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Management of veno-arterial ECMO in infants and children

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VA support remains common in neonates and children placed on extracorporeal membrane oxygenation (ECMO) for respiratory, cardiac or combined dysfunction.¹ Providing adequate ECMO flow to reverse tissue oxygen debt is imperative in the first few hours of ECMO. Several studies outline the poor outcome which results if lactic acidosis and pH do not improve after institution of ECMO. Following serial lactate, urine output, and other signs of organ perfusion are vital aspects of care.

For infants and children, the common route for adequate vessel size is use of the right internal jugular vein and right common carotid artery. Some centers also utilize a venous drainage cannula placed retrograde up the internal jugular vein to the level just below the jugular bulb to augment venous drainage. Whether this also reduces risk for venous congestion in the brain is unknown. Older children (usually at least 15 kg or 2–3 years old) may be supported via the femoral vessels (vein and artery) or a combination of cervical and femoral routes. There is some evidence to suggest that use of the carotid artery is associated with more risk for neurologic abnormalities such as seizures or intracranial infarction. For patients cannulated via the femoral vessels, care must be taken to avoid distal venous congestion in the extremity, which can lead to compartment syndrome. Similarly, distal lack of arterial perfusion can lead to ischemia and need for amputation in severe cases. Placement of a distal cannula which is then Y-ed into the arterial return from the ECMO circuit can provide perfusion to the limb. Neurovascular integrity of the lower extremities is important to prevent injury.²

Veno-arterial ECMO increases left ventricular after-load. This can result in sudden and severe left ventricle failure, leading to pulmonary edema or hemorrhage from back-up into the left atrium and pulmonary

venous hypertension. Transmural ischemia from left ventricular distention can also occur. While afterload reduction or low-dose vasoactives to improve ventricular performance and maintain left ventricular output can be effective, some patients will require decompression of the left side of the heart. This can be done via a balloon septostomy across the atrial septum (allowing left atrial blood to then be drained into the right atrium and removed with the venous drainage cannula), by placement of a direct venting cannula into the left atrium, left ventricle, or pulmonary vein and then Y-ing this into the venous side of the ECMO circuit.³ Following left ventricle performance with ECHO and maintaining a pulse pressure of at least 10 mmHG following ECMO

initiation are important aspects of VA care. For weaning during VA ECMO, decompression efforts must be ceased to allow adequate filling of the left ventricle. For post-cardiotomy patients placed on VA ECMO, early cardiac catheterization to identify correctable residual lesions should be performed. Failure to recover heart function within the first week of ECMO is associated with high mortality and discussion of listing for heart transplant or discontinuation should occur as appropriate.⁴

Keywords: ECMO, ECLS, respiratory failure, children, neonates

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