PROCEDURE

Extracorporeal membrane oxygenation

ECMO temporarily pumps blood through an external machine to add oxygen and sometimes support circulation when the lungs or heart are failing.

PURPOSE
Temporarily oxygenate blood and sometimes support circulation

PROCEDURE TYPE
Therapeutic - bedside or surgical large-vessel cannulation

WHERE IT IS DONE
ICU bedside or operating theatre

ANAESTHESIA
Deep sedation or general anaesthesia

HOW LONG IT TAKES
1-3 hours for cannulation and circuit start

PREPARATION
Blood tests, medication review, fasting when time allows

RECOVERY
Prolonged ICU stay; no driving until medically cleared

MAIN RISKS
Bleeding, infection, blood clots, stroke, limb injury

RESULTS
Blood oxygen and circulation response known immediately

Overview

Extracorporeal membrane oxygenation, or ECMO, is advanced life support used when the lungs, heart, or both are not working well enough to keep the body supplied with oxygen-rich blood.

Large tubes called cannulas are placed into major blood vessels. Blood flows through the tubes to an external circuit. The circuit adds oxygen, removes carbon dioxide, and pumps the blood back into your body.

There are two main types:

ECMO does not cure the underlying illness. It provides temporary support while treatment works, the heart or lungs recover, or the healthcare team considers longer-term options such

as transplantation or a heart-assist device.

Starting ECMO usually takes a few hours. Support may then continue for days or weeks in an intensive care unit, or ICU.

- Venovenous, or VV, ECMO supports the lungs. Blood leaves and returns through veins, while the heart continues pumping.
- Venoarterial, or VA, ECMO supports the heart and lungs. Blood is returned through an artery, allowing the circuit to help pump blood around the body.

Why the procedure is performed

ECMO may be considered when severe heart or lung failure has not improved enough with standard intensive care treatment.

VV ECMO may be used for severe respiratory failure caused by conditions such as pneumonia or acute respiratory distress syndrome. It may also support someone around a lung transplant.

VA ECMO may be used when the heart cannot pump enough blood, including after a major heart attack, severe inflammation of the heart, some heart operations, or cardiac arrest in selected circumstances.

The goal must be clear before ECMO begins. It may serve as:

- A bridge to recovery
- A bridge to a transplant or implanted heart-support device
- Short-term support while the team determines whether recovery or another treatment is possible

Who should and should not have it

ECMO is generally considered when heart or lung failure is immediately life-threatening but there is a reasonable possibility of recovery or another treatment.

It is not suitable for everyone. The likely benefit is weighed against the burdens of major bleeding, infection, stroke, organ injury, and a long ICU stay.

ECMO may be avoided when the underlying illness cannot recover and no transplant or long-term support option is possible. It may also be unsuitable after severe, irreversible brain injury or when advanced illness makes meaningful recovery very unlikely.

Treatment may be avoided or delayed when there is uncontrolled bleeding, a major

blood-clotting disorder, or a recent injury or operation that makes blood-thinning treatment especially dangerous. Severe damage to the blood vessels used for cannulation can also prevent safe placement.

These are not always absolute rules. The decision is made by a specialist ECMO team based on the cause of organ failure, how long it has been present, other medical conditions, treatment goals, and your preferences. If you cannot take part, the team will usually speak with your legally authorized representative or family.

How to prepare

ECMO often begins during an emergency, so there may be little time to prepare. The treating facility's own instructions take priority over general information in this article.

If time allows, the team will review your medicines, allergies, previous operations, bleeding risks, and relevant medical conditions. Tell them about anticoagulants or antiplatelet medicines, which reduce blood clotting. Do not stop these medicines unless the treating team tells you to.

You may need blood tests, heart tests, chest imaging, and ultrasound to identify the safest blood vessels. You may be told not to eat or drink before cannulation if the situation allows.

The team will explain the expected benefits, major risks, alternatives, and goals of treatment. Consent may come from you or an authorized representative. In a life-threatening emergency, treatment may need to begin before a representative can be reached.

What happens during the procedure

You will usually receive deep sedation or general anaesthesia. Medicines may also prevent movement while the cannulas are placed. Your heart rhythm, blood pressure, oxygen level, and other vital signs are monitored continuously.

The doctor cleans the skin and uses ultrasound or X-ray guidance to place one or more cannulas into major blood vessels. Common locations include the neck and groin. In some situations, particularly after heart surgery, cannulas are placed directly into vessels in the chest.

The cannulas connect to the ECMO circuit. A pump moves blood through an artificial lung called a membrane oxygenator. This adds oxygen and removes carbon dioxide before blood returns to your body.

Once support begins, the team adjusts the blood flow and oxygen delivery. Blood tests and imaging confirm that the cannulas are positioned correctly and that the circuit is providing enough support.

Most people receive medicine to reduce clotting within the circuit. The amount is adjusted using frequent blood tests and balanced against the risk of bleeding.

