NICE National Institute for Health and Care Excellence

NICE guidance

Extracorporeal carbon dioxide removal for acute respiratory failure

HealthTech guidance
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Your responsibility

This guidance represents the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, healthcare professionals are expected to take this guidance fully into account, and specifically any special arrangements relating to the introduction of new interventional procedures. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the Yellow Card Scheme.

Commissioners and/or providers have a responsibility to implement the guidance, in their local context, in light of their duties to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity, and foster good relations. Nothing in this guidance should be interpreted in a way that would be inconsistent with compliance with those duties. Providers should ensure that governance structures are in place to review, authorise and monitor the introduction of new devices and procedures.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

Contents

This guidance replaces IPG776 and IPG564.

1 Recommendations

People with acute hypoxic respiratory failure

1.1 For people with acute hypoxic respiratory failure, extracorporeal carbon dioxide removal ($ECCO_2R$) should not be used. Find out why NICE recommends not to use some procedures on the NICE guidance page.

People with acute hypercapnic respiratory failure

1.2 For people with acute hypercapnic respiratory failure, $ECCO_2R$ should be used only in research. Find out what only in research means on the NICE guidance page.

1.3 Patient selection should be done by a multidisciplinary team including healthcare professionals with specialist expertise in managing acute hypercapnic respiratory failure.

1.4 The procedure should only be done by healthcare professionals with specialist expertise in the procedure in specialist intensive care centres with appropriate levels of support.

1.5 Research should report:

- short-term and long-term:
  - patient-reported outcomes
  - improvements in respiratory function
- adverse events including:
  - bleeding
  - symptomatic and asymptomatic intracranial bleeding

- infection
- cannulation complications
- pain.

Why the committee made these recommendations

Some people with acute respiratory failure have low levels of oxygen in their blood (acute hypoxic respiratory failure). When compared with standard care, available evidence shows that $ECCO_2R$ has no effect on how long these people live, how long they spend in hospital, or how long they spend in intensive care. There is also evidence of an increased risk of bleeding in the brain when this procedure is used. So, this procedure should not be done for acute hypoxic respiratory failure.

Some people with acute respiratory failure have increased levels of carbon dioxide in their blood (acute hypercapnic respiratory failure). There is limited evidence for the efficacy of $ECCO_2R$ in this group, and there are safety concerns around its use. When compared with standard care, the evidence suggests that people who have this procedure spend less time on ventilation, and there is no change in the number of serious adverse events. But it is uncertain if this procedure leads to improved long-term benefits. So, this procedure should only be used in research for acute hypercapnic respiratory failure.

2 The condition, current treatments and procedure

The condition

2.1 Acute respiratory failure is a life-threatening condition. It can be categorised as acute hypoxic respiratory failure (abnormally low levels of oxygen in the blood) or acute hypercapnic respiratory failure (abnormally low levels of oxygen and abnormally high levels of carbon dioxide in the blood). Acute respiratory distress syndrome is a severe type of acute respiratory failure. It can be caused by conditions such as:

- sepsis
- pneumonia
- respiratory viruses
- chest trauma
- inhalational injury
- aspiration and
- pancreatitis.

The most common cause of hypercapnic respiratory failure is an acute exacerbation of chronic obstructive pulmonary disease.

Current treatments

2.2 The management of acute respiratory failure involves treating the underlying cause and providing increased oxygen by non-invasive or invasive ventilation.

The procedure

2.3 The 2 main types of extracorporeal carbon dioxide removal ($ECCO_2R$) are venovenous ($vvECCO_2R$) and arteriovenous ($avECCO_2R$). In both types, cannulae are connected to a low-resistance synthetic membrane device where exchange of carbon dioxide takes place. In $vvECCO_2R$, either a single-access double-lumen catheter or a dual-access system using 2 venous catheters is inserted into a large vein or veins (usually the femoral or internal jugular veins). It is then connected to a venovenous circuit. Flow across the membrane is maintained using a pump. In $avECCO_2R$, cannulae are inserted into an artery and a vein (usually the femoral artery and femoral vein). Arterial blood pressure drives blood continuously through the device and it is returned through the vein.

2.4 $ECCO_2R$ can be done using either a true $ECCO_2R$ system or a modified extracorporeal membrane oxygenation system. People having $ECCO_2R$ are given blood-thinning drugs such as heparin to prevent blood clots forming in the circuit.

2.5 For people with acute hypoxic respiratory failure, $ECCO_2R$ aims to lower carbon dioxide levels in the blood, independently of the lungs. Lung-protective ventilation settings such as lower airway pressures and lower tidal volumes can be used to reduce the risk of ventilator-induced lung injury. But, using lung-protective settings can cause carbon dioxide levels to rise, leading to negative effects. $ECCO_2R$ is used to reduce blood carbon dioxide levels so that lung-protective ventilation settings can be maintained. This may improve the likelihood and speed of lung recovery.

2.6 For people with acute hypercapnic respiratory failure, $ECCO_2R$ aims to reduce the need for intubation and mechanical ventilation. It may also reduce the length of time that a person has non-invasive ventilation.

3 Committee considerations

The evidence

3.1 NICE did a rapid review of the published literature on the efficacy and safety of this procedure. This comprised a comprehensive literature search incorporating literature published since the last interventional procedures guidance on this procedure and a detailed review of the evidence from 9 sources. This was then discussed by the committee. The evidence included 2 systematic reviews and meta-analyses, 3 randomised controlled trials (RCTs), a long-term follow-up analysis of 1 of the RCTs, 2 case series, and a secondary analysis of 1 of the case series. It is presented in the summary of key evidence section in the overview. Other relevant literature is in the appendix of the overview.

3.2 The professional experts and the committee considered the key efficacy outcomes to be: mortality, reduction in hospital length of stay, reduction in intensive care unit length of stay, and reduction in duration of ventilation.

3.3 The professional experts and the committee considered the key safety outcomes to be: bleeding, intracranial bleeding, infection, and cannulation complications.

3.4 Patient commentary was sought but none was received.

Committee comments

3.5 The committee was informed that arteriovenous extracorporeal carbon dioxide removal ($ECCO_2R$) is largely being replaced by venovenous $ECCO_2R$ in the UK.

3.6 The committee noted that there are ongoing clinical trials into $ECCO_2R$ for acute hypercapnic respiratory failure.

3.7 The committee was informed that implementation of standard care such as non-invasive ventilation is variable across centres.

Update information

Minor changes since publication

January 2026: Interventional procedures guidance 776 has been migrated to HealthTech guidance 703. The recommendations and accompanying content remain unchanged.

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Endorsing organisation

This guidance has been endorsed by Healthcare Improvement Scotland.