



Review Article

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Medicolegal Autopsy, Collection and Submission of Postmortem Specimens from Deceased Persons with Known or Suspected COVID-19

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Abstract

WHO declared COVID-19 a global pandemic on 11th March, 2020. The heightened fear regarding COVID-19 is a result of many things. It is a new pathogen with some unknown characteristics, and misinformation is all over the news and social media. In this pandemic situation, to combat any known or unknown biohazard risk associated with medicolegal autopsy, handling autopsy specimens, each section of the diagnostic procedure and laboratory processes have some specific guidelines for handling infectious agents like spread of SARS-CoV-2 that convey excessive risk for exposure and possible infection and/or occupational injury. These risks typically are associated with design flaws or lack of or inadequacy of safety procedures and training. However, we still lack a concrete guideline in our country on medicolegal autopsy, collection and submission of postmortem specimens from deceased persons with known or suspected covid-19 cases during this pandemic situation. This review aims to provide some evidence-based recommendations for biosafety and infection control practices during autopsy procedures, specimen collection, handling and submission for biochemical and toxicological analysis. The guidance can be followed by coroners, forensic investigators, biochemist and pathologist as well as other workers involved in postmortem service and respective authority/department.

Keywords: Medicolegal autopsy, postmortem specimen, infection prevention and control, biohazard, COVID-19.

Introduction

In 2020, the COVID-19 pandemic came home to laboratories and morgues across the country, as we have found that no one is immune. The heightened fear regarding COVID-19 is a result of many things. It is a new pathogen with some unknown characteristics, and misinformation is spreading all over the news and social media.

However, the concept of a “culture of safety” encourages all medical and health facilities to promote an organizational culture of systematic assessment of all work processes and procedures to identify associated risks and safety issues and implement certain plans to mitigate those risks.^{1,2} To combat any known or unknown biohazard risk associated with medicolegal autopsy, handling

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autopsy specimens, each section of the diagnostic procedure and laboratory processes have some specific guidelines for handling infectious agents like SARS-CoV-2 (the virus that causes COVID-19) that convey excessive risk for exposure and possible infection and/ or occupational injury. These risks typically are associated with design flaws or lack of or inadequacy of safety procedures and training.^{1,2} Current knowledge indicates that spread of COVID-19 usually happens when a person is in close contact (i.e., within about 6 feet/2 meters) via respiratory droplets produced when an infected person coughs, sneezes, or talks.^{2,3} This route of transmission might not be a concern when handling human remains or performing postmortem procedures with adoption of proper personal protective equipment (PPE). However, it may be possibility that anyone may get infected by COVID-19 while touching a surface or object having the virus on it and then touching his/her own mouth, nose, or eyes.^{2,3} According to the experts in the fields, we are still learning more about how this virus spreads.² However, we feel that a concrete guideline is still lacking in our country on medicolegal autopsy, collection and submission of postmortem specimens from deceased persons with known or suspected COVID-19 cases during this pandemic situation. While scientific studies on COVID-19 are still insufficient, it is certain that attention should be paid to autopsy procedures.⁴ Hence, in this review, we tried to highlight some of the evidence-based discipline-specific recommendations for health professionals engaged in medicolegal autopsy, collection and submission of postmortem specimens.

Precautions and Procedures of Medico-legal Autopsy

In the beginning of the discussion, we feel that the following factors should be considered when determining if an autopsy will be performed for a deceased known or suspected COVID-19 cases²:

a) Medicolegal jurisdiction, b) Facility environmental controls, c) Availability of recommended personal protective equipment (PPE), d) Family and cultural wishes. Personnel who have contact with human remains, including those performing autopsy and

collecting or handling specimens, are at risk for exposure to infectious agents, such as COVID-19 virus, which may be present in tissues, blood, and other bodily fluids of the deceased person.²⁻⁶ Additionally, personnel might be exposed to residual surface contamination.²⁻⁶ Autopsy should be undertaken by using appropriate biosafety measures and procedures. All autopsy facilities should have written biosafety policies, site-specific risk assessments, and procedures, and all participating personnel should receive prior training in policies and procedures.^{2,4,5} To prevent or limit exposures, standard precautions, contact precautions, and airborne precautions with eye protection (goggles or a face shield) should be followed during autopsy.² Although many of the following procedures are consistent with existing national infection prevention guidelines for safe work practices in the autopsy settings, we lack a specific one for using in the mortuary and post-mortem viscera and toxicological analysis laboratory.

The following measures can be taken in the institutional level where autopsies are being done and post-mortem viscera and toxicological analysis laboratory is in place.

