Commentary: V-V ECMO: The Surgeon’s Clew

Chase Donaldson, MD
Department of Intensive Care and Resuscitation, Cleveland Clinic Foundation

Andrew D. Shaw, MB FRCA FFICM
Department of Intensive Care and Resuscitation, Cleveland Clinic Foundation

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Correspondence: shawa8@ccf.org

Central Message: Postoperative refractory hypoxia involves a variety of different mechanisms, including cardiogenic sources which make extrapolation of trials for ARDS and the use of ECMO for ARDS difficult. However, V-V ECMO provides an important option to bridge the cardiothoracic surgery patient to lung recovery.

Central Picture Legend: Andrew Shaw, MBBS
In the story of Theseus and the minotaur, Theseus is given a clew, or a ball of string, by the princess Ariadne of Crete when entering the labyrinth as means to escape upon completion of his mission. Without the string, even though he may have accomplished his aim of slaying the minotaur, he would have been lost in the labyrinth and perished. Likewise, in cardiothoracic surgery, although technical success in the operating theatre of the procedure may be successfully accomplished, hemodynamic instability and specifically refractory hypoxia may occur that limit the ability to liberate from cardiopulmonary bypass or achieve the necessary stability to recover in the intensive care unit. V-V ECMO can function as the clew to bridge the patient across the acute process that resulted in refractory hypoxemia and allow the patient to safely leave the operating theatre. In this issue, Copeland et al provides a concise review of mechanisms for hypoxia in cardiothoracic surgery patients as well as the indications, contraindications, procedure, and management of V-V ECMO in this patient population.

As the risk profile of patients undergoing cardiothoracic surgery continues to increase, the need for more sophisticated and typically invasive modalities of postoperative respiratory care will likely follow, including postoperative ECMO support. However, a significant complicating factor in the evaluation and treatment of refractory hypoxia in the cardiothoracic surgery patient is the heterogeneity of etiologies for the hypoxia. In addition to the typical causes of ARDS described by the authors, a significant burden of post-cardiothoracic surgery refractory hypoxia may be due to pulmonary edema from a cardiogenic source as a result of mitral regurgitation, left ventricular systolic and diastolic dysfunction, volume overload, and acute right ventricular failure causing left ventricular failure. These etiologies are definitionally distinct from ARDS and management may vary on account of differing mechanisms of alveolar injury, specifically damage to epithelial and endothelial barriers as well as the relative sensitivity to driving
pressures in the traditional pathophysiology of ARDS.

Extrapolating management strategies and outcomes from ARDS trials or even the use of ECMO in ARDS may also be problematic because the populations studied differ significantly from those in cardiothoracic surgery. For example, sepsis and pneumonia cause up to 80% of cases of ARDS and are thus rarely seen in the immediate postoperative course. Instead, typical etiologies of intraoperative or postoperative ARDS described by Copeland et al include inflammation from cardiopulmonary bypass, aspiration of gastric contents, transfusion reactions, ischemia-reperfusion injury, and atelectasis, all of which typically follow a shorter clinical course and often demonstrate more rapid improvement than is seen with sepsis and pneumonia. The short-lived hypoxic effects of many of these etiologies makes postoperative V-V ECMO an ideal strategy to bridge the postoperative cardiothoracic surgery patient to lung recovery. At our institution, intraoperative venous or arterial sheaths are commonly placed in patients at very high risk of postoperative cardiac or pulmonary failure in anticipation of the potential need for V-A or V-V ECMO.

Outcomes of V-V ECMO in post-cardiothoracic surgery are poorly characterized in the literature outside of the lung transplantation population, but its use is commonly accepted and regardless of etiology of the refractory hypoxia, it can be Ariadne’s gift for the patient’s treatment team in the operating theatre.
References


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