



Extracorporeal Life Support Organization (ELSO)

Guidelines for Adult Cardiac Failure

Introduction

This adult cardiac failure guideline is a supplement to ELSO's "General Guidelines for all ECLS Cases" which describes prolonged extracorporeal life support (ECLS, ECMO). This supplement addresses specific discussion for adult cardiac failure patients.

This guideline describes prolonged extracorporeal life support (ECLS, ECMO). This guideline describes useful and safe practice, but these are not necessarily consensus recommendations. These guidelines are not intended as a standard of care, and are revised at regular intervals as new information, devices, medications, and techniques become available.

The background, rationale, and references for these guidelines are found in "ECMO: Extracorporeal Cardiopulmonary Support in Intensive Care (The Red Book)" published by ELSO. These guidelines address technology and patient management during ECLS. Equally important issues such as personnel, training, credentialing, resources, follow up, reporting, and quality assurance are addressed in other ELSO documents or are center-specific.

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Adult Cardiac Cases

I. Patient condition

A. Indication for ECMO in adult cardiac failure is cardiogenic shock:

1. Inadequate tissue perfusion manifested as hypotension and low cardiac output despite adequate intravascular volume.
2. Shock persists despite volume administration, inotropes and vasoconstrictors, and intraaortic balloon counterpulsation if appropriate.
3. Typical causes: Acute myocardial infarction, Myocarditis, Peripartum Cardiomyopathy, Decompensated chronic heart failure, Post cardiectomy shock.
4. Septic Shock is an indication in some centers.

Guidelines on relative survival without ECMO:

IABP score postcardiotomy(Hausmann H Circ 2002)

Samuels score postcardiotomy (Samuels LE J Cardiac Surg 1999)

Options for temporary circulatory support

Surgical temporary VAD: Abiomed, Levitronix

Percutaneous VAD:TandemHeart, Impella

ECMO: Advantages: Biventricular support, bedside immediate application, oxygenation, Biventricular failure, Refractory malignant arrhythmias, Heart failure with severe pulmonary failure

ECMO is a bridge to...

Recovery: Acute MI after revascularization, Myocarditis, Postcardiotomy

Transplant: Unrevascularizable acute MI, Chronic heart failure

Implantable circulatory support: VAD, TAH

B. Contraindications to ECMO

1. Absolute: Unrecoverable heart and not a candidate for transplant or VAD, Advanced age, Chronic organ dysfunction (emphysema, cirrhosis, renal failure), Compliance (financial, cognitive, psychiatric, or social limitations), Prolonged CPR without adequate tissue perfusion.
2. Relative: Contraindication for anticoagulation, Advanced age, Obesity.

II. Vascular Access

A. Postcardiotomy

Intrathoracic cannulae: ensure site hemostasis, Patch chest open for frequent exploration.

B. Non-postcardiotomy

Percutaneous femoral artery and vein, Typically most rapid access, 15-21 Fr arterial, 21-28 Fr venous (advance to right atrium if possible).

Percutaneous jugular vein, 21-28 Fr to right atrium, Common carotid via surgical exploration, 10-15% watershed cerebral infarction with carotid ligation, 8-10 mm end to side polyester graft
Femoral arterial cannulation associated with ipsilateral leg ischemia, Percutaneous distal cannulation of superficial femoral artery (may require ultrasound or fluoroscopic guidance),
Surgical exploration of superficial femoral artery, Surgical exploration of posterior tibial artery
8Fr retrograde cannula.

III. Management

Maintain left ventricular ejection.

Avoid left ventricular distension.

Promote recovery.

Avoid pulmonary edema/hemorrhage.

Avoid intracardiac/aortic root thrombosis.

Continue inotropes.

Minimize vasoconstrictors.

Avoid unnecessary flow.

Liberal use of intraaortic balloon pump.

Frequent assessment by echocardiography.

Ventricular distension.

Refractory left ventricular distension.

Mean PA pressures >30.

Nonpulsatile arterial line tracing.

Aortic valve does not open.

Decompress left ventricle.

Open chest postcardiotomy.

Insert LV vent.

Closed chest cannulation.

Transeptal left atrial decompression.

Cerebral hypoxia.

Femoral arterial ECMO infusion with severe respiratory failure.

Hypoxia to coronaries.

brain and right upper extremity.

PaO₂ measured in femoral artery or left radial artery may be elevated.

Measure saturations in right hand.

Arterial line preferably in right radial artery.

Adjust ventilator to maintain adequate oxygenation.

May require maximum ECMO flow.

Cerebral perfusion may be improved with hybrid VVA.

IV. Weaning

A. Bridge to recovery (postcardiotomy, acute MI, myocarditis)

1. Expect early signs of recovery within one week of support.
2. With evidence of improved aortic pulsatility and contraction on echocardiography, optimize inotropes and reduce flow to 50%, then 25% of adequate cardiac output.
3. Use echo to visualize ventricular function and major valvular pathology.
4. Clamp circuit and allow recirculation for trial period of 30 minutes to 4 hours.
5. Flush cannulae with heparinized saline continuously or flush from the circuit every 10 minutes to avoid cannula thrombosis.
6. If hemodynamics and oxygen delivery are adequate on less than maximum inotropic infusions, consider decannulation.

B. Bridge to VAD

Transition to VAD when end organs resuscitated, Neurologically intact, Restoration of renal hepatic function, Pulmonary edema resolved, Ideally within one week.

V. Expected results:

40% survival to discharge (may be less with postcardiotomy)