

Specialty guides for patient management during the coronavirus pandemic

Clinical guide for extra corporeal membrane oxygenation (ECMO) for respiratory failure in adults during the coronavirus pandemic

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As doctors we all have general responsibilities in relation to coronavirus and for these we should seek and act upon national and local guidelines. We also have a specific responsibility to ensure that essential care continues with the minimum burden on the NHS. We must engage with those planning our local response. We may also need to work outside our specific areas of training and expertise and the General Medical Council has already indicated its support for this in the exceptional circumstances we may face: <https://www.gmc-uk.org/news/news-archive/how-we-will-continue-to-regulate-in-light-of-novel-coronavirus>

ECMO for respiratory failure

Respiratory ECMO is indicated for acute severe but potentially reversible respiratory failure. It is therefore expected that the service will experience increased demand in response to patients with COVID-19.

Given the more recent national and international evidence that suggests that severe respiratory failure from COVID-19 carries the same prognosis as other aetiologies, the ***ECMO criteria should be common to severe Acute Respiratory Distress Syndrome (ARDS) from all aetiologies including COVID-19¹***.

Referrals to the service should be made by adult intensive care units for patients who are critically ill who are receiving lung protective mechanical ventilation or for patients in whom lung protective ventilation is not possible due to the severity of hypoxaemia/hypercapnia.

Referral information

To refer a patient to the National ECMO service or to seek clinical advice on the management of severe acute respiratory failure, including those with COVID-19, please use the [online ECMO referral form](#). This national referral system will help us coordinate the national response to the COVID-19 pandemic.

Referral criteria

Inclusion Criteria for referral (in **bold**) and *additional considerations for ECMO* in all patients regardless of aetiology:

- **Potentially reversible severe respiratory failure** (e.g., $\text{PaO}_2/\text{FiO}_2 < 6.7$ kPa for ≥ 3 hours or $\text{PaO}_2/\text{FiO}_2 < 10$ kPa for ≥ 6 hours)²
- **Murray Lung Injury Score ≥ 3**
- **Uncompensated hypercapnia with a $\text{pH} \leq 7.20$** despite respiratory rate $> 35/\text{min}$ or due to life threatening airway disease (e.g., asthma or airway trauma, air leak)²
- Failed trial of ventilation in the prone position for ≥ 6 hrs (unless contraindicated)
- Failed optimal respiratory management with lung protective ventilation after discussion with a national ECMO centre.

Exclusion Criteria

- Refractory or established multiorgan failure
- Evidence of severe neurological injury
- Prolonged Cardiac arrest (> 15 min)

Additional considerations by the ECMO centres:

At least two ECMO centres must agree that it is appropriate to proceed to ECMO for patients meeting one of the following criteria:

- Indices of low potential to recover such as RESP Score ≤ 3
- Receiving invasive mechanical ventilation > 7 days²

For the calculation of RESP score:

- If COVID-19, aetiology will be “*viral pneumonia*”
- High-flow nasal cannula (HFNC) will **NOT** count towards ventilated days
- If on continuous positive airway pressure (CPAP)/non-invasive ventilation (NIV) pre-intubation **> 1 day** – these days will count towards mechanical ventilation days if – *on average*:
 - CPAP/NIV used > 12 hours/day
 - and**
 - $\text{PaO}_2/\text{FiO}_2 < 20$ kPa with $\text{FiO}_2 > 60\%$ ⁴
 - $\text{PaCO}_2 < 4$ kPa or respiratory rate $> 25/\text{min}$ ⁴; or $\text{PaCO}_2 > 6.5$ kPa/increasing since CPAP/NIV⁴; or inspiratory tidal volume (if measured) > 9.5 ml/kg predicted body weight (PBW)⁵

References

1. Warren A, Chiu YD, Villar SS, et al. Outcomes of the NHS England National Extracorporeal Membrane Oxygenation Service for adults with respiratory failure: a multicentre observational cohort study. *Br J Anaesth*. 2020;125(3):259-266.
2. Combes A, Hajage D, Capellier G, et al. Extracorporeal Membrane Oxygenation for Severe Acute Respiratory Distress Syndrome. *N Engl J Med*. 2018;378(21):1965-1975.
3. Bagshaw M, Majumdar SR, Rolfson DB, Ibrahim Q, McDermid RC, Stelfox HT. A prospective multicenter cohort study of frailty in younger critically ill patients. *Crit Care*. 2016;20(1):175.
4. Bellani G, Laffey JG, Pham T, et al. Noninvasive Ventilation of Patients with Acute Respiratory Distress Syndrome. Insights from the LUNG SAFE Study. *Am J Respir Crit Care Med*. 2017;195(1):67-77.
5. Carteaux G, Millan-Guilarte T, De Prost N, et al. Failure of Noninvasive Ventilation for De Novo Acute Hypoxemic Respiratory Failure: Role of Tidal Volume. *Crit Care Med*. 2016;44(2):282-290.

Service providers

There are five commissioned centres in England for the provision of ECMO and one in Scotland, each working to a specified geographical area (detailed [here](#)). However, in order to manage service demand, following assessment and triage, admission may take place at any of the designated centres.

- Guy's and St. Thomas' NHS Foundation Trust
- Royal Papworth Hospital NHS Foundation Trust
- Royal Brompton and Harefield NHS Foundation Trust
- University Hospitals of Leicester NHS Trust
- Manchester University NHS Foundation Trust
- Aberdeen Royal Infirmary, NHS Grampian

(Note: additional centres have been identified to support the national network during extreme surge (if required), however all referrals should continue to be made directly to the national portal)