

Post Mortem Examination of COVID-19 Deceased and Collection Preservation of Specimens

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Abstract

Forensic autopsy plays a crucial role in death investigations. It deals with the identification of cause, manner and time since death of deceased for the judgement by criminal justice system. A thorough examination frequently leads to the efficacious of an autopsy. It initiates with the external examination of the body and further proceeds according to the history of deceased. The postmortem examination of a deceased who is expected to have a serious infectious disease that can be transmitted during autopsy called infectious autopsy. So, medical experts need to take more precautions while performing autopsies on infectious bodies. Disease could be spread in many numerous ways. Some diseases are commonly transmitted during autopsy i.e. human immunodeficiency virus (HIV), viral hepatitis B and C, and tuberculosis infections. The risk is at increasing level for obtaining these types of postmortem infections especially in the cases where the death cause is unidentified. The use of standard precautions during an autopsy can minimize the risk of the transmission of infections. The present article highlights the risk of contagious diseases during autopsy and preservation of artefacts of deceased suffering of highly infectious disease COVID -19.

Keywords: Forensic examination; Medico legal experts; Forensic Autopsy; Covid-19.

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Introduction

The study of timing, reason and manner of death is known as forensic autopsy. The study consists of many tests and examination in order to detect type of internal and external injury. A medical expert is crucial for these postmortem and examination who can conclusively interpret the whole study.¹⁻⁸ There is a high-risk factor of transmission of contagious diseases like HIV, viral Hepatitis B and C, tuberculosis and most recently discovered COVID-19 from cadaver to medical expert, during forensic autopsy. A medical expert should aware of all essential preventions and precautions needs to be taken while performing thorough examination of cadaver. Corona virus caused COVID-19 is an easily transmittable disease from one human to another

by coughing and sneezing and cause respiratory infection, the most severe form of infections caused by corona virus are Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). If decedent had any symptom of COVID-19 then more precautions must be taken by the medical expert while performing the forensic autopsy.⁹ The post-mortem examination should only be carried out with permission of medical expert unless they declare it essential for the case.

If the deceased is known to have died with COVID-19, then its postmortem could expose the staff to the risk of infection, in such conditions if postmortem is essential for the case then it should be carried out in a well ventilated room with all essential protective equipments as per accepted

forensic medicine procedures.¹⁰ All waste either solid or liquid must be decontaminate before incineration. Aerosol formation must be avoided during examination. When a patient dies without any definitive test of COVID-19 then after death on public health ground limited diagnostic test must be performed for COVID-19.

General Requirements

There are some general requirements which should be taken under consideration while dealing with a COVID-19 Cadaver: the person must comply with all protective measures while wrapping and locating the body. Prior of shifting the body to the any location the proper wrapping should be done to prevent any bodily exudates and other substance leakage. The bag should be clearly and permanently marked with identification details and prescribed infectious disease of the dead person. If the deceased is confirmed or suspected case of COVID-19 then body must be packed in double body bags with an absorbent material between them, and the bags sealed and disinfected with a1,000-ppm sodium hypochlorite solution or other appropriate disinfectant. Cremation must be done as soon as possible. Persons who dispose of the body must take the same personal protection precautions outlined for medical and laboratory staff. A guideline is released by Royal College of Pathologists (RCPATH) on postmortem examinations of suspected COVID-19 cases.¹¹

Autopsy Procedure and body protections

In case of suspected or confirmed COVID-19 patient guidelines recommend Airborne Infection Isolation Rooms (AIIRs). In absence of AIIR facility, the area where HG3 Autopsies activities conducted should be properly ventilated and free from aerosol generation, if aerosol generation observed then immediate engineering controls measures should be taken. The pressure of the room should be negative and no air re-circulation is going on, so that surroundings shall be preventing from any cross contamination from postmortem room.¹² In COVID-19 infected patients avoid the use of any oscillating bone saw.

