Identifying Speed-Bumps: Challenges of ECMO Transportation

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Within the field of cardiovascular perfusion, many practices are left up to the discretion of specific healthcare organizations rather than state, national, or international regulatory bodies. One facet of this is the transportation of patients while on extracorporeal membrane oxygenation (ECMO). The techniques used to safely stabilize and transport ECMO patients may be similar, but the differences in practice can bring variations in challenges each program may face.

There are a myriad of components that contribute to ECMO transport and characteristics of ECMO transport programs that vary from one another (Broman et al., 2020). Despite varying elements, a commonality among most ECMO transport programs is that several practices must be properly organized to ensure a successful transportation from the very moment the decision has been made to launch an ECMO transport team (Broman & Frenckner, 2016). Depending on the time of day and availability of personnel, the typical response time for activating an ECMO transport team is 30 to 90 minutes, including the organization of vehicle/aircraft transportation (Ehrentraut et al., 2019).

Ground (ambulance), rotary-wing (helicopter), and fixed-wing aircraft (plane) are three modes of commonly executed ECMO transport (Broman & Frenckner, 2016). There are several circumstances and contributing factors that influence the vehicle/aircraft used for ECMO transport. Choice of vehicle is a nuanced decision that relies on a multitude of factors regarding the trip. A few of these factors that contribute to which mode of transportation to use are the weight limitations, distance of transport, and patient condition, which dictates the speed at which a patient must be moved (Broman & Frenckner, 2016). Other circumstances such as toleration of noise, ease of mobility in the cabin, environmental conditions, and security of equipment should also be considered when choosing a mode of transit. Not all medical transportation is made equally, and each vehicle has its own advantages and disadvantages when regarding ECMO transport (Steenhoff & Zohn, 2020).

In a retrospective review, the University of Michigan ECMO program performed 221 ECMO transports between the years 1990 and 2012. The frequency and examples of complications experienced during the 221 ECMO transports were recorded. The complications were categorized into seven sections, including missing item, electrical complication, complication with overall aspects of patient care, complication causing substantial delay in travel, circuit issue, inadequate circuit flow, and patient death (Bryner et al., 2014). Of the 221 ECMO transports, electrical complications such as ambulance battery outage, portable laboratory device not working, battery loss requiring hand-cranking of pump, and water

heater failure occurred the most frequently at 39% of the time (Bryner et al., 2014). The patient death category of complications occurred the least frequently at 1% of the time (Bryner et al., 2014).

In a retrospective observational cohort study of 908 ECMO transports performed by the Karolinska University Hospital between the years 1996 and 2017, at least 1 complication occurred in 28% of all transports (Fletcher-Sandersjöö et al., 2019). This study categorized the complications into five categories; patient, environment, human error, transportation vehicle, and equipment. Of all modes of transportation, the study experienced a higher risk of transportation complications with a fixed-wing aircraft (Fletcher-Sandersjöö et al., 2019). The study explained that this complication likely reflected the fact that fixed-wing aircraft transportations involve an additional aspect of transportation requiring the reloading of the patient from the ambulance to the actual fixed-wing aircraft (Fletcher-Sandersjöö et al., 2019).

Just as no two perfusionists pump a case the exact same way, no two ECMO programs operate identically. Knowing that there are so many variables at play in the transportation of a single patient from one healthcare facility to another, it's no surprise that each team would have to work through their own specific challenges that arise during transportation. The challenges experienced by an ECMO transport team on the west coast may not be the same challenges experienced by an ECMO transport team on the east coast. The same goes for healthcare systems that work with fixed-wing airplanes versus ground transportation. Knowing what stands in opposition to efficient, safe, and evidence-based practice will aid in building a stronger system of ECMO transportation across the United States.

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