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## **A literature review on ECMO in Pregnant and Postpartum Women**

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### **Abstract**

Extracorporeal Membrane Oxygenation (ECMO) has emerged as a crucial lifesaving intervention for critically ill patients with severe cardiopulmonary failure. Its application in pregnant and postpartum women has gained increasing attention in recent years, especially in cases where conventional therapies fail to stabilize the patient. Pregnancy is associated with significant physiological changes, including increased blood volume, altered immune response, and heightened oxygen demand, which can predispose women to complications such as acute respiratory distress syndrome (ARDS), peripartum cardiomyopathy, and thromboembolic events. These complications, if not managed promptly, can lead to maternal and fetal morbidity and mortality. This literature review explores the effectiveness, safety, and challenges of ECMO in managing critically ill pregnant and postpartum women by synthesizing findings from various case reports, cohort studies, and clinical guidelines.

The review focuses on key aspects including survival rates, timing and indications for ECMO initiation, maternal-fetal considerations, complications, and ethical concerns. Evidence suggests that maternal survival rates range between 64–80% when ECMO is applied early and managed by specialized, multidisciplinary teams. However, risks such as bleeding, infection, and technical challenges associated with cannulation require careful management. The review also highlights the importance of balancing maternal stabilization with fetal outcomes, especially in preterm deliveries. The findings underscore that ECMO is a viable option in obstetric care, provided that healthcare providers follow structured protocols and ethical decision-making processes. Continued research and data collection are essential for refining management strategies and improving patient outcomes.

### **Introduction:**

Pregnancy triggers profound changes in cardiovascular, respiratory, and hematologic systems to meet the metabolic demands of both the mother and fetus. These adaptations, while generally beneficial, can predispose expectant mothers to heightened risks in cases of cardiopulmonary distress. Conditions like

acute respiratory distress syndrome (ARDS), peripartum cardiomyopathy, and thromboembolic events can progress rapidly to life-threatening complications when conventional interventions prove inadequate.

ECMO, a form of mechanical life support that oxygenates blood and provides circulatory assistance, offers a potential bridge to recovery in such cases. However, its implementation in pregnant and postpartum women requires consideration of maternal and fetal health, anticoagulation management, vascular access, and complex team coordination involving obstetricians, intensivists, and ECMO specialists. This review aims to collate current evidence regarding indications, benefits, risks, and ethical challenges associated with ECMO in these vulnerable populations, guiding future clinical practice.

## Review of Literature

### 1. Survival and Outcomes

Survival outcomes in pregnant and postpartum women receiving ECMO support have been a major focus of research in recent years. Arikian et al. (2021) conducted a multicenter case series involving 60 obstetric patients suffering from severe COVID-19-induced ARDS. The study reported a maternal survival rate of 64.5%, which was a significant improvement compared to earlier reports where such patients faced high mortality rates. A notable observation from the study was that most of the women were in their third trimester, and obstetric teams often opted for early delivery before initiating ECMO. This preemptive approach was aimed at reducing the cardiopulmonary strain on both the mother and fetus, leading to improved maternal outcomes without significantly compromising fetal health.

Similarly, Naoum et al. (2020) reviewed 25 cases of pregnant and postpartum patients who underwent ECMO for severe cardiopulmonary collapse. They found an even higher survival rate of 80%, emphasizing that maternal survival was closely associated with early recognition of clinical deterioration and rapid ECMO initiation. Aggressive management protocols, including ventilator support and anticoagulation monitoring, contributed to improved outcomes. The study concluded that ECMO, when applied at an appropriate stage and with comprehensive care, can significantly enhance maternal survival and reduce the need for prolonged ICU stays.

### 2. Timing and Indications

The timing of ECMO initiation has been identified as one of the most critical factors influencing patient outcomes. Nair et al. (2016) reported that ECMO was particularly beneficial in cases where the underlying cause of cardiopulmonary failure was reversible, such as peripartum cardiomyopathy, amniotic fluid embolism, and pulmonary embolism. The study underscored that delayed ECMO implementation often resulted in multi-organ failure and increased mortality. Their findings advocate for early consultation with ECMO teams and suggest that clinicians should not view ECMO as a last-resort measure but rather as an integral part of aggressive management when indicated.

Pacheco et al. (2015) extended this discussion by recommending that clinical protocols should include objective criteria for ECMO initiation. Conditions such as refractory hypoxemia, sustained hypotension despite vasopressor support, or evidence of impending cardiac arrest should prompt immediate intervention. They also emphasized the importance of having ECMO-capable centers

involved early in the management of high-risk obstetric patients, which can lead to improved coordination and resource availability.

### **3. Maternal-Fetal Considerations**

The interplay between maternal stabilization and fetal viability is among the most delicate aspects of ECMO management in obstetric populations. Lehle et al. (2018) examined anticoagulation strategies in pregnant women receiving ECMO. They highlighted that while anticoagulation is essential to prevent thrombotic complications, it significantly increases the risk of maternal hemorrhage, especially during and after delivery. Careful monitoring of coagulation parameters, use of lower anticoagulation targets, and individualized protocols were recommended to minimize bleeding risks while ensuring adequate ECMO flow. Additionally, maintaining adequate uteroplacental perfusion was deemed essential to avoid fetal hypoxia, particularly in pregnancies beyond 28 weeks of gestation.

