



ECMO Treatment at Ohio State

Extracorporeal Membrane Oxygenation



THE OHIO STATE UNIVERSITY

WEXNER MEDICAL CENTER

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Learning About ECMO

Extracorporeal Membrane Oxygenation

Adjusting to treatment

It can be overwhelming to walk into a room and see your loved one on this treatment. They will be connected to many tubes and machines. Equipment surrounds the bed with beeping and alarms sounding.

Care team members are in and out of the room to check on your loved one and the equipment. The nurse and others on the team will try to help you understand what is happening.

Someone getting ECMO treatment will often be sedated, so they may not respond to you or they may open their eyes or squeeze your hand. If there is a breathing tube and ventilator, they will not be able to talk to you. It is best to let them rest.

Swelling of the arms, face, and legs may change your loved one's appearance and may make it hard for you to recognize them at first.

Talk to the care team and ask questions

You can expect that there will be changes to your loved one's care hour by hour, based on their response. The early hours and days of treatment will seem chaotic, but know that there is a skilled team that is closely watching your loved one.

Care may be discussed as looking better, worse, or about the same. A lot of information will be shared with you. Please ask if you do not understand what is being said. It can be a very stressful and emotional time.

We encourage you to take notes, so you can better remember what was shared. This is also a good time to write down your questions, so you do not forget to ask them.

If there is anything you do not understand, please ask us to explain it a different way.

What is ECMO?

ECMO, or extracorporeal membrane oxygenation, is a life support treatment for people with severe lung (respiratory) failure or heart failure that does not respond to usual treatments. ECMO uses a machine that takes carbon dioxide out of the blood and puts oxygen back into the blood. It does what the lungs and heart normally do on their own.

ECMO is used in serious cases when a person's heart or lungs are not working like they should. It does not cure these problems and it is only used when there are no other options.

It is like a heart and lung bypass machine used in open heart surgery. It is used in intensive care units for days to months of treatment. The ECMO machine gives the patient's failing heart or lungs a chance to rest and recover. It can also provide more time until a transplant or other life-saving procedures can happen.

Because patients are very sick before receiving ECMO and often have problems from the treatment, death may still occur.

