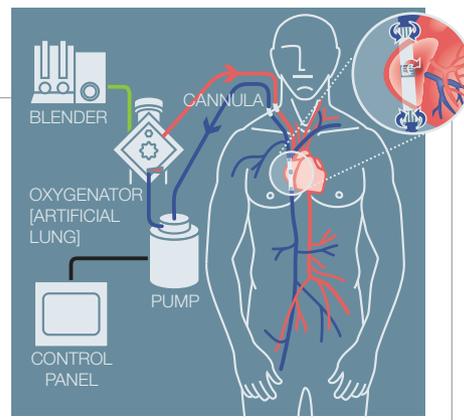


What is ECMO?

Extracorporeal membrane oxygenation (ECMO) is a life support machine. People who need ECMO have a severe and life-threatening illness that stops their heart or lungs from working properly. For example, ECMO is used during life-threatening conditions such as severe lung damage from infection, or shock after a massive heart attack.



The ECMO machine replaces the function of the heart and lungs. People who need support from an ECMO machine are cared for in a hospital's intensive care unit (ICU). Typically, people are supported by an ECMO machine for only a few hours to days, but may require it for a few weeks, depending on how their condition progresses. There are many overlaps and differences between the use of ECMO in children and adults. For a focus on Pediatric ECMO, please refer to the Medline Plus resource listed at the end, in addition to this document.

Why is ECMO used?

ECMO is used to help people whose:

- Lungs cannot provide enough oxygen to the body even when given extra oxygen
- Lungs cannot get rid of carbon dioxide even with help from a mechanical ventilator
- Heart cannot pump enough blood to the body

ECMO may also be used to support people with heart or lung disease that cannot be cured while they wait for an organ transplant (e.g. new heart and/or lungs).

How does an ECMO machine work?

The ECMO machine is connected to a patient through plastic tubes (*cannula*). The tubes are placed in large veins and arteries in the legs, neck or chest. The procedure by which a healthcare provider places these tubes in a patient is called *cannulation*.

The ECMO machine pumps blood from the patient's body to an artificial lung (oxygenator) that adds oxygen to it and removes carbon dioxide. Thus, it replaces the function of the person's own lungs. The ECMO machine then sends the blood back to the patient via a pump with the same force as the heart, replacing its function. The ECMO machine is controlled by a person called a *perfusionist*, or a nurse or respiratory therapist with advanced training called an ECMO specialist. The perfusionist or ECMO specialist will adjust the settings on the machine to give the patient the amount of heart and lung support they need.

How is a patient on an ECMO machine monitored?

Any patient connected to an ECMO machine in the ICU is also connected to monitors. These monitors measure heart rate, blood pressure, and oxygen levels. Patients on ECMO need their blood tested very often to measure the oxygen and carbon dioxide levels.

These tests are called *blood gases*. Patients on ECMO are also given a medication to thin the blood so it does not clot. Thus, the blood is tested frequently to make sure it is thin enough. Members of the patient's health care team use all these results to see how well the ECMO machine is helping the patient, and to make changes if needed.

How long is an ECMO machine used?

An ECMO machine can help save a patient's life, but it does not treat the patient's disease or injury. An ECMO machine simply provides support for a patient while the healthcare team works on treating the underlying disease or injury (such as an infection) or until organs for transplant become available. Healthcare providers will always try to help people get off the ECMO machine as soon as possible. Some diseases or injuries can be treated quickly, and patients only need the ECMO machine for a few hours. Other conditions may take longer to get better, in which case the patient may need the ECMO machine for several days to weeks. Unfortunately, in some cases, patients do not improve enough to be taken off the ECMO machine. ECMO does not save everyone but it has improved survival for many critically ill people who are not responding to usual life support options.

How does it feel to be on ECMO?

When a patient is first being connected to an ECMO machine, he or she is sedated and does not feel the tubes going into their veins and arteries. A person on ECMO is usually already connected to a breathing machine (*ventilator*) through a tube (*endotracheal or ET tube*) that is placed in the mouth or nose and down into the windpipe. (For more information, see Mechanical Ventilation at www.thoracic.org/patients).

Once connected to an ECMO machine, the cannulae are not painful. Patients who are on an ECMO machine may be given medicines (sedatives or pain controllers) to keep them comfortable. These medicines may also make them sleepy. Other patients are awake and can talk and interact with people while on an ECMO machine. In some cases, patients can exercise to help build up their strength while they are on an ECMO machine. However, some movements can cause the ECMO tubes to get kinked, so patients need to be assisted and carefully supervised when they are moving.

What are the risks of being on ECMO?