Minimum numbers of peoples should be allowed to enter the room at a time, to prevent contamination risk. The examination of other containment belongings and specimens of the decease should be carried out in a separate biosafety cabinet. The tools used for postmortem should be dispose off more cautiously, use puncture proof, labeled containers for disposing used needles and

sharp tools to avoid contamination. A supportive custodian staff should be present all the day during examination around the medical expert to prevent his/her movement outside the room, in need of necessary tool, equipment or any other additional item. Staff involved in postmortem activities should be equipped with all essential PPE's like a waterproof apron and a fluid resistant gown that covers the entire including forearms to avoid any contact with the body.

Double surgical synthetic gloves with a cut proof mesh layer inside should be used to cover hands. Respiratory protection mask with a filter to prevent entrance of small contaminant should be used to cover mouth and nose. Goggles should be used for eye protection.

Head cover, shoe cover and surgical scrubs should be used prior to enter the specified premises. The personnel involved in autopsy activity should avoid touching his/her mouth, face, nose and eyes during the period. Once the activity over carefully disposes the disposable PPE's as per their prescribed protocol and at their allocated location. The reusable PPE's should be sterilized as per manufacturer's guideline. Immediately wash hands with soap for at least 20 seconds or sanitize them with 60%-95 % alcohol-based sanitizer.

Collection of Postmortem Specimens from Deceased Persons with COVID-19

The biosafety measures are recommended to take while collection and handling of specimen from COVID-19 patients; or deceased at the time of autopsy. Several cases of COVID-19 are reported in recent weeks whereas its pathological findings are limited.^{13,14} The specimens recommended to collect from COVID-19 deceased are: Nasopharyngeal Swab (NP swab), Upper and Lower respiratory tract swab: Lung swab from each lung. For additional postmortem tests and other respiratory pathogens test separate swab specimen should be collected like major organs, upper airways and formalin-fixed autopsy tissues from lungs.

For only Nasopharyngeal Swab (NP swab) collection from deceased, no disposable N-95 respirator mask is required and synthetic fiber swabs with plastic shaft is recommended for NP specimen collection. Do not use calcium alginate swabs or wooden shafts swabs as they may contain some PCR inhibitory substances or substances that may have impact on viral activity of some viruses. Different swabs should be immediately placed in 2-3 ml viral transport media containing separate

vials after collection. Refrigerate the specimens at 2-8°C and ship overnight on ice pack.

Specimen Collection Procedure

For Nasopharyngeal Swab (NP swab) insert a swab into the nostril parallel to the palate, leave the swab in place for a few seconds to absorb secretions. For lung swabs after the heart-lung block is removed, insert one swab as far down into the tracheobronchial tree as possible on either side. First wipe the surface of each lung with an iodine-containing disinfectant clean and dry the surface; then use a sterile scalpel to cut a slit of the lung and insert the swab to collect sample on either side.

Storage of Postmortem Swab Specimens

Store specimens at 2-8°C for up to 72 hours after collection. If a delay in testing or shipping is expected, store specimens at -70°C or below.

Collection of Fixed Autopsy Tissue Specimens

4-5 mm thick tissue sample is recommended to collect from deceased recommended organs only, as it fit in the tissue cassette. The collected tissue shall be placed in 10% formalin buffer for 72 hours for optimal fixation.

The volume of formalin should be 10 times of tissue volume. Along with major organs like heart, kidney, liver, GI tract and spleen, the respiratory tract tissue specimen from sites like trachea (proximal and distal), pulmonary parenchyma from right and left lung, Central (hilar) lung with segmental bronchi, right and left primary bronchi are recommended to collect from COVID-19 deceased. As COVID-19 is a respiratory disease, so high probability of distribution of viral antigens and nucleic acid in respiratory epithelium of large airways, which can be frequently detected through immunohistochemistry staining and molecular testing.

Preparing the Specimens for Shipment

The specimens should be placed in a primary container with appropriate storage media/ solution, only after essential secondary packaging and proper labeling with all essential information of the specimen it should be transfer to the laboratory staff from autopsy suite for processing.

1. Within the autopsy suite, primary containers should be placed into a larger secondary container and the secondary container should then be placed into a reseal able plastic bag

that was not in the autopsy suite when the specimens were collected.

