

Extracorporeal Membrane Oxygenation for Solid Organ Transplant

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NURS 613: Evidence-Based Practice in Healthcare

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April 28, 2024

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The following paper was written after watching a webinar that describes the process of Extracorporeal Membrane Oxygenation for Solid Organ Transplant and the ethical issues that lie within. The process of procuring organs from a donor is already a complex procedure, however, there have been many advancements throughout the years to help ensure success with both the procurement and implementation of the solid organ into the recipient. A significant advancement focuses on ensuring that the organ continues to be perfused with oxygenated blood after the donor has expired. This process can be completed through the process of using extracorporeal membrane oxygenation (ECMO). There are many ethical concerns and implications with using the process of continuing to oxygenate organs after the death of a donor, either via cardiac arrest or brain death. This webinar covered the history, advancements, and potential ethical concerns of using ECMO for organ transplantation. Additionally, the complications that arise from organ donation were discussed, with one of the biggest complications that occur in the process of receiving an organ is rejection, whereas one of the biggest concerns with donating is having the organ become non-viable due to improper handling of the organ after procurement.

History of Organ Donation

In the beginning, early organ transplantation was focused solely on kidneys, specifically from live donors since the patient can still live after the removal of one kidney (Nordham & Ninokawa, 2021). The first renal transplant was performed in 1933, however the recipient expired 2 days after the procedure due to blood type incompatibility (Nordham & Ninokawa, 2021). The first successful renal transplant from a live donor happened in 1953 with both patients being identical twin brothers (Nordham & Ninokawa, 2021). In 1959, the first successful

renal transplant between two patients that were not genetically identical occurred, where the recipient lived for 25 years afterwards (Nordham & Ninokawa, 2021).

Cadaveric organs were first received from patients who had died of cardiac arrest, with the first occurring in 1959. At the time, cardiac arrest was considered as the only recognizable death where a patient could have an organ procured (Nordham & Ninokawa, 2021). By the late 1960s, patients that were considered brain dead were acceptable donors, and other solid organs began to be transplanted such as the pancreas, liver, and heart (Nordham & Ninokawa, 2021). Currently, evidence-based practice states that ECMO should only be used in the procurement process of organs when there is clear benefit in preserving the viability of cadaveric organs (Nordham & Ninokawa, 2021).

Pros of ECMO for Organ Procurement

In most cases, ECMO is only used when the lungs and heart are no longer working in the proper manner, which works by bypassing both organs to perform the jobs to keep the rest of the body perfused with oxygenated blood and remove carbon dioxide (Yale Medicine [YM], 2022). In the case of organ transplantation after cardiac death, ECMO would continue to perfuse the organs until the point that they are procured from the patient (YM, 2022).

Recently, ECMO has been found to have another beneficial role in keeping organs viable in a cadaveric donor (Madrahimov et al., 2023). One of the biggest concerns with obtaining organs from a donor after death is ischemic damage to all donatable organs due to the loss of contractability of the heart from cardiac death (Madrahimov et al., 2023). However, with ECMO, after cardiac death the donor can be re-perfused, keeping organs viable and oxygenated until the end of procurement (Madrahimov et al., 2023). With the use of ECMO, organs have a lower

chance of rejection and needing to be discarded due to cyanotic injury (Madrahimov et al., 2023).

Organs procured from a donor using ECMO have been shown to have a lower rate of rejection, with a coinciding higher rate of graft and recipient survival (Rajic et al., 2024). Goldberg et al. (2021) demonstrated a successful heart transplant after cardiac death from a pulmonary embolism after the donor was placed on ECMO during procurement. With ECMO, a heart that would be considered as non-viable was capable of being re-perfused and transplanted into a recipient successfully (Goldberg et al., 2021).

Cons of ECMO for Organ Procurement

After reviewing all the benefits, it is important to also examine the cons associated with such a procedure as ECMO in organ procurement. Although not as significant as the survival of the recipient, the cost of such procedures should also be taken into account. Specifically, the cost of utilizing ECMO during organ procurement will be placed upon the recipient and their insurance (National Institute of Health [NIH], 2022). The mean estimated cost of ECMO was 73,122 dollars, with a median of 62,545 dollars (NIH, 2022).

Receiving an organ transplant is expensive to begin with, however adding in the factor of ECMO increases the cost ten-fold. The cost of the transplant process is solely placed on the recipient; even though ECMO increases the odds of success, it will also greatly increase the cost. There also comes the problem of having the required equipment for ECMO to be performed to preserve the function of solid organs, where using said equipment for procurement removes a machine from being able to keep another alive.

Ethical Concerns Regarding ECMO

Currently, healthcare is working to expand the number of organ donations in patients post cardiac death, otherwise known as donation after circulatory death (DCD); in these patients, ECMO is utilized to maintain perfusion even after cardiac death (Schiff et al., 2023). In these cases, the patient has experienced cardiac arrest, resuscitation was unsuccessful, and then the patient is placed on ECMO (Schiff et al., 2023). Here lies the biggest ethical issue regarding the practice of ECMO in organ donation, where using such a process will resuscitate the patient, posing the question of whether the surgeon is killing the patient by removing their organs (Schiff et al., 2023). The authors of this article identified this conundrum and recommended that only health systems with inherent capability for all patients to utilize ECMO, should be the only ones allowed to have ECMO as an option for organ transplant. (Schiff et al., 2023)

Previously, the cost of using ECMO in the procurement process was discussed. Not all patients that need an organ transplant will be able to afford the use of ECMO in the procurement process. As a result, this leaves the ethical consideration of both affordability and access to be considered when determining if ECMO should be utilized. For example, should a patient that does not have insurance be excluded from obtaining an organ transplant due to the lack of ability to pay for the surgical procedure? This doesn't seem fair, but so often that's the reality of many patients around the world. As the article describes, in certain countries with universal help or one insurance payor system, the implementation of ECMO for organ transplant should have less ethical implication, since all patients would have had even chances of ECMO during their treatment and subsequent end of life.

Rapid Critical Appraisal

Using the questionnaire provided, the webinar was assessed via the rapid critical appraisal of evidence-based guidelines. The guideline developers for the ethical concerns were

created by physicians that directly work alongside the procurement team in organ transplants.

The presenter was a physician that performs organ procurement surgeries and worked alongside the developers of the guideline that was created for Advocate South Suburban Hospital's evidence-based practice guidelines for ECMO use in organ procurement.

The research used for this guideline was provided by the hospital's foundation, and not from the pocket of any of those performing the research. The presenter and associated surgeons posed the idea of having the ethical committee being involved in all possible organ donation cases to determine if ECMO would be an appropriate measure to be taken to not go against the patient or families wishes. The presentation broke up all the different sections for understanding the history of organ donation, the current guidelines, and the pros/cons and ethical concerns of using ECMO in organ procurement. Literature review that was performed for the webinar presentation was all within the past five years, not within the last 12 months. The peer review performed for this guideline incorporated other surgeons within the hospital network.

The intent for this webinar was to provide guidelines specific to all Advocate Hospitals, meaning that it was more of a local/regional evidence-based guideline. The recommendation to use ECMO for organ procurement is clinically relevant to the care of patients that are both organ donors, as well as organ recipients. Although I am a nurse, this guideline does not specifically help me in providing care to my patients. However, even though they are not helpful to me, that are practical and useful for other healthcare team members providing care to patients that are both donors and recipients.

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