The healthcare team looking after patients on ECMO aim to avoid any complications that may occur from being on the machine. Some of the more serious problems that may occur when a patient is on ECMO include:

Bleeding: Because of the blood thinning medication that patients need while on ECMO, they can start bleeding in different parts of their body. This can be a very serious problem if the bleeding happens in their brain, lungs, insertion sites of cannulae or from their stomach. The healthcare team monitors patients very carefully by frequent physical exams and lab tests to make sure there is no bleeding. If there is bleeding, then medications can be given to help the blood to clot. Sometimes, surgery is needed to stop the bleeding. Blood and other blood products (such as platelets) may also need to be given if blood counts drop too low.

Kidney Failure: Patients who are on ECMO sometimes do not get enough blood flow to their kidneys. This can cause their kidneys to stop working, known as “acute renal failure”. If the kidneys stop working, then a patient may need to be connected to a machine that does the work of the kidneys. This is called *dialysis*. The kidney damage may get better. However, in some cases, patients may need dialysis for the rest of their life.

Infection: The tubes from the ECMO machine go from outside the patient’s body directly into their bloodstream. This increases the risk for infection, because the tubes are a way for germs to enter the body. The infection can reach the lungs, or any other part of the body. Infections in patients on ECMO can usually be treated with antibiotics. However, some patients who develop infections while on ECMO can get sicker and suffer organ damage.

Leg Damage: Some patients are connected to the ECMO machine through a vein or artery in their thigh. In some cases, this can impair the blood flow down that leg, and the tissue in the leg can die. If this happens, doctors will try to get blood flowing back down the leg. This usually means changing the ECMO tubing to another part of the body. Unfortunately, the damage can occasionally be bad enough that the patient needs surgery to correct the problem, which may include amputation (removal of part of the leg).

Stroke: In patients on ECMO, certain areas of the brain may not get as much blood flow as they need because of small blood clots. This can cause a stroke, and parts of the brain may be permanently damaged. The area of the brain that is damaged will determine what problems a person has from a stroke. Some patients may not be able to move certain parts of their body, see, remember, speak, read or write. Sometimes a person will recover some function after a stroke, but that is not always the case. Fortunately, strokes are very rare and happen less than 5% of the time to patients on ECMO.

How does a patient get taken off ECMO?

The ECMO machine supports the patient while he or she tries to overcome a disease or injury. If the disease or injury improves, the patient may not need the support of the ECMO machine anymore. The healthcare providers will slowly reduce the amount of support the ECMO machine is providing to see if the patient will be okay without it, just like they do with a ventilator (See ATS Patient Education Document on Mechanical Ventilation). If the patient remains stable (or improves) as this is being done, the ECMO tubes are removed and surgeons stitch the entry spots up to close them.

What happens if a patient cannot be taken off ECMO?

ECMO is only a “life-sustaining treatment.” It does not cure or treat the disease or injury that led to heart and/or lung failure. This means it is a treatment that can prolong life to allow for more time to try to fix the problem. Sometimes patients do not get better while they are on ECMO because their disease or injury cannot be fixed. A decision about whether there is benefit to continuing ECMO can be hard, and some patients will not want to stay on ECMO if they are not improving.

If the healthcare providers believe that the patient’s disease or illness is very severe and will not get better, they will discuss this carefully with the patient and family members and help to make decisions about the end of life and removing the patient from ECMO support. If the patient cannot talk or communicate his or her decision, the healthcare providers will talk with the patient’s legally authorized representative (usually a spouse, parent, or next of kin). While patients can die even though they are connected to ECMO, sometimes ECMO seems to prolong the dying process.

It is important to talk to your family members and your healthcare providers about your wishes regarding end of life and what you would like to happen in different situations. The more you clearly explain your values and choices to your loved ones and healthcare providers, the easier they will be able to follow your wishes if and when you are unable to make decisions for yourself. An advanced directive (or a “living will”) is a way to put your wishes in writing to share with others. In the hospital, nurses, doctors, and social workers can provide information about how to complete an advanced directive form.

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Rx Action Steps

- ✓ Talk with the healthcare team about the risks and benefits of ECMO if you or a loved one is having heart or lung failure.
- ✓ Consider what you would want to happen if you had a severe illness and make an advanced directive.

Healthcare Provider’s Contact Number:

Resources:

Medline Plus—Extracorporeal Membrane Oxygenation (Pediatric Focus)

<https://www.nlm.nih.gov/medlineplus/ency/article/007234.htm>

Healthline Reference Library—ECMO

<http://www.healthline.com/health/extra-corporeal-membrane-oxygenation#Overview1>

A Family Guide to Adult ECMO

<http://www.ards.org/learnaboutards/treatment/ecmo.html>

ECMO Family Support Group (UK)

www.ecmofamilysupport.com

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