1. The first and foremost safety precaution is that the corpse should be stored in a morgue environment, the ventilation of which is separated from other units, and then the morgue cabinet/area for confirmed/suspected COVID-19 persons should be disinfected.^{4,7}
2. Autopsy room must have a precautionary sign posted on the entry door (e.g., "Autopsy in Progress", "Authorized Personnel Only", "COVID-19 Awareness", "Proper PPE Required" etc.).²
3. Personnel must wear appropriate PPE. Surgical scrub suit worn under impermeable gown or apron with full sleeve coverage. Double surgical gloves interposed with a layer of cut-proof synthetic mesh gloves. At a minimum, an authority-approved disposable N95 respirator should be worn; however, due to the likelihood of generation of contagious aerosols during various autopsy procedures, powered air-purifying respirators (PAPRs) equipped with N95 or HEPA filters are

- recommended.^{2,3,5} PAPRs with high efficiency filters may provide increased comfort during extended autopsy procedures. Eye protection such as goggles or face shield that covers the front and sides of the face is recommended and it should not affect the fit or seal of the respirator. Surgical caps and shoe-covers with non-slip tread should be worn. PPE should be worn following required don, use, and doff protocols to avoid self-contamination and to mitigate risk of carrying the virus outside the autopsy room or adjacent corridor.^{5,7}
4. Working professionals and supporting staff in the autopsy room should be limited to the minimum number that is only necessary to safely conduct the autopsy at this moment.
 5. Use a biosafety cabinet Class II for the handling and examination of specimens and other containment equipment whenever possible.^{6,8,9}
 6. Use caution when handling needles or other sharps, (e.g., never recap, bend, or cut needles), and dispose of contaminated sharps in puncture-proof, labeled, closable sharps containers.^{5,6}
 7. A separate register along with traditional logbook should be maintained for autopsy of persons with known or suspected COVID-19, which may include names, dates, and activities of all workers participating in the postmortem care and cleaning of the autopsy room should be kept and available for future follow up. It might be used for contact tracing, if needed. The names of custodial staff entering after hours or during the day, should also be included in the register.^{2,7}
 8. Cleaning and disinfection procedures of the autopsy room, surfaces, and equipment must be performed as per available guidelines.^{2,3,5,10} Work surfaces should have integral waste containment and drainage features that minimize spills of body fluids and wastewater.²
 9. Autopsy room should have adequate air-handling systems. It must maintain negative pressure relative to surrounding areas with no air recirculation to adjacent spaces³ and provide a minimum of 6 air changes per hour (ACH) for existing structures

and 12 ACH for renovated or new structures.^{2,3,11}

It also have to have air exhaustion capability directly to unoccupied areas outside the building.^{2,11}

10. Additionally, doors to the room should be kept closed except during entry and exit.⁵ Entry and exit should be limited to prevent interruptions in airflow. A portable high-efficiency particulate air (HEPA) recirculation unit could also be placed in the room to provide further air filtration.^{2,3} If use of an AIIR or HEPA unit is not possible, the procedure should be performed in the most protective environment possible.^{3,11}

Collection of Autopsy Tissue Specimens

Formalin-fixed wet tissues, and formalin-fixed, paraffin-embedded (FFPE) tissue specimens, obtained at autopsy, can be used to establish a postmortem diagnosis of COVID-19 as well as cause of death by using immunohistochemical and molecular techniques available in specific laboratory at IPH, Dhaka. Submission of fixed autopsy tissues has an important advantage that it allows for the preservation and retention of relatively stable specimens that can be tested at a later date to provide a confirmatory diagnosis.^{2,3} The collection of fixed tissues can be particularly important when conventional swab-based testing methods are not available or have provided inconclusive results for detection of COVID-19. Alternating to swab-based method, sections of lung parenchyma, preferably from different locations and any areas with lesions like sections of trachea, bronchi, or both airways, may be sent for molecular testing like rt-PCR.^{7,11} To minimize potential viral contamination of non-involved tissues, lung and airway specimens should be collected immediately following removal of the chest plate. Then place specimens into a separate sterile specimen cup containing 10% neutral buffered formalin.^{2,7,11} The other necessary specimens can be sent in the same manner to find out medicolegal diagnosis. Moreover, representative sections of major organs (i.e., heart, liver, spleen, kidney, and brain) could assist with an alternate diagnosis if tests for

SARS-CoV-2 are unrevealing. Collection of tissues from other major organs can also facilitate the evaluation of possible extrapulmonary complications of COVID-19. Alternately, formalin-fixed, paraffin-embedded tissues (original blocks obtained at autopsy) can be submitted for evaluation, if facilities are available.^{2,7}

