



Utilization of Extracorporeal Membrane Oxygenation (ECMO) in the Emergency Department



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Introduction

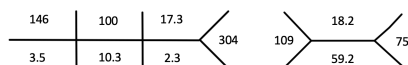
- Utilization of ECMO has increased dramatically in recent years¹ and is now seen as a viable intervention option for patients who present with either refractory acute cardiac or pulmonary failure.
- ECMO provides sustained mechanical cardiopulmonary support. It involves the use of a heat exchanger and mechanical pump to drain, circulate, and reintroduce blood into the vascular system.
 - There are two configurations:
 - Venovenous ECMO
 - Provides respiratory support
 - Venoarterial ECMO (FIGURE 1)²
 - Provides both respiratory and hemodynamic support
 - We present a case of **undifferentiated shock that resulted in activation of the mobile ECMO unit** and initiation of ECMO prior to transfer to a hospital capable of managing ECMO patients.
 - This case illustrates the importance of recognizing when conventional management is insufficient and when to initiate alternative interventions in the ED in order to avoid occult life-threatening conditions.

Case

- A 28-year-old female Gravida 1 Para 1 at 11 weeks of gestational age by her last menstrual period presenting with abdominal cramps and heavy vaginal bleeding. She was experiencing an ongoing miscarriage and had taken misoprostol 4 days prior to emergency room (ED) arrival. The patient reported waking up today feeling unwell with a large amount of blood and tissue around her vagina. Associated symptoms included abdominal cramping, nausea, non-bloody non-bilious vomiting, shortness of breath, and fever.
- Initial triage vital signs: 97.2F, HR 108, BP 106/52, RR 18, 92% on RA.
- Initial evaluation by the EM physician revealed a patient in severe distress with mottled skin, hypotension (BP 90/50), and severe tachycardia (HR 170).
- Initial labs:

INR: 1.56
PT: 18.7
PTT: 56.6
Lactate: 20

ABG:
pH / PaCO₂ / PaO₂
<6.8 / 83.6 / 53.2



Case (continued)

- Given concern for hemorrhagic shock, emergent intravenous access was placed via a “crash” right femoral central venous catheter and transfusion of type O- blood was initiated empirically.
- ED point-of-care ultrasound revealed a “flat” inferior vena cava (IVC), hyperdynamic cardiac function **without evidence of pericardial effusion, and a negative Extended Focused Assessment with Sonography in Trauma (eFAST)**.
- During the resuscitation, the patient became progressively more hypoxemic and “altered” and required emergent endotracheal intubation.
- During her ED stay, it became **increasingly difficult to oxygenate the patient as she required max levels of inspired oxygen and positive end-expiratory pressure (PEEP)**.
- The patient **required multiple pressors to maintain her blood pressure**. The patient **lost pulses multiple times** during the resuscitation and **received cardiopulmonary resuscitation (CPR) of up to 6 minutes each episode** to obtain return of spontaneous circulation.
- After discussion with the pulmonary critical care provider, it was determined that the patient be placed on Extracorporeal Membrane Oxygenation (ECMO)

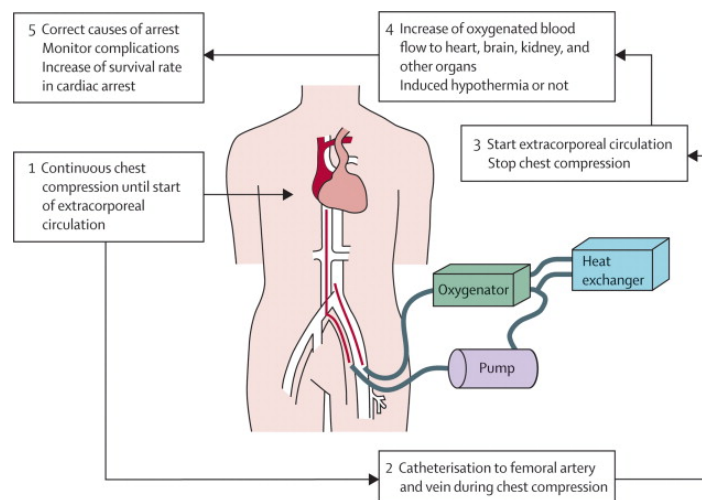


FIGURE 1: Extracorporeal life-support in patients requiring CPR²

Discussion

- Venoarterial ECMO was the ideal intervention for our patient given the need for both cardiac and pulmonary support.**
- It was indicated given that:³
 - She was as unresponsive to conventional management to maintain perfusion
 - Required multiple pressor drips and rounds of calcium and bicarbonate
 - Required maximum levels of FiO₂ and PEEP to maintain oxygenation
- There were no contraindications to ECMO given her young age and no history of chronic organ dysfunction or terminal malignancy.³
- Early initiation of ECMO was key in this situation, given the recurrent need for CPR and risk of multiple organ failure if stable cardiopulmonary support was not established.**⁴

Conclusion

- Emergency medicine physicians are at the frontlines of healthcare when it comes to patient resuscitation. Utilization of every treatment modality available is critical in providing an environment for success.
- Although not every medical facility is equipped to provide ECMO, all physicians should be aware of its capabilities and limitations. The provider should have this modality in mind as a possible intervention in case conventional resuscitative efforts are unsuccessful.
- Recognizing candidates early in the hospital course will:
 - Minimize delays in involving getting other specialties involved to initiate ECMO**
 - Activate a mobile ECMO team and/or**
 - Initiate the transfer process to an ECMO-equipped facility**

References

- Life Support Organization (ELSO). 2017. Available from: [https://www.elso.org/Portals/0/ELSO Guidelines For Adult Respiratory Failure 1.4.pdf](https://www.elso.org/Portals/0/ELSO%20Guidelines%20For%20Adult%20Respiratory%20Failure%201.4.pdf) Rush B, Wiskar K, Berger L, Griesdale D. Trends in Extracorporeal Membrane Oxygenation for the Treatment of Acute Respiratory Distress Syndrome in the United States. J Intensive Care Med. 2017 Oct;32(9):535-539. doi: 10.1177/0885066616631956. Epub 2016 Feb 17. PMID: 26893318.
- Lee, S., & Hong, Y. (2008). Extracorporeal life-support in patients requiring CPR. The Lancet, 372(9638), 512-514. doi:10.1016/S0140-6736(08)60959-9
- Guidelines for Adult Respiratory Failure [Internet]. Extracorporeal
- Debaty G, Babaz V, Durand M, Guide-Chevromay L, Fournel E, Blancher M, Bouvaist H, Chavanon O, Maignan M, Bouzat P, Albaladejo P, Labarère J. Prognostic factors for extracorporeal cardiopulmonary resuscitation recipients following out-of-hospital refractory cardiac arrest: A systematic review and meta-analysis. Resuscitation. 2017 Mar;112:1-10. doi: 10.1016/j.resuscitation.2016.12.011. Epub 2016 Dec 19. PMID: 28007504.