

# Extracorporeal Membrane Oxygenation

## Quick Facts



Extracorporeal membrane oxygenation (ECMO) is used for patients suffering from acute respiratory and/or cardiac failure. ECMO is a short-term, life-support system that replaces or supplements the natural function of the heart and/or lungs, allowing them to rest and potentially recover. ECMO provides valuable time to further assess and treat the underlying cause of the acute problem.

### Physician



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*Director of Mechanical Circulatory Support,  
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### Referrals

Physicians with patients who might be candidates for ECMO should contact WellSpan.

- Call (717) 851-BEDS (2337)
- Inform the logistics coordinator you have an ECMO patient

### Criteria for Initiation of ECMO

#### Indications

Any patient less than 70-years-of-age with any of the following:

- Refractory cardiogenic shock
- Witnessed cardiac arrest with continuous CPR
- Respiratory failure as follows:
  - Severe hypoxemia (e.g., ratio of PaO<sub>2</sub> to Fio<sub>2</sub> < 100, despite the application of high levels of PEEP [typically 15–20 cm of water]) for at least 3 hours in patients with potentially reversible respiratory failure
  - Uncompensated hypercapnia (PaCO<sub>2</sub> > 50) with acidemia (pH < 7.2) despite the best accepted standard of care for management with a ventilator
  - Excessively high end-inspiratory plateau pressure (>35–45 cm of water, according to the patient's body size) despite the best accepted standard of care for management with a ventilator

#### Contraindications

- Active bleeding or intracranial hemorrhage
- Mechanical ventilation duration > 8 days
- Any condition or organ dysfunction that would limit the likelihood of overall benefit from ECMO, such as severe, irreversible brain injury or untreatable metastatic cancer
- DNR/DNI order

If a patient meets these criteria for initiation of ECMO, make a referral immediately. If a patient does not yet meet these criteria, but is deteriorating, please consider early referral for the potential need for mechanical support.

### WellSpan Cardiothoracic Surgery

Apple Hill Medical Center  
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[www.WellSpan.org/HV](http://www.WellSpan.org/HV)

## Potential Benefits of ECMO

ECMO may be a life-saving measure for patients with severe pulmonary and/or cardiac injury that is not responsive to standard forms of treatment, including mechanical ventilation and medications. Patients with severe congestive heart failure may also be candidates for ECMO as a bridge to more durable mechanical support, recovery or transplantation.

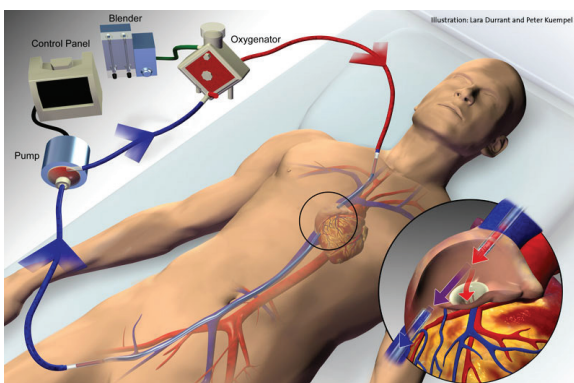
Even though ECMO is not a treatment, it provides immediate hemodynamic support and oxygenation to tissues. By doing so, ECMO can provide time needed to allow the heart and lungs to recover and prevent ongoing organ injury during this time. The length of time a patient remains on ECMO may vary and depends on the diagnosis and the individual's capacity for recovery.

## Hospital Affiliation

The physicians in the WellSpan Cardiothoracic Surgery practice give patients access to exceptional inpatient care at WellSpan York Hospital.

## ECMO Circuit

A basic ECMO circuit consists of cannulas, tubing, a pump and an oxygenator. Cannulas are inserted into major blood vessels and allow blood to be removed and returned to the patient. Blood is transported through the circuit via tubing. A mechanical pump drives the blood through the circuit and can provide circulatory support to the patient. A membrane oxygenator delivers oxygen into and removes carbon dioxide out of the patient's blood.



Circuit configuration for VV ECMO using two site cannulation, including femoral cannulation.

## Types of ECMO Support

There are two basic types of ECMO support dependent upon the patient's need.

**Veno-Venous (VV):** V-V ECMO provides gas exchange only and is used to support patients with acute pulmonary failure. Cannulas are commonly placed in the right internal jugular vein and right common femoral vein. Cannulation strategies can vary and single site cannulation strategies have been developed. V-V ECMO does not provide hemodynamic support. In this configuration, the ECMO circuit will carry venous blood from the patient to an oxygenator, which oxygenates the blood and removes carbon dioxide. The blood is then returned back to the right side of the heart through a cannula. Patients on V-V ECMO rely on their native cardiac function to circulate the oxygenated blood throughout their bodies.

**Veno-Arterial (VA):** V-A ECMO provides full cardiopulmonary support. This strategy is employed for patients that require hemodynamic support in addition to oxygenation. Cannulas are most commonly placed in the femoral artery and vein, but a variety of cannulation sites can be used. The ECMO circuit will drain blood from the venous circulation, provide gas exchange, and then return the blood to the arterial circulation. This method allows the blood to "bypass" the heart and lungs.

Throughout ECMO support, the patient is the center of a highly coordinated medical team effort and receives around-the-clock care.

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