proper vacuum aspirators reduces the generation of aerosols during bone sawing.[34] A postmortem should be staged, and minimal invasive postmortem examination can be performed to collect necessary fluid and tissue samples.[12,35] Sometimes, Lettule's method, which involves the removal of the organ blocks as a whole, can be deferred to minimize the risk. Rather Virchows or Rokitansky method is preferable.

A 1:10 (0.5%) or 1:100 (0.05%) solution of sodium hypochlorite can decontaminate any autopsy instrument after the use. 1% glutaraldehyde for 10 minutes can be used for instruments that can be sterilized by autoclaving. A 2% glutaraldehyde solution can be used for the decontamination of stainless steel and aluminium utensils. A 10% formalin solution can be used to disinfect surfaces, tables, and instruments after an autopsy in high-risk cases with blood-borne viral infections. Phenol (1-2%) solutions can disinfect the bacteria and *Mycobacterium tuberculosis*. In prion disease, extended soaking in sodium hydroxide solution can be employed.[15,28-30] Preventive measures, universal precaution and knowledge attitude, and safe autopsy practices will be helpful to registered medical practitioners at primary health centers, rural health centers, district health centers, and hospitals attached to medical colleges handling infectious bodies.

CONCLUSION

Many variables can affect the chance of infection transmission. Mortuaries should have a biosafety level of 2, regulate employee access, and use all precautions while performing the autopsy. Certain staff members receive training on the various mortuary procedures, identifying potential dangers and hazards. The personnel who work in the morgue should be immunized against tetanus and hepatitis B. hazard signs that are visible and restricted access to the workplace. Strict adherence to infection control strategy is required to manage Covid-19 positive corpses. In Covid-19 positive bodies, minimally invasive postmortem or non-invasive procedures should be employed.

REFERENCES

1. Andrion A, Pira E. What's new in managing health hazards in pathology departments. Path Res Pract. 1994;190(12):1214-23.
2. Wetli CV. Autopsy safety. Lab Med. 2001;32(8):451-3.
3. Kadam SS, Akhade S, Desouza K. Autopsy practice, potential sources of occupational hazards: A Review for Safety and Prevention. J Indian Acad Forensic Med. 2015;37(2):196-201.
4. Cardo DM, Bell DM. Blood-borne pathogen transmission in health care workers: Risks and Prevention Strategies. Infect Dis Clin North Am. 1997;11(2):331-46.Hansen ME. Blood-borne pathogens and procedure safety in interventional radiology. Semin Ultrasound CT MR. 1998;19(2):209-14.
5. Hanley B, Lucas SB, Youd E, Swift B, Osborn M. Autopsy in suspected COVID-19 cases. J Clin Pathol. 2020;73(5):239-42.
6. Hansen ME. Blood-borne pathogens and procedure safety in interventional radiology. Semin Ultrasound CT MR. 1998;19(2):209-14.
7. Indian Council of Medical Research. Standard guidelines for medicolegal autopsy in COVID-19 deaths in India. New Delhi. Available at: ICMR,2020.https://www.icmr.gov. in/pdf/covid/techdoc/CO VID19_AUTOPSY_GUIDELINES_2020_19052020.pdf (accessed 1 July 2022).
8. Shaha KK, Patra AP, Das S, Sukumar S, Mohanty MK. Awareness of risks, hazards and

