

ECMO (extracorporeal membrane oxygenation) during the COVID-19 pandemic

This document provides the framework to support provision of ECMO during an escalating pandemic. It should be used to inform local policies and procedures which should be current and reviewed regularly.

Introduction

Extracorporeal membrane oxygenation (ECMO) is an advanced form of life support – targeted at the heart and lungs. It may be indicated in cases of acute severe cardiac or pulmonary failure that is both potentially reversible and unresponsive to conventional management. Usually delivered in an intensive care unit (ICU), there are two main types of ECMO – veno-venous (V-V) and veno-arterial (V-A).

Both provide respiratory support, but only veno-arterial ECMO provides haemodynamic support. There are 38 adult intensive care units and three paediatric intensive care units in NSW providing services to a total population of 8 million people. NSW adult patients who require ECMO, can currently receive treatment at eight tertiary Adult ICUs in metropolitan Sydney and John Hunter Hospital. NSW has a well-established Adult ECMO retrieval service which has been operational for more than 10 years, supported by clinicians on a dedicated roster from Royal Prince Alfred and St Vincent's Hospitals.

Acute respiratory failure is the predominant feature of severe COVID-19. It is clear that mortality due to severe COVID-19 associated acute respiratory distress syndrome (ARDS) is similar to severe ARDS from non-COVID-19 causes.¹ As such, veno-venous ECMO may have a role in the management of these critically ill patients.

In a pandemic, use of ECMO needs to take into consideration patient factors as well as the workforce (i.e. available skills and resource availability to provide safe care) and current system capacity.

In NSW, the decision to initiate ECMO follows a multidisciplinary discussion led by an ECMO intensivist. In neonates and children all ECMO and other clinical discussions are conducted through NETS (newborn and paediatric emergency transport service).

International experience

The World Health Organization currently recommends that patients with acute respiratory distress syndrome (ARDS) in settings with access to expertise in ECMO who have refractory hypoxaemia despite lung protective ventilation are referred for consideration of ECMO.

Significant international (and some smaller Australian experience) exists in the use of V-V ECMO for COVID-19. In Europe (as of 8 March 2021), 1,682 of 3,165 (53%) V-V ECMO cases were successfully weaned from ECMO.²

A multicentre French study of 83 patients with COVID-19-related ARDS managed with ECMO revealed an estimated 60-day mortality of 31%.³

Similar survival for COVID-19 and non-COVID-19 respiratory failure patients on V-V ECMO has been demonstrated.³ The duration on V-V ECMO for COVID-19 patients appears to be six or more days longer than non-COVID-19 V-V ECMO patients. Hospital length of stay is also very long.⁴ Similarly good survival has been demonstrated in other health systems.⁵

Considerations during COVID-19 pandemic in NSW

Complex ethical and clinical treatment issues can occur during a pandemic, especially when healthcare demand exceeds supply. It may be necessary at some point to begin prioritising limited critical care resources to those with a need for treatment and those who are most likely to survive. Such prioritisation decisions would need to take account all patients' probability of survival, as well as the availability of limited critical care resources,

- ECMO is contraindicated in patients with pre-existing conditions which are incompatible with recovery (severe cardiac or baseline respiratory disease or severe neurological injury, end stage malignancy), with the exception of bridge to transplant.
- V-V ECMO may be utilised for patients with COVID-19 and severe respiratory failure with expected outcomes comparable to patients supported with V-V ECMO pre-pandemic.⁴
- V-A ECMO may be utilised for patients with COVID-19 and severe cardiac failure; however, the experience is more limited.⁴
- Patients should have optimised conventional therapy prior to consideration of ECMO. This includes dexamethasone, neuromuscular blockade, tocilizumab, judicious fluid management, optimised ventilation, appropriate positive end expiratory pressure (PEEP) and most importantly prone ventilation. Hence, ECMO is not recommended as first-line therapy.
- The usual contraindications to all ECMO apply to the COVID-19 patient group as they do to non-COVID-19 patients.

As ECMO is a highly specialised service requiring higher ratios of skilled staff in initiation, maintenance and post treatment phases, its use during a pandemic should be carefully considered.

- With increased demands, adult patients requiring ECMO should be distributed across multiple centres, such that one or two hospitals are not overwhelmed when skilled staff may be limited.
- Lower volume ECMO capable hospitals with established resources could manage adult patients on V-V ECMO with support from higher volume centres.

Recommendation

During the pandemic, all patients being considered for initiation of ECMO for COVID-19 has to be discussed with the ECMO consultant on call for the NSW ECMO Retrieval Service, or in the case of newborns and children, with NETS. This ensures careful collaborative decision making which considers the patient needs as well as current state capacity. This will also ensure an ability to collate whole of state data for the use of ECMO in COVID-19 pandemic allowing for ongoing evaluation of the appropriateness of ECMO in pandemic.

References

1. Ferrando C, Suarez-Sipmann F, Mellado-Artigas R, et al. Clinical features, ventilatory management, and outcome of ARDS caused by COVID-19 are similar to other causes of ARDS. *Intensive Care Med* 2020;46,2200–2211.
2. Broman LM, Eksborg S, Coco VL, et al. Extracorporeal membrane oxygenation for COVID-19 during first and second waves. *Lancet Respir Medicine* 2021.
3. Garfield B, Bianchi P, Arachchillage D, et al. Six-month mortality in patients with COVID-19 and non-COVID-19 viral pneumonitis managed with veno-venous extracorporeal membrane oxygenation. *Asaio J* 2021 (epub ahead of print).
4. Badulak J, Antonini MV, Stead CM, et al. Extracorporeal Membrane Oxygenation for COVID-19: Updated 2021 Guidelines from the Extracorporeal Life Support Organization. *Asaio J* 2021;67(5):485–95.
5. Rabie AA, Azzam MH, Al-Fares AA, et al. Implementation of new ECMO centers during the COVID-19 pandemic: experience and results from the Middle East and India. *Intens Care Med* 2021;1–9.

Document information	
Version number	3
Original publication date	24 March 2020
Developed by	Developed by ACI Intensive Care
Consultation	Consulted with Senior Clinicians from St Vincent's and Royal Prince Alfred Hospitals that provide ECMO Retrieval service. Consulted with Paediatric Intensive care clinicians.
Endorsed by	Nigel Lyons
Review date	29 June 2021
Reviewed by	Co-chairs of ECMO Advisory Group, senior intensive care consultant, Intensive Care NSW Clinical Director and Network Manager.
For use by	To assist clinicians with ECMO in COVID-19 pandemic



© State of New South Wales (Agency for Clinical Innovation) 2020.

[Creative Commons Attribution-NoDerivatives 4.0 licence.](https://creativecommons.org/licenses/by-nd/4.0/)

For current information go to: aci.health.nsw.gov.au

The ACI logo is excluded from the Creative Commons licence and may only be used with express permission.

ACI 0398 [07/21] SHPN (ACI) 200598 TRIM ACI/D21/1797