

# Extracorporeal Membrane Oxygenation Management Techniques to Liberate from Extracorporeal Membrane Oxygenation and Manage Post-Intensive Care Unit Issues



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## KEYWORDS

• Decannulation • Weaning • Complications • Rehabilitation • Palliative

## KEY POINTS

- Once extracorporeal membrane oxygenation (ECMO) has been established, attention must be directed toward optimizing recovery, minimizing complications, minimizing end-organ damage, and ultimately weaning patients from ECMO support.
- Detailed understanding of the weaning process and application of validated weaning techniques can greatly improve patient outcomes.
- Post-ECMO patients often require physical, occupational, and speech therapy in addition to assistance with nutritional issues.
- Recent studies have shown that both physical and emotional domains improved with longer follow-up after ECMO.

## INTRODUCTION

Extracorporeal membrane oxygenation (ECMO) is a life-saving technique used in circumstances when patients require pulmonary and/or cardiac support for days to weeks for recovery, bridge to decision, or transplantation.<sup>1</sup> Over the past several decades, ECMO has evolved to provide cardiopulmonary support to patients recovering from lung failure; heart failure; trauma; acute arrest; and pretransplantation, during transplantation, or post-cardiac transplantation or post-lung transplantation in both children and adults. More recently, ECMO has been used for temporary

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support to allow diagnostics, recovery, or determination of eligibility or availability of a suitable donor organ. Decades of publications and educational materials have addressed the management of ECMO in different settings and populations. Little has been written regarding post-ECMO management and optimal rehabilitation of the ECMO survivor. In many ways, the post-ECMO period recapitulates the entire field of critical care.

## COMPLICATIONS

As ECMO continues to evolve so does its safety profile. Nevertheless, it remains an invasive therapy with requirement for extracorporeal circulation of the patient's blood volume to remove carbon dioxide and oxygenate red blood cells before returning blood to the patient's body. Caregivers must be particularly vigilant to prevent or minimize the complications that may arise while a patient is on ECMO to lessen the burdens of post-ICU care.

## WEANING FROM EXTRACORPOREAL MEMBRANE OXYGENATION

Due to the complications associated with ECMO, as discussed previously, it is best to keep patients on ECMO as little time as necessary to accomplish recovery, a bridge to destination therapy, transplant, or withdrawal. Patients can potentially be on ECMO for several days to weeks to months. As the technology of ECMO has improved and complications have decreased, the risk/benefit of longer ECMO runs has improved. Recruitment maneuvers should be performed prior to the weaning trial to optimize lung function. Also, according to Extracorporeal Life Support Organization guidelines, hepatic function should have recovered prior to any attempt to wean patients from ECMO, irrespective of the findings of cardiac assessment. Once a patient demonstrates good performance with no support from the oxygenator, the cannulas may be removed, either percutaneous (with pressure) or open (with direct vascular control or repair). Either can be done at the bedside or in the operating room with the patient sedated and monitored. In an international survey that analyzed 141 responses from 283 Extracorporeal Life Support Organization-registered ECMO centers contacted across 28 countries, 90% of the centers favored weaning patients from the ECMO circuit before weaning from the ventilator.<sup>2</sup>

Weaning protocols at the authors' center have been streamlined to a standardized method. The principles of weaning from ECMO no matter the etiology require the following pre-weaning parameters: clear chest radiograph, afebrile, euvoemia, and resolution/treatment options (left ventricular assist device [LVAD], total artificial heart [TAH], and transplantation) of the first problem. Failure to respect the principles results in unsuccessful outcomes.

Weaning from VV support in the setting of respiratory failure alone is somewhat subjective but involves an amalgamation of the data derived from a patient's overall pulmonary performance from current ventilator parameters, including oxygen requirements, compliance, and radiologic evidence of resolution of the initial insult. The goal of weaning should be successful conversion to conventional modes of ventilatory support without the need for ECMO support.

In the circumstances of dual system failure, such as cardiac stunning secondary to a hypoxic event, successful weaning involves encompassing a combination of both approaches. Regardless of which mode of support is weaned from, the primary mandate remains that there must be resolution of the original organ system insult to allow for ongoing physiologic stability without ECMO support or an alternative capability to

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