

V-A ECMO PATIENT ACCEPTANCE AND TRANSPORT HOTLINES

24/7 VAD Transport Coordinator: 801-507-LVAD (5823)
CT Surgeon, Dr. Bruce Reid: 801-719-8253
Interventional Cardiologist, Dr. Jim Revenaugh:
801-440-7496

REFERRAL CHECKLIST

Provide the following information to the Intermountain Medical Center receiving physician:

- **Patient history:**
 - Patient's name, age, date of birth, height, weight
 - Cardiac conditions and prior cardiac interventions
 - Comorbidities
 - Active infection
 - Vascular access
 - Limiting advance directives
- **Cardiac arrest?** If yes, duration and etiology of arrest, whether chest compressions were required
- **Bleeding issues**
- **Vital signs:** BP, HR, RR, temp, SpO₂
- **Neuro:** Status and when last assessed
- **Echo:**
 - Date and time, inotropes or pressors at time of echo
 - LVEF, RVEF, other findings
- **Chest x-ray**
- **Swan/PA cath parameters:** RA, PA, PCWP, CI, SvO₂
- **Inotropes/pressors:** Agent and dose
- **Ventilator parameters:** Mode, PEEP, VR, TV, FiO₂
- **Arterial blood gas:**
 - Time of ABG, FiO₂ and PEEP at time of ABG
 - pH, HCO₃, PCO₂, PO₂
- **Lab data:** Lactate, AVO₂ difference, CBC, PTT, PT/INR, CMP, fibrinogen

V-A ECMO IMPLEMENTATION

1 ASSESS CARDIAC DYSFUNCTION

See the other side for diagnostic tests, primary indications, clinical presentations, exclusions, and red flags that indicate V-A ECMO must be initiated immediately.

2 CALL FOR PATIENT ACCEPTANCE AND TRANSPORT

- *See the panel at left* for a hotline number to contact the Intermountain Medical Center CV receiving MD, with the needed referral checklist information.
- The Intermountain Medical Center receiving physician will contact the MCS on-call nurse to make Life Flight transport arrangements.

3 CHOOSE APPROPRIATE CANNULA

- **Open chest cannula:**
 - Aortic cannula: DLP 22 Fr. CB77722 or DLP 24 Fr. CB77724 (depending on size of patient)
 - Right Atria Edwards Thinflex 40 Fr. D11TF040L90
- **Femoral cannula:**
 - Femoral artery: Bio-Medicus 17 Fr. #96570-017, FemFlex II 20 Fr. D11FEM11020A or DLP 22 Fr. CB77722
 - Femoral vein: Edwards 24 Fr. DVFEM024

4 PERFORM CANNULATION

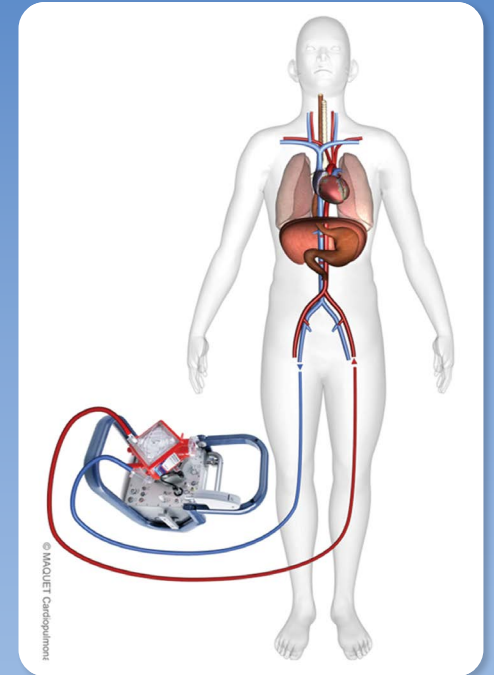
- **Open sternotomy:**
 - V-A ECMO: uptake in RA appendage to RA/IVC junction, return to ascending aorta
 - RVAD configuration: uptake in RA appendage to RA/IVC junction, return to main pulmonary artery
 - LVAD configuration: uptake in right superior pulmonary vein to left atrium, return to ascending aorta
- **Femoral venous-femoral arterial (groin access):**
 - RA uptake via femoral vein, tip in RA or RA/SVC junction
 - Return cannula to contralateral femoral artery (+/- dacron side graft by cutdown)

5 STABILIZE PATIENT

- Ensure correct positioning and stabilization of cannulae
- Ensure stable and adequate ECMO flows
- Achieve hemostasis, then start IV heparin drip to aPTT of 55–70
- Ensure optimized gas exchange and acid base status
- Apply open chest sterile dressing
- Give meds for sedation and immobilization

6 COMMUNICATE WITH THE FAMILY

- **Lead family discussion regarding:**
 - Patient's prior directives for ongoing ICU and surgical support
 - Referral of patient to Intermountain Medical Center for tertiary level multidisciplinary Advanced Heart Failure Team evaluation and management
 - Assessment for best therapy after arrival at Intermountain Medical Center, with the opportunity for the family to participate in treatment planning
 - The risks and benefits of transport
 - Guarded survival prognosis for post-cardiotomy shock



