# ECMO

## VA ECMO

- Venoarterial bypass is performed by accessing the right atrium or inferior vena cava for venous drainage and infusion into the carotid or femoral artery.
- Access to all vessels except the carotid can usually be performed by percutaneous Seldinger technique.
- Because arterial flow is antegrade and directed to the proximal aorta, there is hypothetically better perfusion to the brain, coronary vessels, and viscera. However, the incidence of cerebrovascular accident is as high as 15%.
- the advantage of cannulating the femoral vessels is that it can be performed completely percutaneously.
- the disadvantages of femoral artery cannulation are retrograde flow and the possibility of rendering the cannulated leg ischemic. However, the ischemia can be treated by placing a third cannula in the ipsilateral leg and "Y-ing" it to the arterial side of the extracorporeal life support circuit.

## VV ECMO

- Venovenous access is the most common route of extracorporeal support for respiratory failure.
- In adults, the right atrium and inferior vena cava are cannulated via the internal jugular and femoral veins.
- In neonates and small children, double-lumen cannulas can be inserted into the internal jugular vein.
- Venovenous support has several advantages: percutaneous techniques can be used, the risk of cerebrovascular accident is greatly reduced, normal hemodynamics are maintained, and there is no risk of ischemia to the lower extremity.

## settings

- Once bypass is initiated, flow is begun at around 50 to 60 mL/kg per minute.
- The extracorporeal life support circuit provides the majority of support, and the ventilator settings are minimized to decrease pulmonary trauma. Typical ventilator settings with extracorporeal life support are pressure of 30/10, frequency of 5, and FIO2 of 0.40.
- Systemic heparinization is maintained and titrated to activated clotting time, which should range from 160 to 220 seconds.

- The ventilator is gradually resumed until native lung function is adequate to wean thepatient off of extracorporeal life support.
- Patients with cardiac failure may improve with time, but some cardiac patients require ventricular assist devices and transplant evaluations.
- In experienced centers, extracorporeal life support can be maintained for weeks without  major complications.

## diagrams

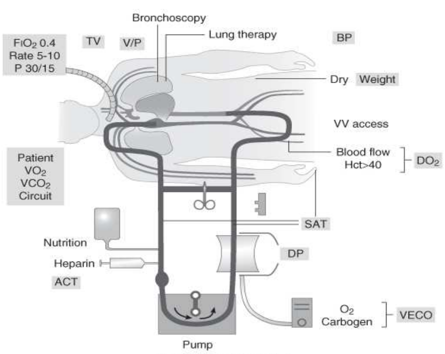


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Figure 70-1 Typical venoarterial bypass setup. ACT, activated clotting time; BP, blood pressure; Hct, hematocrit.

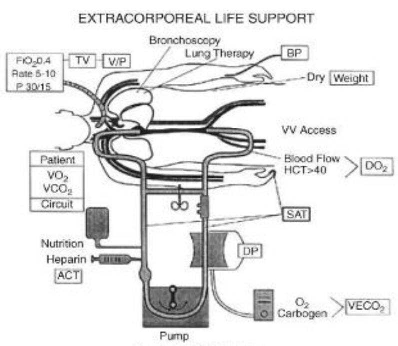


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Figure 70-2 Typical venovenous bypass setup. ACT, activated clotting time; BP, blood pressure; Hct, hematocrit.

## outcome

- Extracorporeal life support is a viable and effective treatment.
- Patients who are placed on extracorporeal life support typically have a 20% predicted survival rate without bypass.
- In the 1970s, trials failed to show improved survival with extracorporeal life support. However, since that time, there have been improvements in technology, technique, and understanding of the involved pathophysiology.
- A randomized, controlled trial is currently under way in the United Kingdom to assess the outcome with current extracorporeal life support protocols

## general

- Extracorporeal life support, also known as extracorporeal membrane oxygenation, is the use of a cardiopulmonary bypass device to prolong the life of a critically ill patient who has inadequate pulmonary or cardiac function.
- Extracorporeal life support provides full life support in the absence of cardiac or pulmonary function, but it is not active treatment. It affords time to treat the primary condition without reliance on native heart or lung function.

## indications

General:
- Extracorporeal life support is used for patients with severe (predicted mortality 80%) but potentially reversible cardiopulmonary failure. It is invasive and expensive and requires anticoagulation; therefore, it is reserved for patients who have failed simpler treatment regimens.
- Extracorporeal life support provides rest from high ventilator settings, high inspired oxygen fractions (FiO2), and high doses of pressors.

Criteria for adult & paediatric ECMO

| Indications | Contraindications |
|---|---|
| Poor gas exchange | >7 days on high ventilator settings (adult) |
| | >14 days on high ventilator settings (pediatric) |
| Compliance <0.5 mL/cm $H_2O$/kg | Incurable disease (e.g., malignancy) |
| $PaO_2/FIO_2$ <100 | Age >70 yr |
| Shunt fraction >30% | Pulmonary artery pressures >[lcub ]2/3[rcub ] systolic pressures |
| | Poor neurologic status |
| | Active bleeding or unresolved surgical issues |

Criteria for neonatal ECMO

| |
|---|
| Age >32 wk |
| Weight >1.5 kg |
| No intracranial hemorrhage (>grade 1); recent head |
| ultrasonography needed |
| No coagulopathy |
| Ventilation <10-14 days |
| AaDO >605-620 for not more than 4-12 h |
| $AaDO_2$ = 713 |
| Oxygenation index >25 |

- Common neonatal conditions for which extracorporeal life support is used are:
(i) meconium aspiration syndrome,
(ii) persistent pulmonary hypertension,
(iii) congenital diaphragmatic hernia,
(iv) pneumonia, and
(v) respiratory distress syndrome

- Common diagnoses leading to extracorporeal life support are:
(i) pneumonia;
(ii) ARDS following surgery,
(iii) trauma, or
(iv) sepsis;
(v) status asthmaticus;
(vi) aspiration; and
(vii) pulmonary embolism.

## transport

- in some cases, patients at referring facilities are too unstable to be transported on conventional ventilation. The University of Michigan recently reported 100 patients transported on extracorporeal life support. Overall survival to discharge \was 66%, and the complication rate during transport was 17%, with no deaths in transit