Handling Specimens Collected at Autopsy

Personnel handling collected specimens and preparing them to be taken out of the autopsy suite should follow standard precautions. Specimens must be properly secured according to diagnostic laboratory recommendations and placed in an appropriately labeled leakproof primary container.^{2,4,10} Within the autopsy room/facility, those primary containers should be placed into a leakproof secondary container. If possible, the secondary container should then be placed into a resealable plastic bag that was not in the autopsy room when the specimens were collected. The resealable plastic bag should then ideally be placed into a labeled biological specimen bag with absorbent material; and then can be transferred outside of the autopsy room.^{2,3} Supporting workers receiving the biological specimen bag outside the autopsy room should deliver the specimen in a safe manner to a laboratory staff who can proceed with final packing and shipping procedures.^{7,11}

Cleaning and Waste Disposal Recommendations

Beside the conventional guidance of Directorate General of Health Services (DGHS), a new recommendation¹⁰ states that the management of regulated medical waste should be performed in accordance with routine procedures as it has not been implicated in the transmission of COVID-19. However, autopsy facilities should have a plan compliant with the medical waste management policy describing the procedures of transporting waste out of the autopsy room into a designated accumulation area. Waste should then be treated by an incineration method onsite or transported to an approved offsite facility for further treatment. Moreover, concerned professionals should determine the most appropriate disinfectant for the surface or object, specifically for use on hard,

non-porous surfaces and for the specific application need, by following the manufacturer's instructions for all cleaning and disinfection products (e.g., concentration, application method, contact time). However, after an autopsy of a decedent with confirmed or suspected COVID-19, the following recommendations apply for cleaning of the autopsy room:^{2,3,7,11}

1. Ensuring proper ventilation systems in the autopsy facilities.
2. Wearing appropriate PPE is a must along with all standardized parts.
3. Proper training of professionals and supporting workers is very essential, especially on COVID-19 contamination, safety procedures and hazardous chemicals used in infection prevention.
4. If PPE is in low supply, concerned institution may consider only supplying to the personnel who performed autopsies and conduct the cleaning and sanitizing of the area. Institutions may plan their own contingency and crisis strategies during PPE shortages.
5. Gross contamination and liquids should be collected with absorbent materials, such as towels, by staff conducting the autopsy wearing designated PPE. Gross contamination and liquids should then be disposed of properly. Large areas contaminated with body fluids should be treated with disinfectant following removal of the fluid with absorbent material. The area should then be cleaned and given a final disinfection., while small amounts of liquid waste (e.g., body fluids) can be flushed or washed down ordinary sanitary drains without special procedures.

Handling and Transportation of Human Remains

The risk of transmission of SARS-CoV-2 virus from human remains outside of the autopsy setting is low^{7,11}; however, use standard precautions, including additional PPE if splashing of fluids is expected when handling and transporting human remains. Patients who die because of COVID-19 can be buried or cremated depending on the preferences. Standard body bagging procedures

should be followed, consistent with procedures used for deaths when there is no confirmed or suspected COVID-19 case.^{5,6,12-14} However, given the varying weights of decedents and variety, construction, and conditions of body bag materials, postmortem care workers should use prudent judgement determining if risks for puncture, tearing, or failure of body bags could occur and whether a second body bag or a body bag of thicker, stronger material (e.g. minimum of 6 mil thickness) is necessary.^{5,6,12-14} After the body has been bagged, disinfect the outside of the bag with an authority-approved disinfectant that meet the criteria for use during COVID-19 pandemic should be applied according to the manufacturer's recommendations.^{5,6,11-14} Generally, families and friends may see the body before the burial; however, the restrictions concern physical contact. In addition, under the principles of social distancing, the number of mourners must be limited. Burial procedures are not systematized, but they should be, since the lack of proper and sufficient protective precautions might be associated with an increased epidemiological risk.¹³ The risk assessment regarding the funeral premises should include known or suspected infection hazards, the timing of procedures, the number of required staff.^{13,14}

Conclusion

There are still speculations as to whether individuals with confirmed COVID-19 should receive an autopsy. Several guidelines clearly stated that it is completely possible to autopsy in a body presumed or confirmed to be infected by COVID-19. However, this is conditional on following certain safety measures to avoid any risk of contaminating the personnel who perform or help in the autopsy procedure in the morgue. We tried to discuss on some of the prominent guidelines available to date. The guidance can be followed by the coroners, forensic investigators, biochemist and pathologist as well as other workers involved in postmortem service and respective authority/department.

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