

Enhancing Autopsy Workflow Through a Downdraft Set Up

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The autopsy or necropsy is a post-mortem procedure that consists of a thorough examination of a corpse by dissection: to determine the cause, mode, and manner of death, and, to evaluate any disease or injury that may be present for research or educational purposes. Autopsy literally means “seeing for oneself.” A significant number of major findings cannot be diagnosed without histology; thus, without a biopsy or an autopsy they cannot be diagnosed.

Autopsies can be regarded as a form of quality control. One large review in JAMA suggests that approximately 25% of autopsies reveal a finding that would have changed clinical management, and 5% of autopsies reveal a missed diagnosis that probably affected the outcome. For the past decade, clinical autopsy has not been given proper attention due to various factors including advancements in medical diagnostic technology that deem the need for postmortem examinations to be uncertain. Yet in the recent COVID-19 pandemic, autopsies have been instrumental in the provision of important public health information.¹⁻⁴

All autopsies to be performed must be handled as if they contain an infectious agent (standard precautions). The entire autopsy area and its contents are designated as a biohazard area and posted with appropriate warning signs. Autopsies are ideally performed in negative pressure room suites (i.e., the pressure in the room is lower than those outside it) to allow air to flow into the isolation room or autopsy suite, but not escape from this room. Air will naturally flow from areas with higher pressure to areas with lower pressure, thereby preventing contaminated air from escaping the autopsy suite with negative pressure. The internal air is forced out so that negative air pressure is created pulling air passively into the system from other inlets.⁵⁻⁷

At the Research Institute for Tropical Medicine (RITM), autopsy services were suspended since the SARS pandemic in 2003 due to inadequate facilities. As recent events have underscored the need for autopsy, efforts to resume its operation have been pursued to include emerging and re-emerging infectious diseases. This article aims to revisit the proceedings in an autopsy and also feature the design of the RITM morgue suite.

The RITM autopsy suite (Figure 1) is a well-ventilated room with negative pressure airflow exhaust system and contains a separate low-traffic isolation room. Whenever possible, autopsies performed on human remains that are potentially infectious should be done in settings that have adequate air-handling system. This includes: 1) a minimum of six (old construction) to twelve (new construction) air changes per hour (ACH), 2) negative pressure relative to adjacent areas as per recommendations for airborne infection isolation rooms (AIIRs), and 3) direct exhaust of air to the outside or passed through a HEPA filter if





Figure 1. Autopsy suite.

air is recirculated. The RITM autopsy suite has a 23-34 ACH (minimum 12 ACH per WHO guidelines) with 12 to 20% differential air on the supply and exhaust air. The inward airflow smoke pattern test also ensures the uni-directional ventilation at the door openings of the suite.^{2,3,7-10}

Preceding the autopsy procedure, the pathologist and the team must perform proper hand washing technique before donning of the personal protective equipment (PPE) in the ante room. A biosafety officer will perform a risk assessment for the case and assists in ensuring proper donning. The autopsy team will enter the morgue suite, which is a negative pressure room, that incorporates a ventilation system designed so that air flows from the corridor into the negative pressure room, ensuring that contaminated air cannot escape from the negative pressure room to other parts of the hospital area. The cadaver is placed in the autopsy table.

The autopsy table with downdraft ventilation (CSI Jewett DEM Dyna-Poise, Spire Integrated Solutions) (Figure 2) is used for the postmortem examination, ideal for examining cadavers, especially potentially infectious cases. The downdraft ventilation in an autopsy table facilitates airflow (Figure 3) that will decrease the exposure of the prosector from infectious agents that may be transported airborne. Exhaust systems around the autopsy table direct air (and

aerosols) away from healthcare workers performing the procedure (e.g., exhaust downward). This downdraft table can also be rotated through an arc of 180 degrees with elevating mechanism that is of an ergonomic design. The downward exhaust system HEPA filter test of the autopsy table resulted in a percentage of less than 0.005% (0.00014), and the airflow visualization of the downdraft using a smoke test pattern showed a downward direction.

The autopsy suite is equipped with mortuary refrigerators. These are low-temperature refrigerated cabinets composed of condensing and evaporating units, that are used to keep dead bodies. Autopsy tools are stationed near the autopsy table for easy access. Obtained tissue are placed in the pass box, which is used to transfer materials from the suite to the tissue processing area through a controlled environment in order to avoid airborne cross-contamination.