preventions in autopsy practice: a review. J Evol Med Dent Sci. 2013;2(22):4030-41.
9. Wenner L, Pauli U, Summermatter K, Gantenbein H, Vidondo B, Posthaus H. Aerosol generation during bone-sawing procedures in veterinary autopsies. Vet Pathol. 2017;54(3):425-36.
10. Weston J, Locker G. Frequency of glove puncture in the post mortem room. J Clin Pathol. 1992;45(2):177–8.
11. Gerberding JL. Management of occupational exposures to blood-borne viruses. N Engl J Med. 1995;332(7):444-51.
12. Osborn M, Lucas S, Stewart R, Swift B, Youd E. Briefing on COVID-19. Autopsy practice relating to possible cases of COVID-19 (2019-nCov, novel coronavirus from China 2019/2020). 2020.
13. Mazuchowski EL, Meier PA. The modern autopsy: What to do if infection is suspected. Arch Med Res. 2005;36:713–23.
14. Lee JA. Guidelines on autopsy practice. London: The Royal College of Pathologists; 2002. p. 12-28.
15. Lucas S. Autopsies of people with high-risk infections. In: Burton JL, Rutty GN, editors. The hospital autopsy: a manual of fundamental autopsy practice. 3rd ed. London: Hodder Arnold; 2010. p. 71-89.
16. Ludwig J. Principles of Autopsy Techniques, Immediate and Restricted Autopsies. In: Ludwig J, editor. Handbook of autopsy practice. 3rd ed. Totowa: Humana Press; 2002. p. 3-6.
17. Waters BL. Handbook of Autopsy Practice. 4th ed. Totowa, NJ: Humana Press; 2009. p. 127-7.
18. O'Briain DS. Patterns of occupational hand injury in pathology. The interaction of blades, needles, and the dissector's digits. Arch Pathol Lab Med. 1991;115(6):610–3.
19. Johnson MD, Schaffner W, Atkinson J, Pierce MA. Autopsy risk and acquisition of human immunodeficiency virus infection: a case report and reappraisal. Arch Pathol Lab Med. 1997;121(1):64-6.
20. Nolte KB, Yoon SS. Theoretical risk for occupational blood-borne inections in forensic pathologists. Infect Control Hosp Epidemiol. 2003;24(10):772-3.
21. Sepkowitz KA, Raffalli J, Riley L, Kiehn TE, Armstrong D. Tuberculosis in the AIDS era. Clin Microbiol Rev. 1995;8(2):180–99.
22. Marmelzat WL. Laennec and the "Prosector's Wart": Historical Note on Classic Descriptions of Inoculation Tuberculosis of the Skin. Arch Dermatol. 1962;86(1):74-6.
23. Tapias L, Tapias-Vargas LF, Tapias-Vargas L. Primary cutaneous inoculation tuberculosis in a healthcare worker as a result of a surgical accident. Int J Dermatol 2008;47(8):833-5.
24. Goette DK, Jacobson KW, Doty RD. Primary inoculation tuberculosis of the skin: prosector's paronychia. Arch Dermatol. 1978;114(4):567–9.
25. Sharma BR, Reader MD. Autopsy room: a potential source of infection at work place in developing countries. Am J Infec Dis. 2005;1(1):25-33.
26. World Health Organization, 1993. Laboratory Biosafety Manual. 3rd ed. Geneva: World Health Organization.
27. Chosewood LC, Wilson DE. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. Washington: U.S. Government Printing Office; 2009. p. 9-51.
28. Burton JL. Health and safety at necropsy. J Clin Pathol. 2003;56(4):254–60.
29. Nolte KB, Taylor DG, Richmond JY. Biosafety considerations for autopsy. Am J Forensic Med Pathol. 2002;23(2):107-22.
30. Hardin NJ. Infection control at autopsy: a guide for pathologists and autopsy personnel. Curr Diagn Pathol. 2000;6(2):75–83.
31. Kanchan T, Ateriya N, Meshram VP. Disinfection and biomedical waste management: Mortuary practices during COVID-19. J Indian Acad Forensic Med. 2020:77-9.
32. WHO. Coronavirus disease (Covid-19) pandemic. Available: www.who.int/ emergencies/ diseases/novel-coronavirus-2019 (accessed 20 June 2022).
33. Vidua RK, Duskova I, Bhargava DC, Chouksey VK, Pramanik P. Dead body management amidst global pandemic of Covid-19. Medico-Legal Journal. 2020;88(2):80-3.
34. Nolte KB, Taylor DG, Richmond JY. Biosafety considerations for autopsy. Am J Forensic Med Pathol. 2002;23(2):107-22.
35. Castillo P, Martínez MJ, Ussene E, et al. Validity of a minimally invasive autopsy for cause of death determination in adults in Mozambique: an observational study. PLoS Med. 2016;13:e1002171.