

H33 Extracorporeal Membrane Oxygenation (ECMO) in the Forensic Setting: A Series of 19 Forensic Cases

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Learning Overview: After attending this presentation, attendees will have be familiar with the ECMO procedure, including common scenarios, indications, configurations, and complications that are likely be to be encountered by forensic pathologists.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by increasing awareness among death investigation professionals of a complicated intervention used as salvage therapy in individuals who develop acute cardiorespiratory failure, a population whose deaths are likely to fall under medical examiner jurisdiction.

Introduction: ECMO is a surgical intervention employing vascular cannulation and a gas exchange circuit to provide circulatory and respiratory support to critically ill patients with severely compromised cardiopulmonary function. Clinical settings may include both acute (trauma, cardiac arrest) as well as subacute and chronic conditions (idiopathic lung disease, viral pneumonia, sepsis). More recently, ECMO has gained some attention as a potential treatment for severe COVID-19 infections. As a salvage therapy, ECMO is often the last major intervention taken before death and thus presents a unique set of challenges to medical examiners.

This study describes the characteristics of a series of 19 deaths involving patients who were on ECMO at the time of death, including clinical indications, types of circuit configurations (venovenous versus venoarterial), causes and manners of death, gross and histopathologic findings at autopsy, and complications that may arise with both short -and long-term ECMO support.

Methods: Medical examiner files (MDILog, ORA, Inc.) of the Southern Minnesota Regional Medical Examiner Office were searched for keywords “ECMO” or “extracorporeal membrane oxygenation” between 2013 and 2019.

Results: Nineteen cases of decedents who were on ECMO at the time of death were identified. All 19 cases were autopsied, and all were considered medical examiner cases. The median age was 36 years (range, 2–83 years) with 11 men and 8 women represented. The circumstances surrounding the initial presentation included: sudden death in a young person ($n=6$, mean age: 28.7 years), trauma ($n=3$), history of substance abuse ($n=3$), possible or confirmed homicide ($n=2$), therapeutic complication ($n=2$), work-related injury ($n=1$), drowning ($n=1$), and hypothermia due to environmental exposure ($n=1$). Of the two therapeutic complications, one was directly related to the ECMO therapy.

The underlying causes of death included: seven injury-related deaths (including drowning/hypothermia, accidental falls, assault, work-related injury, and overdose); six respiratory-related natural diseases (including viral pneumonia, rapid onset organizing pneumonia, pulmonary thromboembolism, and complications of lung transplantation); and six deaths due to cardiac-related natural diseases (including ischemic heart disease, familial cardiomyopathy, valvular heart disease, and aortic aneurysmal disease).

The time spent on ECMO varied greatly from less than one hour to ten months. The majority of cases ($n=17$) utilized Venoarterial (VA) cannulation and two cases utilized Venovenous (VV) access. The most common cannulation sites for central VA-ECMO were the right atrium and aorta, while peripheral VA most commonly accessed the right femoral artery and right femoral vein. VV-ECMO accessed the right internal jugular and right femoral veins. Complications encountered due to ECMO intervention included cannulation site bleeding, pneumohemopericardium, retroperitoneal hematoma, limb ischemia, clotting, and cannula dislodgement.

Conclusion: The patient population likely to receive ECMO has significant overlap with the populations that are likely to be reported to the medical examiner. As ECMO therapy has become increasingly available in the community, it is of importance for medical examiners and death investigators to be familiar with the procedure as well as its limitations. Familiarity with ECMO and its sequelae allows for the proper documentation of postmortem findings and fosters an informed determination of the cause and manner of death.

ECMO, Forensic, Cardiovascular