

Is Extracorporeal Membrane Oxygenation a Deceiver or Savior?

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Editorial

Extracorporeal life support, or commonly referred to as Extracorporeal Membrane Oxygenation (ECMO) is considered as a rescue therapy for patients who fail to respond to conventional treatment. ECMO is basically classified into veno-venous (VV) and veno-arterial (VA) mode. VV ECMO provides solely lung support with oxygenator, whereas VA ECMO uses pump and oxygenator to provide both heart and lung support.

Lung protective ventilation is the only proven strategy to consistently reduce mortality in patients suffering from Acute Respiratory Distress Syndrome (ARDS) [1]. VV ECMO allows adoption of lung protective strategy in severe ARDS patients as it can directly oxygenate blood and remove carbon dioxide from blood with the oxygenator. Positive results from the CESAR trial and ECMO patents suffering from influenza A pandemic (H1N1) 2009 virus infection have led to an exponential use of this technology to other respiratory disease entities [2-5]. However, there is lack of high quality data, including prospective studies or randomized control trial to prove VV ECMO can decrease mortality in severe ARDS patients or patients with severe pneumonia. ECMO to Rescue Lung Injury in Severe ARDS (EOLIA), a randomized controlled trial, compares conventional standard of care management (including lung-protective ventilation, neuromuscular blockade, and prone positioning) to veno-venous ECMO in severe ARDS, will help shed some light on this issue [6].

VA ECMO works by creating blood flow in the arterial system for end-organ perfusion and theoretically can alleviate workload of the heart and allow time for its recovery. Its use is rapidly increasing worldwide, especially after having the evidence that Intra-aortic balloon pump (IABP) does not have beneficial effect on mortality for AMI patients complicated with cardiogenic shock [7,8]. VA ECMO is indicated when the patient is unresponsive to inotropes and/or an IABP alone. However, there is no high quality data to suggest using mechanical cardiac support device or ECMO is superior to IABP for cardiogenic shock patients [9]. Outcome of VA ECMO depends on recovery potential of the disease and risk profile of the patient. Central VA provides shorter duration of organ support and is usually reserved to postcardiotomy cardiogenic shock.

Peripheral VA ECMO is easier and safer to implement but also has its own complications. Pulmonary oedema, vascular injury, systemic thromboembolic events, and intracerebral hemorrhage are most commonly reported complications [9].

Differential hypoxia is an interesting phenomenon that only happens in peripheral VA ECMO. It happens when retrograde oxygenated blood from the femoral arterial cannula joins antegrade blood flow ejected from the left ventricle [10]. In addition, these two opposing forces create an area of "watershed" inside the aorta that has

relatively stagnant flow and may result in catastrophic thromboembolic events [11].

Although there are many theoretical benefits when applying IABP to VA ECMO patients, combination use of IABP and VA ECMO is still controversial [12,13]. IABP helps to unload the left ventricular pressure and thus having less risk of hydrostatic pulmonary oedema [14]. The cyclical opening of intra-aortic balloon also helps to restore pulsatility of LV pressure and facilitates opening of aortic valve. However, active deflation of intra-aortic balloon in systole may paradoxically increase LV afterload in peripheral VA ECMO patients. Balloon inflation inside the aorta in diastole may reduce retrograde blood flow of the peripheral VA ECMO to the aortic arch and attenuate coronary and cerebral perfusion [15,16].

Extracorporeal Membrane Oxygenation is a life-saving technology but also carries significant risks of complications. The implementation of ECMO for patients with severe respiratory failure and patients with cardiogenic shock still warrant further study.