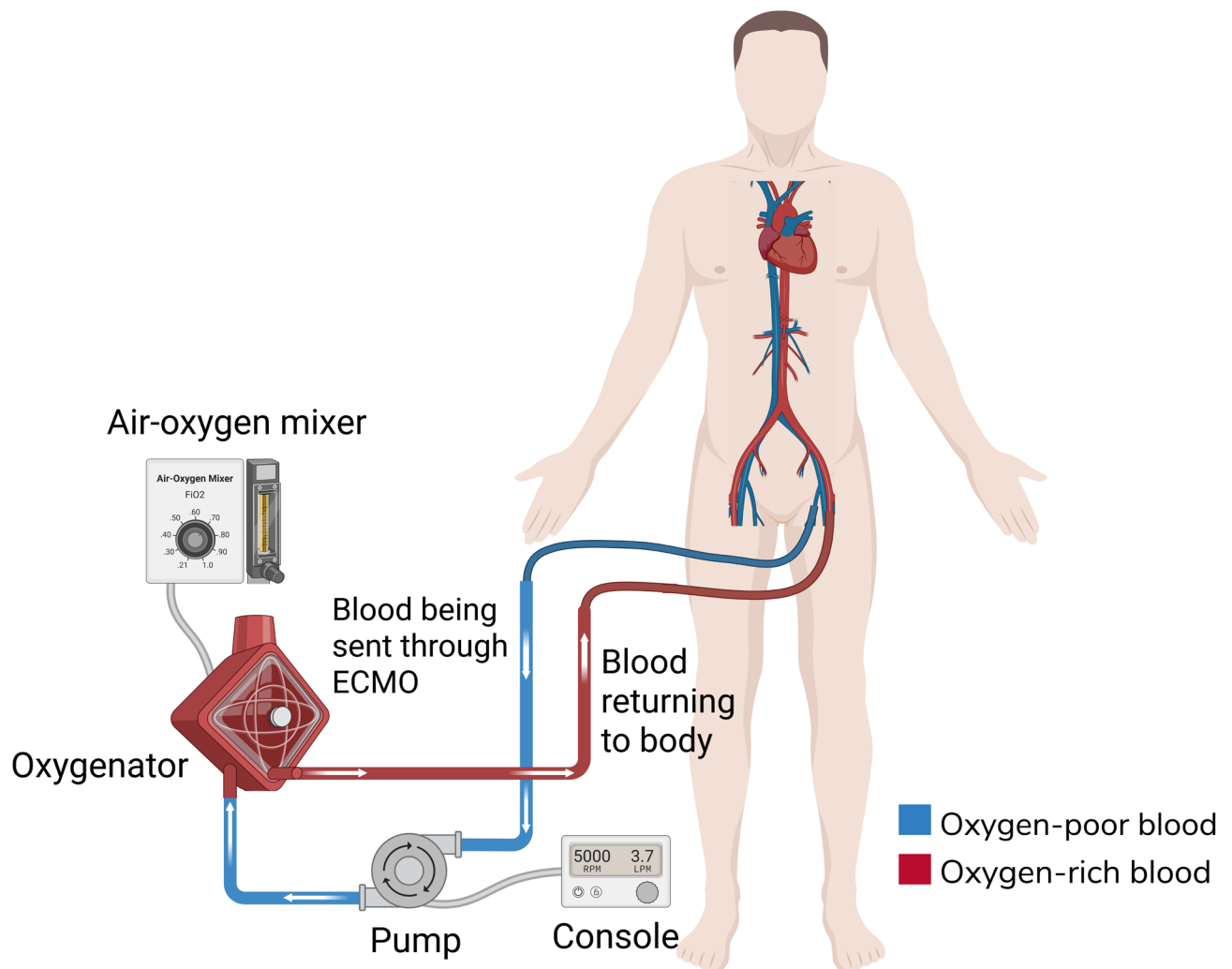
How ECMO works

The person's blood is brought out of their body through a very large tube. The blood is cycled through the ECMO machine to remove waste and to add oxygen, and then the blood goes back into the body through another large tube.

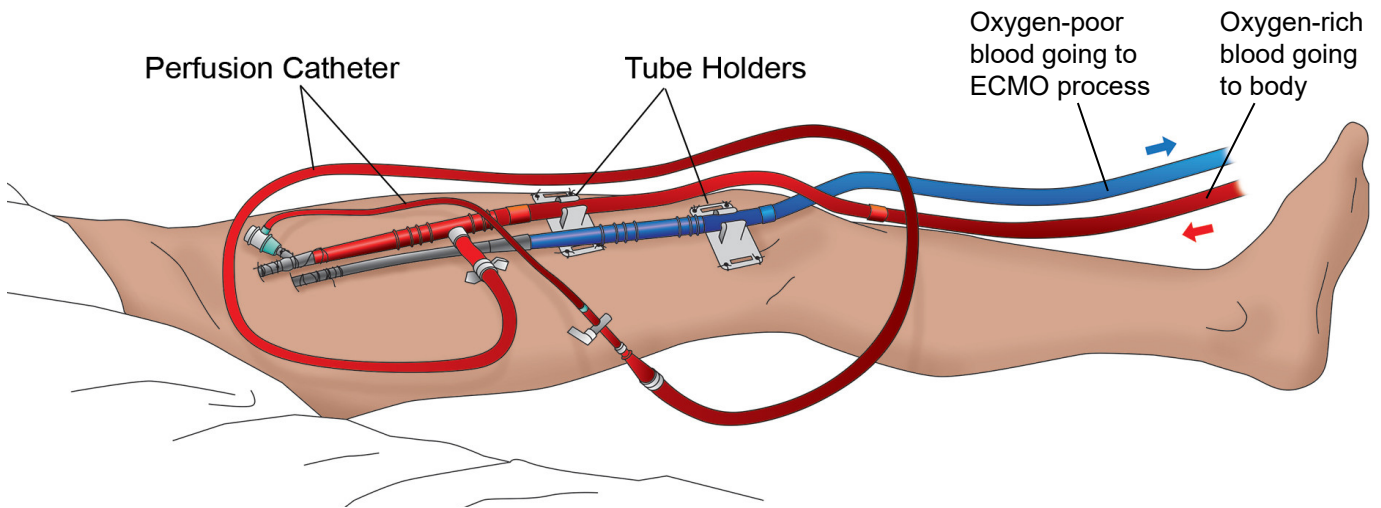
This treatment is also called extracorporeal life support (ECLS). Extracorporeal means outside the body.

The ECMO circuit is made up of tubing, a pump, an oxygenator, and a heater.

- The **pump** works like a heart to pump blood with little oxygen out of the body through a very large tube, called a cannula. This is the **oxygen-poor blood**.
- The **oxygenator** works like the lungs, taking carbon dioxide out of the blood and adding oxygen to the blood.
- The **oxygen-rich blood** is pushed through the **heater** to warm the blood to body temperature. The warmed blood is pumped back into the body through another tube, called a **cannula** or return line.
- The **air-oxygen mixer** provides a mixture of gases (oxygen and air) to the oxygenator, helping to control the oxygen levels and carbon dioxide levels.
- **The console** is the main control unit that runs and monitors the ECMO circuit, including blood flow, oxygen delivery, and temperature.