After the procedure the team exits thru the autoclave room and doff their used PPE before taking a shower and exiting thru the designated egress leading to the open space at the side of the morgue. The diener will clean up the dead body and place it back to the refrigerator. He/she will clean and disinfect the suite and turn on ultraviolet (UV) lights.

The autopsy table is also connected to a waste water drain treatment system, which ensures that the water waste is



Figure 2. Autopsy table with down draft ventilation. The autopsy table is designed for dissection of cadavers and includes a recessed top which eliminates the need for a body tray. The downdraft system provides a safe environment, completely ventilating formalin vapors down and away from the user.

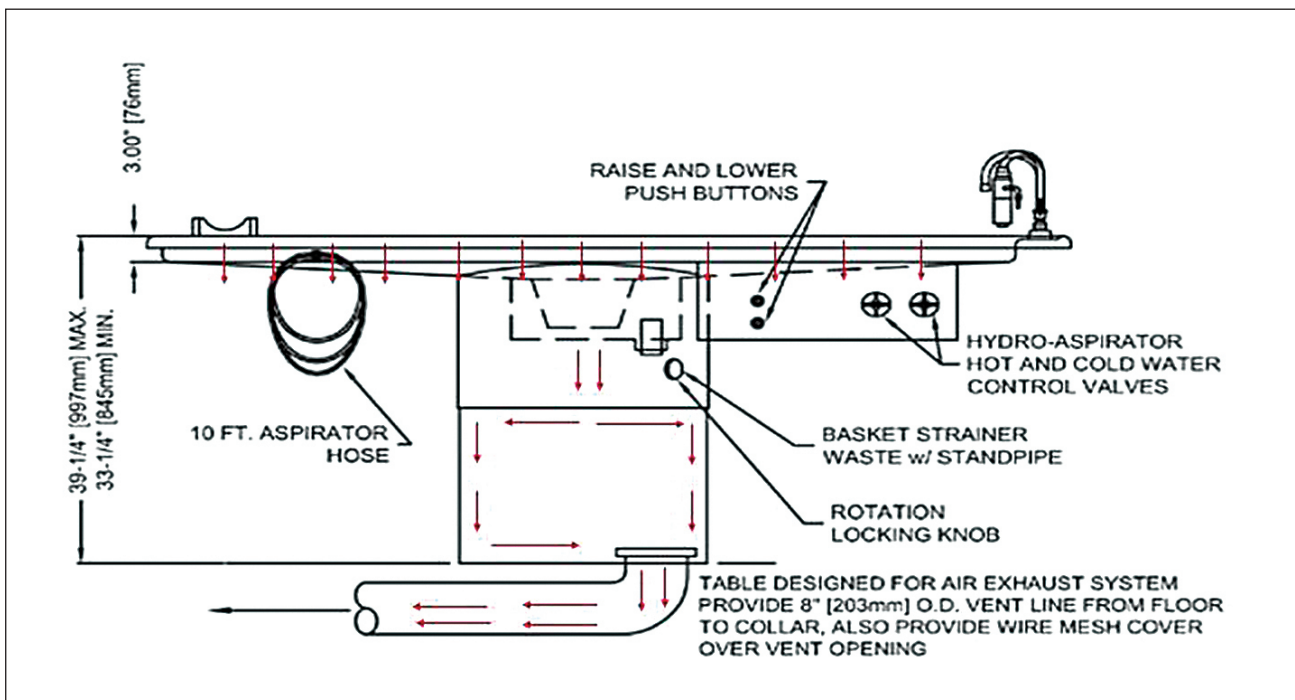


Figure 3. Airflow in downdraft autopsy table. Exhaust systems in and around the autopsy table should direct air (and aerosols) away from the health care worker performing the procedure (e.g., exhaust downward).

disinfected prior to release to the sewage treatment plant (STP). The flow of such system is initiated by trigger switch of the chlorinator into the wastewater within the holding tank (sump pit) then the transfer pump moves the chlorinated waste water into aeration tank. Finally, the effluent pump releases the wastewater into the existing sewer manhole.

Engineering and environmental controls, together with safety procedures, biohazard risk assessment and adequately trained personnel are vital factors in performing autopsies. This is in support of revitalizing the need and performance of autopsies especially with the continued threat of emerging and re-emerging infectious diseases, underscoring its continued relevance in the practice of medicine.

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