References

1. Acute Respiratory Distress Syndrome Network, Brower RG, Matthay MA, Morris A, Schoenfeld D, et al. (2000) Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome. *New Eng J Med*: 342: 1301-1308.
2. Peek GJ, Mugford M, Tiruvoipati R, Wilson A, Allen E, et al. (2009) Efficacy and economic assessment of conventional ventilatory support versus extracorporeal membrane oxygenation for severe adult respiratory failure (CESAR): a multicentre randomised controlled trial. *Lancet* 374: 1351-1363.
3. Australia and New Zealand Extracorporeal Membrane Oxygenation (ANZ ECMO) Influenza Investigators, Davies A, Jones D, Bailey M, Beca J, et al. (2009) Extracorporeal membrane oxygenation for 2009 influenza A(H1N1) acute respiratory distress syndrome. *JAMA* 302: 1888-1895.
4. Pham T, Combes A, Rozé H, Chevret S, Mercat A, et al. (2013) Extracorporeal membrane oxygenation for pandemic influenza A(H1N1)-induced acute respiratory distress syndrome: a cohort study and propensity-matched analysis. *Am J Respir Crit Care Med* 187: 276-285.
5. Patroniti N, Zangrillo A, Pappalardo F, Peris A, Cianchi G, et al. (2011) The Italian ECMO network experience during the 2009 influenza A(H1N1) pandemic: preparation for severe respiratory emergency outbreaks. *Intensive Care Med* 37: 1447-1457.
6. <https://clinicaltrials.gov/ct2/show/NCT01470703>.
7. Thiele H, Zeymer U, Neumann FJ, Ferenc M, Olbrich HG, et al. (2013) Intra-aortic balloon counterpulsation in acute myocardial infarction complicated by cardiogenic shock (IABP-SHOCK II): final 12 month results of a randomised, open-label trial. *Lancet* 382: 1638-1645.
8. Thiele H, Zeymer U, Neumann FJ, Ferenc M, Olbrich HG, et al. (2012) Intraaortic balloon support for myocardial infarction with cardiogenic shock. *N Engl J Med* 367: 1287-1296.
9. Ouweneel DM, Eriksen E, Sjaauw KD, van Dongen IM, Hirsch A, et al. (2017) Percutaneous mechanical circulatory support versus intra-aortic

-
- balloon pump in cardiogenic shock after acute myocardial infarction. *J Am Coll Cardiol* 69: 278-287.
10. Cove ME (2015) Disrupting differential hypoxia in peripheral venoarterial extracorporeal membrane oxygenation. *Crit Care* 19: 280
 11. Angleitner P, Röggl M, Laufer G, Wiedemann D (2016) Watershed of veno-arterial extracorporeal life support. *Euro J Cardio-Thoracic Surg* 50: 785
 12. Thiele H, Jobs A, Ouweneel DM, HJenriques JPS, Seyfarth M, et al. (2017) Percutaneous short-term active mechanical support devices in cardiogenic shock: a systematic review and collaborative meta-analysis of randomized trials. *Eur Heart J* 38: 3523-3531
 13. Aso S, Matsui H, Fushimi K, Yasunaga H (2016) The effect of intraaortic balloon pumping under venoarterial extracorporeal membrane oxygenation on mortality of cardiogenic patients: An analysis using a nationwide inpatient database. *Crit Care Med* 44: 1974-1979.
 14. Bréchet N, Demondion P, Santi F, Lebreton G, Pham T, et al. (2018) Intra-aortic balloon pump protects against hydrostatic pulmonary oedema during peripheral venoarterial-extracorporeal membrane oxygenation. *Eur Heart J Acute Cardiovasc Care* 7: 62-69.
 15. Bělohávek J, Mlček M, Huptych M, Svoboda T, Havránek S, et al. (2012) Coronary versus carotid blood flow and coronary perfusion pressure in a pig model of prolonged cardiac arrest treated by different modes of venoarterial ECMO and intraaortic balloon counterpulsation. *Crit Care* 16: R50.
 16. Tay CK, Yoo KH, Cho YH (2016) Intraaortic balloon pulsation in peripheral venoarterial extracorporeal membrane oxygenation: more is not always better. *Crit Care Med* 44: e1251.