Intermountain
Healthcare

Appropriate Use of VENO-ARTERIAL (V-A) ECMO

VENO-ARTERIAL
EXTRACORPOREAL
MEMBRANE OXYGENATION

Primary Indications

- **Significant cardiac decompensation that does not respond to medical therapy, due to:**
 - Post-cardiotomy heart failure
 - Acute myocardial infarction
 - Adverse non-hemorrhagic outcomes during percutaneous intervention
 - Acute myocarditis
 - Postpartum cardiomyopathy
 - Hantavirus-related cardiac injury
 - Immediate post-cardiac transplant graft failure
 - Acute cardiac transplant rejection
 - Cardiac medication toxicity
 - Hypothermia
 - Pulmonary embolism
 - Refractory arrhythmia
 - Cardiac arrest non-responsive to ACLS (<60 minutes)
Note: Consider initiating V-A ECMO request early in resuscitation efforts (<20 minutes)
- **Elective cardiac support for high-risk cath lab interventions**

EXCLUSIONS

- **Survival unlikely:** >60 minutes of CPR; lactic acid >20 mmol/L; end-tidal CO₂ <5 mm Hg for >15 minutes; irrecoverable multi-organ failure
- **Severe vasodilatory shock**
- **Severe septic shock:** viral, bacterial, or fungal
- **Hemorrhage:**
 - Uncontrollable coagulopathy / hemorrhage
 - Recent hemorrhagic CNS injury
 - CPR or trauma-induced active chest or intra-abdominal hemorrhage
- **Aortic dissection or severe peripheral vascular disease**
- **Primary lung failure** (ARDS or decompensated COPD) or primary pulmonary hypertension
- **Not a candidate for transplant or implantable VAD:**
 - Irrecoverable heart/lung/liver/CNS disease or other known non-cardiac terminal illness (advanced malignancy, end-stage renal disease, etc.)
 - Known exclusionary advance directives
 - Advanced age
 - Known illicit substance addiction (active addiction)
 - Known medical non-compliance

Clinical Presentations

- **CV surgical post-cardiotomy heart failure:**
 - Unable to wean from OR cardiopulmonary bypass (CPB) due to cardiac failure — 3 failures to wean from CPB, despite adequate resuscitation and pharmacologic support
 - Recoverable patient
 - Systolic pressure <90 mm Hg with the following pharmacologic support thresholds:
 - Patient on **multiple vasoconstrictors:**
 - Norepinephrine max: 0.1 mcg/min IV gtt
 - Vasopressin max: 3 units/hr IV gtt
 - Phenylephrine max: 100 mcg/min IV gtt
 - Patient on **multiple inotropes:**
 - Milrinone max: 0.4 mcg/kg/min IV gtt
 - Epinephrine max: 0.1 mcg/kg/min IV gtt
 - Norepinephrine max: 0.1 mcg/kg/min IV gtt
 - If using dopamine, max: 10 mcg/kg/min IV gtt
 - If using dobutamine, max: 10 mcg/kg/min IV gtt
- **Acute, primary cardiogenic shock:**
 - Systolic heart failure (usually unanticipated) due to inadequate contractility or arrhythmia, that results in immediate catastrophic hypotension (due to low cardiac output and hypoperfusion), which leads to:
 - Cardiogenic pulmonary edema
 - Renal, hepatic, GI, and CNS dysfunction

Note: Implement V-A ECMO early in shock state to avoid irrecoverable end-organ injury from hypoperfusion and effects of high-dose pressors. Use peripheral cannulation in acute cath lab situations.
- **Sub-acute progressive deterioration of cardiac function in spite of maximal medical therapies:**
 - Cardiac dysfunction requiring progressively increasing inotropic or vasoconstrictor support, or requiring mechanical ventilation for cardiogenic pulmonary edema
 - Unstable arrhythmia requiring frequent unscheduled cardioversions
 - End-stage cardiomyopathy (if LVAD or transplantation can be considered)
 - Patients supported with percutaneous devices who are not demonstrating progressive recovery

Urgency Red Flags

Physiological thresholds that predict impending medical management failure:

- Oliguria with diuretic resistance
- Hepatocellular enzyme elevation
- Abdominal pain
- Cool and mottled extremities
- Lactic acidemia
- Tachycardia
- Progressive ventricular and/or atrial arrhythmias
- Tachypnea, hypoxemia, increased respiratory effort
- Systemic hypotension despite escalation of drips (see pharmacologic support thresholds at left)
- Pulmonary arterial O₂ (mixed venous) saturation < 50% with Hct <26% and temp <38.3°C
- Arterial to mixed venous O₂ content difference >7
- Abdominal pain
- Cardiac Index (CI):
 - <2.0 L/min/m²
 - 2.0 – 2.2 L/min/m² with inotropic support:
 - Milrinone max: 0.4 mcg/kg/min IV gtt
 - Epinephrine max: 0.1 mcg/kg/min IV gtt
 - Norepinephrine max: 0.1 mcg/kg/min IV gtt
 - Dopamine max: 10 mcg/kg/min IV gtt
 - Dobutamine max: 10 mcg/kg/min IV gtt
- Acutely elevated LVEDP or PCWP >25 mm HG
- Acutely elevated RAP/CVP >15 mm HG

DIAGNOSTIC ASSESSMENT

Objective assessment of cardiac dysfunction before deciding to implement V-A ECMO may include:

- 12-lead ECG
- Cardiac markers
- CBC, renal and hepatic panels, BNP, coagulation testing
- Arterial blood gas with lactic acid
- Chest x-ray
- Inadequate hourly urine output (<30 mL/hour)
- Arterial line for continuous BP monitoring
- PA catheter:
 - RAP, PCWP, PAP, SvO₂, (A-V)O₂ diff
- Echocardiogram:
 - LV, RV function: segmental, global, dilation, hypertrophy, outflow obstruction
 - Atrial abnormalities
 - Valvular disease
 - Pericardial disease
 - Septal defects
 - Aortic pathology

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