Recovery and what to expect afterward

Pain from the cannula sites is usually controlled with medicine. While receiving ECMO, you may be deeply sedated. Some people can be more awake, communicate, and take part in limited rehabilitation when their condition allows.

Eating by mouth is often not possible at first. Nutrition may be given through a feeding tube or vein. After breathing tubes are removed, a swallowing assessment may be needed before you eat or drink normally.

Activity is limited by the cannulas and critical illness. Nurses and physical therapists may help with positioning, joint movement, sitting, standing, or walking when this can be done safely.

You cannot drive while receiving ECMO or during the early recovery period. After leaving hospital, do not drive until your healthcare team confirms that your strength, concentration, medicines, and medical condition make it safe.

Returning to work usually takes weeks or months rather than days. Timing is based on your recovery, the illness that led to ECMO, and the physical or mental demands of your job.

When support is no longer needed, the team reduces the ECMO flow while watching how your heart and lungs respond. The cannulas are then removed. The sites may be closed with pressure, stitches, a blood-vessel closure device, or surgery.

Risks and possible complications

ECMO is used in critical illness and carries substantial risks. These include:

The ECMO team monitors continuously for these problems. Blood tests, neurological checks, circulation checks, imaging, and circuit inspections are performed regularly.

- Bleeding at a cannula site, internally, or around the brain
- Blood clots in the circuit or body, which can cause stroke or organ damage
- Infection involving the bloodstream, cannula, wound, or lungs

- Reduced blood flow to a leg, especially with an arterial groin cannula
- Injury to a blood vessel during cannula placement
- Breakdown of red blood cells as blood passes through the circuit
- Kidney, liver, nerve, or brain injury related to the underlying illness or circulation problems
- Equipment failure, air entering the circuit, or movement of a cannula

Results and follow up

The immediate effect is assessed within minutes. Monitors and blood tests show whether oxygen levels, carbon dioxide removal, blood pressure, and circulation have improved.

A successful start does not predict the final outcome. Over the following days, the team looks for signs that the heart or lungs are recovering and that other organs are functioning.

After ECMO is removed, monitoring continues in the ICU. Follow-up after discharge may include heart or lung testing, wound checks, medicine review, and physical rehabilitation.

Some people experience weakness, sleep problems, low mood, anxiety, memory difficulties, or distressing memories after critical illness. These concerns can be discussed during routine follow-up and may improve with rehabilitation and support.

Alternatives

The alternatives depend on whether support is needed for the lungs, the heart, or both.

For severe lung failure, alternatives include mechanical ventilation, placing you face down to improve oxygen flow, and medicines that affect the lung's blood vessels. These treatments avoid large ECMO cannulas but may not provide enough oxygen or carbon dioxide removal in the most severe cases.

For heart failure or shock, alternatives may include medicines that strengthen the heartbeat or raise blood pressure. A balloon pump, catheter-based heart pump, or surgically implanted ventricular assist device may also be considered. These devices provide different amounts and types of circulatory support and have their own bleeding, infection, and blood-vessel risks.

A heart or lung transplant may be an option for selected people, but it requires specialist assessment and an available donor organ.

If recovery or longer-term treatment is not possible, comfort-focused care is an alternative. Its purpose is to relieve pain, breathlessness, and distress rather than prolong life with invasive

support.

When to call your healthcare team

While you are receiving ECMO, ICU staff monitor you continuously. You or your family can raise concerns with the bedside team at any time.

After leaving hospital, contact your healthcare team promptly for increasing pain, redness, warmth, swelling, drainage, or a new lump at a former cannula site. Also call about persistent fever, worsening weakness, or new problems with mood, sleep, memory, or daily activities. These usually need timely assessment but are not always emergencies.

Seek emergency help for:

- Sudden difficulty breathing or severe chest pain
- Heavy bleeding or bleeding that does not stop with firm pressure
- Fainting, severe confusion, or loss of consciousness
- New facial drooping, arm or leg weakness, or difficulty speaking
- A limb that suddenly becomes cold, pale, very painful, or numb

Common questions

Will I be asleep?

Usually, yes. Deep sedation or general anaesthesia is commonly used for cannula placement. Sedation may later be reduced if your condition and cannula positions make it safe.

Can I drive home afterward?

No. ECMO requires intensive care, and recovery usually continues in hospital after the circuit is removed. You will need medical clearance before driving again.

How painful is ECMO?

Cannula placement is done under deep sedation or anaesthesia. The sites may be sore afterward, and prolonged bed rest can cause muscle and joint discomfort. Pain medicine and careful repositioning are used.

When will I know if it is working?

The team can see the immediate effect on oxygen levels and circulation within minutes. Whether your heart or lungs will recover usually becomes clearer over days.

Can I be awake while on ECMO?

Some people can be awake and communicate while receiving ECMO. Others need continued deep sedation because of their illness, breathing tube, procedures, or safety concerns.

How long can someone stay on ECMO?

Support may last days or weeks. The team reviews it frequently and continues while there is a realistic goal, such as recovery, transplantation, or transition to another support device.

Sources

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