FAST FACTS AND CONCEPTS #339
EXTRACORPOREAL MEMBRANE OXYGENATION IN ADULTS
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Introduction
Use of extracorporeal membrane oxygenation (ECMO) (sometimes called extracorporeal life-support) is increasing in many countries. This Fast Fact will review the role of palliative care teams in caring for adults on ECMO, and their families.

The Technology
The technology is fundamentally the same as a ‘heart-lung bypass machine’ used in some cardiac surgeries, although ECMO can be used for weeks instead of hours. Central venous blood is removed from the patient and pumped through a gas exchange membrane where it is oxygenated and carbon dioxide is removed. In venovenous (VV) ECMO the blood is then reinfused into the right-sided circulation where the patient’s own heart circulates it. In venoarterial (VA) ECMO, the oxygenated blood is reinfused under arterial pressure into the aorta for circulation. Therefore, VV ECMO ‘replaces’ lung function (gas exchange); VA ECMO ‘replaces’ both heart (pump) and lung function. Initiating and providing ECMO requires specialized teams and currently is only offered at specific referral centers.

VV ECMO: VV ECMO is used for severe hypoxic respiratory failure; typically the acute respiratory distress syndrome – ARDS.
- The best available data comes from the CESAR Trial (2009) – a randomized study showing improved disability-free survival at 6 months with ECMO (63%) vs. usual ICU care (47%) (1). There are also observational data suggesting improved survival from ARDS during influenza pandemics (2).
- In the Extracorporeal Life Support Organization’s (ELSO) international ECMO database, 57% of patients receiving VV ECMO survive to hospital discharge (disability rates unknown) (3).
- VV ECMO has seen a 10-fold increase between 2005 and 2015 from ~150 cases to ~1900 cases (4).

VA ECMO: VA ECMO is used for severe cardiogenic shock such as after a massive pulmonary embolus, ST-elevation myocardial infarction, or cardiac surgery.
- Data supporting VA ECMO are less clear than VV ECMO on whether it improves outcomes compared with other advanced technologies for cardiogenic shock (e.g. ventricular-assist devices, intra-aortic balloon pumps, etc.) (5).
- The ELSO database reports hospital survival for VA ECMO is ~40% (disability rates unknown) (3).
- VA ECMO is also used for sudden cardiac death patients who do not have return of spontaneous circulation after CPR. This use is called “E-CPR”. Patients are rapidly transported to an ECMO center where ECMO is initiated in an attempt to perfuse the brain and other organs while the cause of the arrest is treated. The efficacy of E-CPR has not been evaluated yet in high quality trials.

Patient Experience & Complications
ECMO requires large caliber vascular catheters, placed in the groin or neck. Initially patients are intubated, sedated, and paralyzed. Patients who are on ECMO for many days sometimes can be awoken, and even have limited mobility such sitting up in a chair or engaging in physical therapy (6,7). Continuous anticoagulation is required during ECMO to prevent thrombus formation in the circuit. Bleeding (including intracranial, gastrointestinal, and pulmonary) is the most serious complication (30-50%) and can be life-threatening (4,8). Other complications include thromboembolism, infections, acute kidney injury, and limb ischemia.

Patient Trajectories
Apart from the survival statistics above, little has been written about what happens to patients receiving ECMO. Our experience is that most patients fall into 1 of 6 categories.
1. The underlying illness recovers sufficiently for ECMO to be discontinued. These patients can have a full recovery or remain chronically critically ill, albeit off ECMO.
2. No recovery occurs, but an alternative intervention is available such as heart or lung transplantation or ventricular assist device, allowing ECMO to be discontinued.
3. The patient dies while receiving ECMO, for instance from massive intracranial bleeding.
4. ECMO is discontinued with the intent of allowing the patient to die, due to the identification of a poor functional or survival prognosis (e.g. anoxic brain injury).
5. The ECMO circuit fails (for instance, it clots off). This can lead to urgent intervention to replace the
catheters and ECMO devices versus a decision to allow the patient to die. For patients with a poor underlying chance of recovery, ECMO circuit failure should trigger frank conversations about prognosis and goals, and if it is in the patient’s best interest to replace the failing ECMO system.

6. A patient becomes “stuck” on ECMO, without recovery of the underlying illness or available alternative intervention, and little chance of ever surviving without ECMO. This can cause ethical and resource utilization dilemmas if the patient/family do not agree to discontinue ECMO. There is no arbitrary time-limit to ECMO use, however its use in one patient may prevent it being used in another due to the limitation on the number of ECMO machines and personnel (9).

Palliative and End-of-Life Care Fundamentally, palliative care teams can support ECMO patients/ families as they would any other critically ill patient at high risk of dying: assess and clarify patient/family understanding, provide emotional and spiritual care, support patient-centered goals of care discussions, and help provide comfort care to dying patients. Educating families and preparing them early on for the possibility that a patient will not recover and ECMO will need to be discontinued is advisable. Clinicians should be prepared that most families will have no knowledge of ECMO, unlike other ICU treatments such as mechanical ventilation. Different institutions will have different protocols for discontinuing ECMO in a patient who is expected to die. The approach to symptom management in patients expected to die after ECMO discontinuation is similar to the removal of any other advanced life-support technology such as a ventilator or LVAD. It is particularly important to ensure patients are comfortable and have adequate circulating levels of symptom medications prior to discontinuing ECMO due to the probability of rapid circulatory collapse (see Fast Facts #33, 34, 269).

References

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