The **cannulas** are tubes that are about the size of a garden hose. Cannulas may be placed in the neck, chest, or the top of the leg, called the groin. The cannulas may need to be moved to other positions in some cases.



Types of ECMO

ECMO can support a person's failing lungs, failing heart, or failing lungs and heart. The healthcare team will talk with you about the type of ECMO needed for your loved one's condition.

- ❑ **VV (veno-venous):** provides support if the person's lungs are not working.
 - ▶ Used to treat severe respiratory failure from trauma, pneumonia, flu, or other infections, or while waiting for or after a lung transplant.
 - ▶ This treatment is often required for weeks or months. A long hospital stay should be expected.
- ❑ **VA (veno-arterial):** provides life support if the person's heart or lungs are not working.
 - ▶ Used to treat severe heart failure, or while waiting for a heart transplant or device implant.
 - ▶ This treatment is often used for days to weeks.
 - ▶ The surgery incision may be open and covered with a dressing. This is done to prevent extra pressure in the chest if there is swelling. After the swelling decreases, the incision will be closed, either in surgery or in the room.
 - ▶ Sometimes after VA ECMO, patients need a temporary ventricular assist device (VAD), and then a permanent VAD or heart transplant.
- ❑ **ECpella (ECMO + Impella):** uses two devices together — ECMO and Impella. Impella is a temporary heart pump (also called a ventricular assist device). Combining both machines can be used as an option for added heart support.

Other cannulas can be added for more treatment options.

Risks of treatment

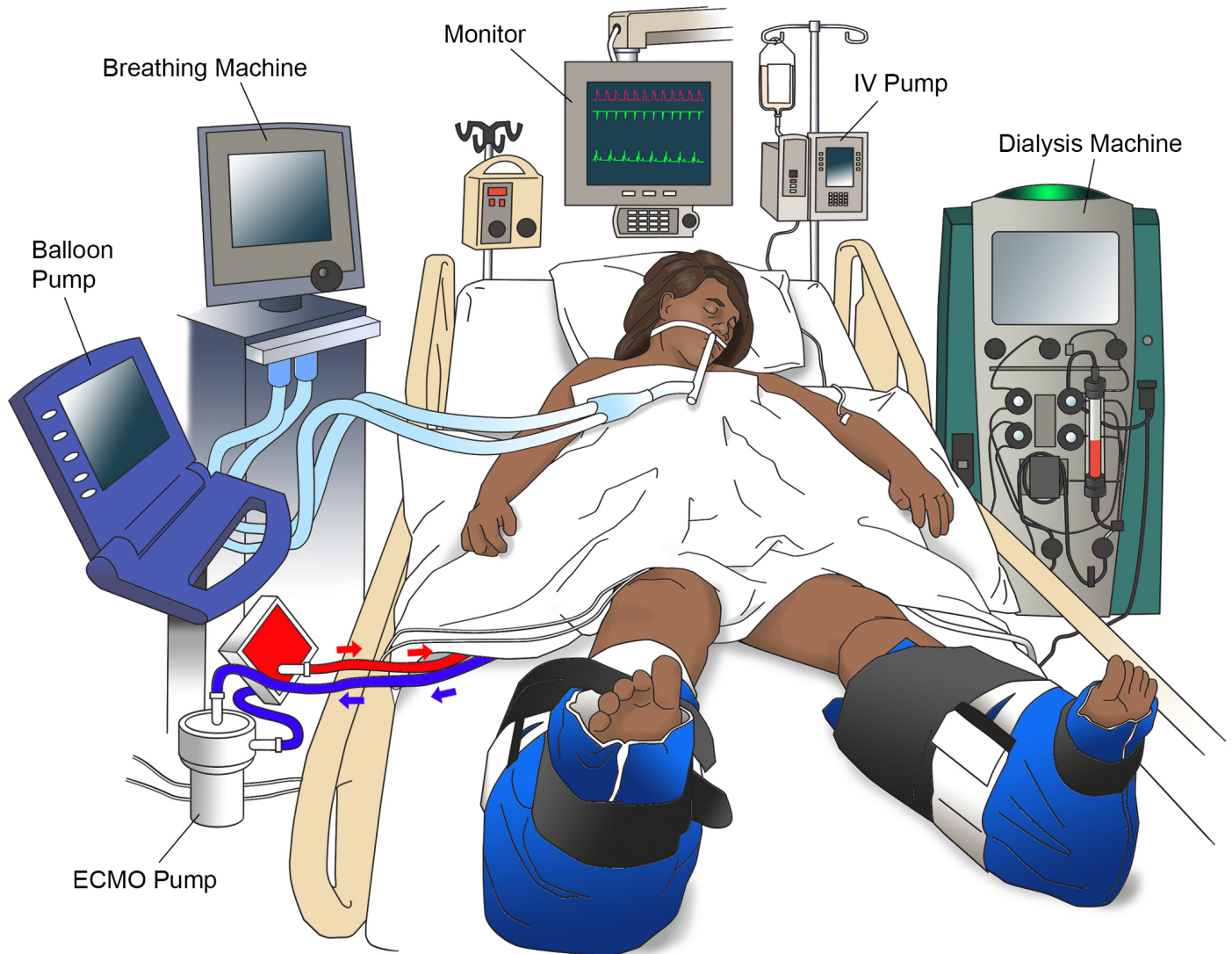
There is a risk of problems during treatment. This includes:

- Bleeding is common and often due to blood thinner medicines needed to prevent blood clots while on ECMO.
- Blood clotting, also known as thrombosis, is where a blood clot partly or completely blocks blood flow.
- Infection.
- Stroke can occur either from bleeding in the brain or from blood clots.
- Swelling of the face, arms, and legs, called edema, because of fluids given for treatment.
- Irregular heart rhythms, called arrhythmias.
- Various body systems may fail, such as the liver, bowels, or kidneys.
- Poor blood flow to arms and legs, which could lead to loss of a limb. This image shows a closer look at the leg site.
 - Anchors are attached to the skin to keep the tubes from being pulled.
 - Another tube, called a perfusion catheter, is connected to the return line to allow more blood flow to the leg below the insertion sites. This is done to reduce the risk of blood flow problems in the leg.
- Other problems may occur.

Equipment in the room

The room will be filled with many pieces of equipment to care for the person on ECMO.

- IV pumps to give IV fluids and medicines, and many IV lines.
- A breathing machine, also called a ventilator or vent, may be used with the ECMO machine to push air in and out of the lungs.
- A breathing tube is placed to help direct air in and out of the lungs. This may be an endotracheal (ET) tube placed in the mouth and into the trachea. Or it may be a tracheostomy or trach tube placed in the person's neck.
- Monitors will be used to check heart rate and rhythm, blood pressure, oxygen levels, breathing rate, temperature, and other measurements.
- A feeding tube may be used for nutrition. Sometimes called an NG (nasogastric) or Dobhoff tube, this is a small tube placed through the nose or mouth and down into the stomach.
- A Foley catheter may be placed to drain urine from the bladder into a bag.
- If there are kidney problems, a dialysis machine may be added to the ECMO machine to remove toxins from the blood.
- A balloon pump or Impella may be used to help the heart pump blood through the body.
- There may be chest tubes to remove fluid. These tubes connect to drainage containers that sit on the floor of the room.
- A temporary pacemaker may be in place to help control the heartbeat.
- The bed will have a special mattress, and the bed may rotate to reduce the chance of pressure injuries (also called bedsores or pressure ulcers).



Medicines

The patient will be on many medicines that may be given through the IV lines or through the breathing tube. Some of the medicines include:

- Blood thinners or anticoagulants given to reduce the chance of blood clots forming during treatment. These medicines may cause bleeding around the mouth, tubes, and under the skin. Blood transfusions may be needed.
- Medicines given for comfort and to help with rest and sleep. You may hear the term sedation or chemical paralysis to allow more oxygen for healing.
- Antibiotic medicines given to treat or prevent infections.
- Diuretic medicines to reduce fluid causing swelling.
- Other medicines may be given for other health problems, such as to keep the bowels working to prevent blockages.

Other treatments and tests

- Blood tests to check many things, such as:
 - Blood gases, the levels of oxygen, and carbon dioxide in the blood.
 - Electrolytes and minerals to check levels of fluids and body functions.
 - Blood counts, including hemoglobin and hematocrit.
 - Platelet levels and clotting ability of the blood.
- Blood and blood products to replace blood loss.
- Computed tomography (CT) scans to check the head and other body organs for problems.
- Tests may be done to check brain function, such as electroencephalograms (EEGs).
- Bronchoscopies may be done to check the lungs. A flexible tube with a camera and light is placed through the mouth and into the lungs.
- Echocardiograms, sometimes called an echo, use sound waves to make pictures to check the valves and chambers inside the heart.

Research studies

Research is an important way we continue to advance healthcare treatment. You may be asked if we could include your loved one in a research study. We will explain what is being studied and how your loved one would be involved. Advances in care are only possible with the support of families like yours.