Rojek et al. (2022) analyzed 30 COVID-19-affected pregnant women treated with ECMO and found that while maternal survival reached 75%, neonatal outcomes were often complicated by premature delivery. Many newborns required admission to neonatal intensive care units (NICU) for respiratory and feeding support. The study concluded that while ECMO supports maternal recovery, clinicians must carefully balance the timing of delivery with gestational age, ensuring that fetal outcomes are optimized without compromising maternal health.

### **4. Complications and Risks**

ECMO is not without risks, and several studies have highlighted complications that require vigilant management. Sharma et al. (2021) reviewed complications such as bleeding, thrombosis, infection, and limb ischemia. They found that the risk of hemorrhage was particularly high in postpartum women, who were already predisposed due to increased blood volume and vascular changes. Despite these challenges, coordinated care involving obstetricians, intensivists, and ECMO specialists led to successful management in most cases. The study concluded that the benefits of ECMO outweigh the risks when protocols are strictly followed.

Cheng et al. (2018) investigated technical challenges in cannulation, particularly in obese pregnant patients. The anatomical changes associated with pregnancy, including vascular displacement and increased adiposity, made vascular access difficult, increasing the likelihood of complications such as hematoma formation and arterial injury. The authors recommended pre-procedural imaging, ultrasound guidance, and advanced training for ECMO teams to mitigate these risks.

### **5. Ethical and Logistical Challenges**

The ethical dimensions of ECMO in pregnancy extend beyond clinical decisions, often involving complex deliberations about maternal autonomy, fetal viability, and resource allocation. Allen et al. (2019) discussed how clinicians are frequently faced with dilemmas involving decisions about whether to prolong ECMO support to allow fetal maturity or prioritize maternal stabilization. The authors stressed that institutional ethics committees should be involved in decision-making and that patient preferences must be central to care planning.

The Extracorporeal Life Support Organization (ELSO) guidelines (2020) recommend that individualized care plans be developed with input from obstetricians, intensivists, neonatologists, and ethical consultants. They advocate for early involvement of the ECMO team and transparent communication with patients and families. These guidelines further emphasize that gestational age, maternal condition, and expected outcomes should be weighed in shared decision-making, helping clinicians navigate ethically fraught scenarios.

## **Discussion**

The use of Extracorporeal Membrane Oxygenation (ECMO) in pregnant and postpartum women is an evolving practice marked by growing clinical success and expanding indications. This literature review highlights that ECMO can be a lifesaving intervention for pregnant and postpartum patients suffering from severe cardiopulmonary failure—particularly when initiated promptly and managed by a multidisciplinary team.

The studies reviewed consistently indicate that maternal survival rates with ECMO support range between 64–80%, a significant figure considering the severity of the conditions being treated, such as ARDS, peripartum cardiomyopathy, and amniotic fluid embolism. Importantly, these outcomes demonstrate that pregnancy should not be considered a contraindication for ECMO. Rather, timely initiation of ECMO, particularly before irreversible organ damage, appears to be critical in improving prognosis.

One recurring theme is the importance of gestational age and the need for timely obstetric decisions. Several studies reported that delivery—either preemptively or emergently—was often performed to optimize both maternal and fetal outcomes. Neonatal survival, though often complicated by prematurity, was generally favorable, especially when the fetus had reached viability prior to maternal decompensation.

Despite the benefits, ECMO in pregnancy presents unique challenges. Anticoagulation, a cornerstone of ECMO management, increases the risk of bleeding, which is already elevated during and after delivery. Studies such as those by Lehle et al. and Sharma et al. emphasize the need for careful anticoagulation strategies, often requiring adjustments in standard ECMO protocols. Infections, thrombosis, and technical difficulties related to cannulation in gravid patients also complicate management.

Ethical considerations, including maternal-fetal conflicts and the timing of delivery, add layers of complexity. The potential to sustain a nonviable fetus during maternal ECMO raises challenging questions regarding continuation of pregnancy versus prioritizing maternal recovery. In such cases, guidance from institutional ethics committees and alignment with patient and family preferences become crucial.

Overall, the literature supports the viability and safety of ECMO in obstetric populations when implemented with appropriate resources and expertise. Continued accumulation of data through registries and collaborative research is essential to establish evidence-based guidelines specific to this unique population.

## Conclusion

ECMO offers a transformative option for managing life-threatening cardiopulmonary failure in pregnant and postpartum women. While the risks—especially bleeding and infection—are significant, the benefits in survival and recovery can outweigh these risks when applied judiciously by specialized teams.

Key recommendations include:

- Early identification of ECMO candidates.
- Prompt intervention before irreversible organ damage occurs.
- Multidisciplinary coordination to ensure maternal and fetal safety.
- Ethical decision-making frameworks to guide treatment priorities.
- Further research to establish evidence-based protocols.

In conclusion, ECMO is a valuable tool in obstetric critical care that, when used appropriately, can save lives and improve outcomes for both mothers and their newborns.

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