2. The reseal able plastic bag should then be placed into a biological specimen bag with absorbent material; and then can be transferred outside of the autopsy suite. Workers receiving the biological specimen bag outside the autopsy suite or anteroom should wear disposable nitrile gloves.

Postmortem Specimen Submission for COVID-19 Testing

All medical examiner should follow the guideline recommended by their state and local health departments for submission of postmortem specimen. In COVID-19 case NP swab and lung swabs should be stored at 2-8°C for up to 72 hours after collection on ice pack. Fixed autopsy tissue specimen which are fixed in 10% buffered formalin should be submitted, if the duration of fixation is more than 2 weeks then an additional tissue block embedded on paraffin should be shipped along with formalin fixed tissue specimen. Tissue specimen should be shipped with suitable packaging and on ambient temperature, freezing should be avoided in case of tissue specimen.

Cleaning and Waste Disposal Recommendations

According to the current researches it is recognized that the novel coronavirus may remain for hours to days on the metal surfaces or surfaces which is made from a variety of materials. The following recommendations should be applied for autopsy room confirmed or suspected COVID-19 deceased.

- While cleaning ventilation should be on, stay in a non health care setting prior of cleaning for 24 hours or for recommended time in the health care setting.
- Wear PPE's while handling disinfectant and pursuing cleaning as per the standard procedure of the manufacturers guide. Dispose of the gloves if they are damaged or soiled. Never wash and reuse gloves.
- If protective equipment is in low supply, the workers who performed autopsies conduct the cleaning and sanitizing of the area. When respirators are necessary to protect workers, employers must implement a comprehensive respiratory protection program that includes medical exams, fit-testing, and training.
- For cleaning do not use any product or method that generate aerosols or cause splashing. Like use of compressed air and/

or water under pressure for cleaning, or any other methods that can cause splashing or might re-aerosolize infectious material.

- Area contaminated with body fluid should be cleaned with disinfectant which is removed by the absorbent material (like towel) first and then be cleaned and given a final disinfection.
- Use tongs and other utensils to minimize the need for personal contact with soiled absorbent materials.
- The protective equipments and tools used during autopsy should be disposed and disinfected as per the standard procedure.
- Sharp tools and needle should be disposed with utmost care and as per standard procedure. Routine pathological procedure should be followed to dispose the human tissues.
- Non disposable tools and equipments should be disinfected or autoclaved, as per their suitability.
- Disposing of gowning should be done as per standard procedure and for washable gowns it should be packed in a leak proof bag that is tied shut and not reopened. These bags then send to laundry for cleaning process.
- Wash reusable, non-laundable items (e.g., aprons) with detergent solution on the warmest setting possible, rinse with water, decontaminate using disinfectant, and allow items to dry completely before next use.
- Camera, telephones, computer keyboards, and other items that remain in the autopsy suite as clean as possible, but treat as if they are contaminated and handle with gloves. Wipe the items after use with appropriate Environmental Protection Agency approved disinfectant products with emerging viral pathogens effective against COVID-19.
- When cleaning is complete and protective equipment has been removed, wash hands immediately with soap and water for 20 seconds or an alcohol-based hand sanitizer that contains 60%-95% alcohol may be used. Avoid touching the face with gloved or unwashed hands.
- After collection of specimens from autopsy pack the body in two leak proof bags with absorbent material in between and the outside of the bag with sodium hypochlorite solution.

Conclusions

Postmortem examination is done by medical experts to establish the patient's history. An experienced physician or medical expert is most appropriate person to accomplish the post mortem examination. The cause of death can be based on the patient's illness history that's why the role of physician is important to get reliable information about the history of patient.

Autopsy rate is decreasing in many parts of the world however it is considerable to determine the detailed information for the cause of death. If the reason of death is unidentified, the circumstances and the manner of death should be documented. In the cases of suspected COVID-19 it is advisable to do external examination as much as possible with recommended precautions. If COVID-19 is supposed to be cause of death, then all the specimen related to chemical and forensic toxicological examination must be informed by cautious labels and specific containers.

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