Support for families

Families need steady, compassionate support during this time. Staff are available to help you and connect you with resources, such as social work, palliative care, pastoral care, and patient experience. They are here to listen, guide, and support you in whatever way you may need. Learn more about their roles on the next page.

It can be difficult to explain ECMO to children. For this reason, we have created **Our Hospital ECMO Story**, a small book for young children to help talk about this treatment. Ask your care team about this if you have young children in your family.



Care Team

ICU care team

- **Critical Care Doctor (Intensivist):** A doctor who specializes in caring for critically ill patients.
- **Cardiac Surgeon:** A doctor who performs surgery on the heart and the major blood vessels connected to it.
- **Registered Nurse (RN):** Plans, directs, and gives nursing care.
- **ECMO Specialist:** Specially trained nurse or perfusionist who manages the ECMO pump (a perfusionist operates heart–lung machines and other advanced life-support equipment).
- **Pharmacist:** Monitors and prepares medicines for the patient.
- **Respiratory Therapy:** Helps with breathing problems and treatments. Takes care of oxygen equipment if needed.
- **Physical, Occupational, or Speech Therapists:** Help with movement, self-care, and speech or swallowing problems.
- **Social Worker:** Helps you with care after the hospital stay, coping, and finding resources to meet your needs.
- **Palliative Care Doctor:** Talks to you about your loved one’s wishes and works with the rest of the team to support your family during this time.
- **Pastoral Care Staff:** Help with spiritual needs. They can assist persons with or without religious beliefs.
- **Patient Experience:** Helps you with any concerns or questions that you may have during your visit.
- **Dietitian:** Checks that the patient is getting enough nutrition.

Rounding

Rounding (or rounds) is when the care team meets each day—often at the patient’s bedside—to review the patient’s condition and decide on the plan of care together.

The cardiac surgeon and critical care doctor will coordinate this care daily with all the providers involved.

- **Formal ICU rounds** happen each day, often between 8 a.m. and 11 a.m.
- **Informal rounding** also happens throughout the day, and will include surgeons, intensivists, consulting doctors, pharmacists, nurse practitioners, and bedside nurses.

You may also see dietitians, respiratory therapists, social workers, and others from the care team. Family members are encouraged to be present to review the treatment plan and progress of the patient.

Consulting doctors

It is common to have many doctors involved in the care of a patient on ECMO, such as:

- Cardiologist or heart doctor
- Nephrologist or kidney doctor
- Transplant doctor
- Infectious disease doctor
- Others as needed to address other problems that come up

Each specialty group of doctors may focus on one problem or organ. Your surgeon will coordinate all of this for your loved one’s care.

Concluding ECMO Care

Steps in the process

- Many tests will be done to be sure the heart and lungs are ready to work on their own before stopping ECMO care. Surgery is needed to remove the tubes and repair the blood vessels.
- For the VV (veno-venous) patient, the cannulas may be moved to the neck as they progress.
- Physical therapy, nursing, and others will help the patient get out of bed, sit up in a chair and start to walk to help them gain strength while still on ECMO. Therapy will be needed for some time after the patient comes off of ECMO.
- The ventilator will stay on for a time after ECMO is stopped.

Recovery

It is common to have long-term health issues after this treatment. Long periods of time in bed for this treatment cause muscles to weaken and strength to be lost.

Most patients will need to go for physical therapy to improve their strength and movement skills. This may include a stay at a rehab hospital, like Dodd Rehabilitation Hospital, a rehab facility, or a nursing home.

The length of time required for rehab will vary based on the age of the person, the strength of their heart and lungs before the treatment, and the extent of damage from treatment.

Follow up care

There will be a need to follow up with a number of doctors after discharge. These may include:

- **Gastroenterology** to follow up on digestive issues.
- **Nephrology** to check on kidney function.
- **Hematology** to follow up on blood work.
- **Vascular surgeon** to check circulation and blood vessels.
- **Infectious disease** to check on infections.

After ECMO care

ECMO care is complex and often needs close follow-up, monitoring, and special expertise after leaving the hospital. The Critical Illness Transition and Recovery Program (CI-TRP) is designed to help with the ongoing recovery needed after the ICU. The team partners with the patient, family, and primary care provider to provide medical care, expert guidance, and to create an individualized recovery plan after leaving the hospital.

If damage is too severe

Because many people who need this treatment are very sick, there are many who will not survive. If there is no hope of your loved one being able to live because of severe heart, lung, or brain damage, or other organs failing, the care team will talk with you about stopping the treatment. Care would change to keeping your loved one comfortable until the end of life.

Notes and Questions



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