



# Advances in ECMO Technology: Impact on Neonatal Septic Shock Treatment

Andrea Miller \*

Department of Neonatal Biology, University of Exeter, Exeter, United Kingdom

## DESCRIPTION

Neonatal septic shock remains a critical condition associated with high mortality rates despite advancements in neonatal intensive care. In severe cases where conventional therapies fail to stabilize the patient, Extracorporeal Membrane Oxygenation (ECMO) therapy emerges as a lifesaving intervention.

### Understanding neonatal septic shock

Neonatal septic shock is a severe manifestation of sepsis, characterized by Systemic Inflammatory Response Syndrome (SIRS) leading to cardiovascular collapse. It typically arises from bacterial infections, often transmitted vertically from the mother or acquired postnatally in the hospital setting. Septic shock in neonates presents with intense hypotension, poor perfusion, and multiorgan dysfunction, necessitating aggressive management to prevent mortality.

### Indications for ECMO in neonatal septic shock

ECMO is considered when conventional therapies, including fluid resuscitation, vasopressors, and ventilatory support, fail to stabilize the neonate's condition.

**Persistent cardiovascular instability:** Despite maximal medical therapy, the neonate remains hemodynamically unstable.

**Refractory hypoxemia:** Inadequate oxygenation and ventilation despite optimal mechanical ventilation.

**Severe Acute Respiratory Distress Syndrome (ARDS):** Associated with septic shock and not responding to conventional management.

**Progressive multiorgan failure:** Including renal failure, hepatic dysfunction, and neurological compromise.

### Benefits of ECMO therapy

ECMO provides several physiological benefits potential for neonates in septic shock.

**Oxygenation and carbon dioxide removal:** ECMO takes over the functions of the heart and lungs, providing oxygenated blood to the body and removing carbon dioxide.

**Circulatory support:** Maintains adequate perfusion to vital organs, despite severe cardiovascular diseases.

**Allows time for recovery:** By supporting vital organ function, ECMO helps for the recovery, allowing time for antibiotics to eradicate the infection and for organ systems to heal.

### Challenges and considerations

Despite its potential benefits, ECMO therapy in neonatal septic shock presents significant challenges.

**Risk of bleeding:** Anticoagulation is necessary during ECMO, which increases the risk of bleeding complications, particularly problematic in neonates.

**Infection risk:** Neonates are already predisposed to infections, and ECMO can further increase the risk of bloodstream infections and sepsis.

**Technical complexity:** ECMO requires specialized equipment, trained personnel, and meticulous management to avoid complications.

**Long-term outcomes:** While ECMO can be life-saving, its impact on long-term neurodevelopmental outcomes in neonates with septic shock requires further study.

### ECMO procedure

The ECMO procedure involves cannulating large vessels to divert blood through an artificial membrane oxygenator.

**Venoarterial ECMO (VA-ECMO):** Provides both cardiac and respiratory support by draining blood from the venous system and returning it to the arterial system.

**Venovenous ECMO (VV-ECMO):** Primarily supports respiratory function by removing deoxygenated blood from the venous system, oxygenating it, and returning it to the venous circulation.

**Correspondence to:** Andrea Miller, Department of Neonatal Biology, University of Exeter, Exeter, United Kingdom, E-mail: Andrumiller@edu.uk

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## Management during ECMO

During ECMO therapy for neonatal septic shock, ongoing management focuses on:

**Monitoring:** Continuous monitoring of oxygenation, ventilation, hemodynamics, electrolytes, and coagulation parameters.

**Antibiotic therapy:** Continued administration of broad-spectrum antibiotics until cultures confirm effective treatment.

**Nutritional support:** Providing adequate nutrition to support growth and development.

**Weaning and decannulation:** Gradual reduction of ECMO support as the neonate's condition stabilizes, followed by careful decannulation to minimize complications.

## Outcomes and prognosis

The outcomes of ECMO therapy in neonatal septic shock vary depending on factors such as the severity of illness, duration of

ECMO support, and underlying comorbidities. Overall, survival rates have improved with advances in ECMO technology and intensive care management. However, long-term neurodevelopmental outcomes require close follow-up and multidisciplinary support.

ECMO therapy represents a critical intervention for neonates with septic shock refractory to conventional treatments. While associated with significant challenges and risks, ECMO can provide a lifeline for neonates facing life-threatening conditions. Advances in ECMO technology, along with improved understanding of patient selection and management strategies, continue to refine its role in neonatal intensive care. Ongoing research and collaborative efforts are essential to optimize outcomes and ensure the best possible care for neonates with septic shock undergoing ECMO therapy.