

ECMO ESSENTIALS

**Veno-Venous and Veno-Arterial
Management**

ECMO MANAGEMENT

- Multi-disciplinary management needs to be viewed as total patient management with the ECMO circuit as an extension of the patient.
- Management of the ECMO patient involves patient systemic physiology, ECMO physiology, and circuit maintenance and management.
 - Every organ system is equally important in caring for an ECMO patient.
 - Attention to details is essential when patient care decisions are being discussed by the treatment team
- Management differs between VV and VA ECMO
 - V-V management focus is providing a bridge to lung recovery or transplant if needed.
 - V-A management focus can solely be cardiac in nature or both pulmonary and cardiac.
- Management also has some similarities
 - Anticoagulation
 - Hematology
 - Fluid balance
 - Circuit maintenance

CIRCUIT MONITORING

- Physical integrity and function of the ECMO circuit must be performed continuously to avoid catastrophic events.
 - Inspection of cannula placement and securement devices
 - Visually inspect the entire circuit to include the pump head and oxygenator.
 - Fibrin
 - Clots
 - Air
 - Pressure monitoring, if available, needs to be monitored with special attention to trends.
 - Venous pressure (drainage)
 - Pre-oxygenator pressure
 - Post-oxygenator pressure (return)
 - Delta pressure/trans-membrane pressure
 - Evaluation of hemodynamic, pulmonary, and renal management and relationship with monitoring circuit with or without pressure monitoring is essential

CIRCUIT MONITORING

- Chattering or chugging
 - Hypovolemia
 - Suction event
 - Increased negative venous pressures
- Oxygenator blood gases
 - Pre/post oxygenator blood gases
 - Efficiency of oxygenator
 - Oxygen consumption
- Laboratory results and management
 - Anticoagulation
 - Hematology
- Circuit awareness during procedures
 - Securing cannulas and circuit during turns, baths, and portable imaging studies
 - Transport

PATIENT MONITORING

- Patient requires critical care attention and continuous assessment of all organ systems
 - Neurological, cardiac, pulmonary, renal, gastro-intestinal, skin
- Anticoagulation
 - Clotting cascade initiated due to blood touching the surface of circuit tubing and oxygenator.
 - Balance with anticoagulation
 - Bleeding
 - Clotting
 - Hematologic effects of anticoagulation
 - Heparin induced Thrombocytopenia
- Neurological
 - Neurologic response
 - Sedation vacation
 - Assess for intracranial hemorrhage due to anticoagulation
- Cardiac
 - Rhythm and pulsatility
 - Medication
 - Blood pressure/pulse pressure

PATIENT MONITORING

- Pulmonary
 - Ventilator settings V-V versus V-A
 - Ventilator pressure monitoring
 - Radiologic studies
 - Pulmonary toileting
- Renal
 - Fluid balance and management
 - Urine output
 - Dialysis
 - Diuretics
- Laboratory results
 - Treating the patient and not just the numbers
 - Adequately supporting the patient
 - Lactate
 - SvO₂

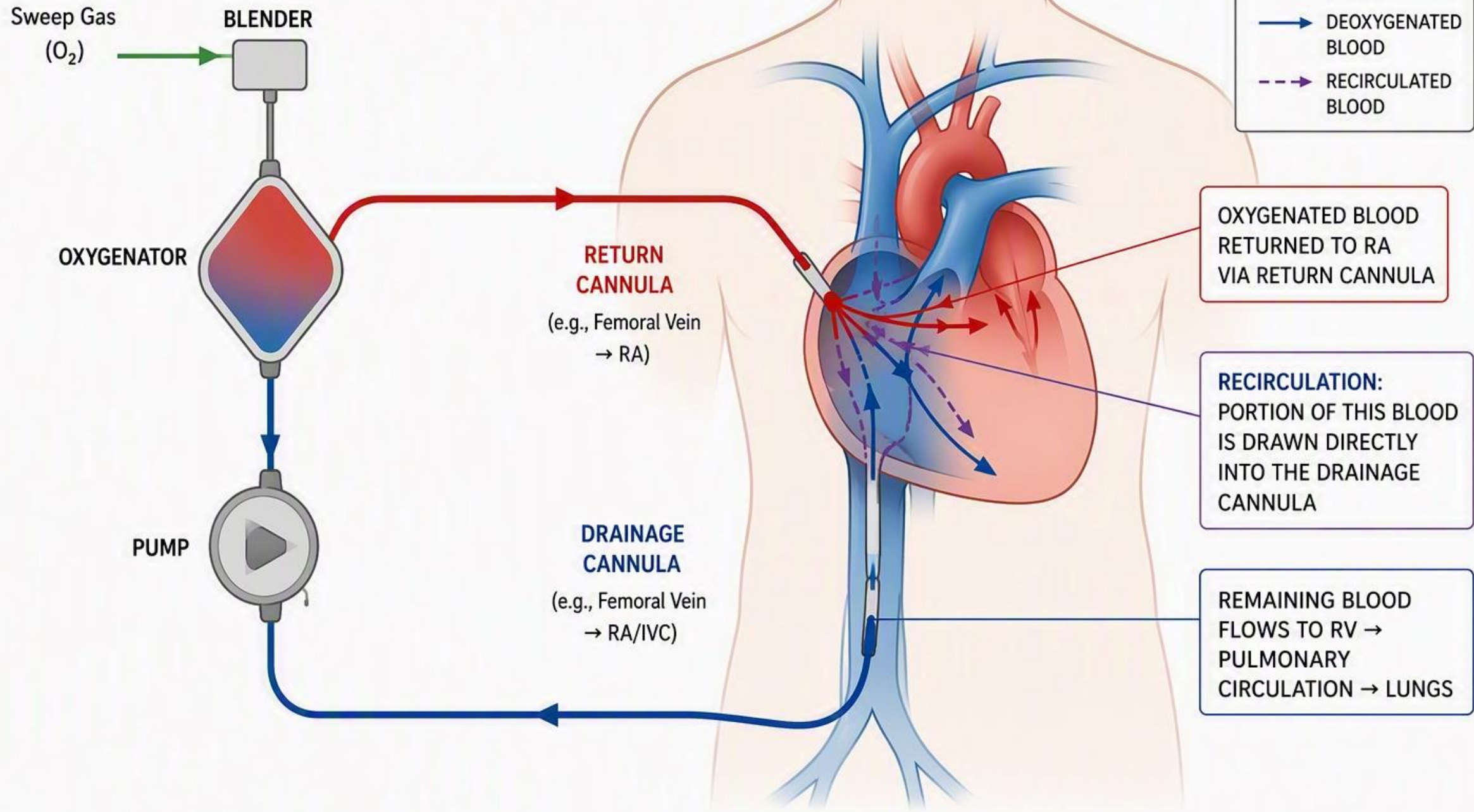
PATIENT MONITORING

- Gastro-intestinal
 - Nutrition
 - Metabolic demand
 - GI bleeds
 - Bowel movement
- Skin
 - Pressure injuries and ulcers
 - Source of infection
 - Scheduled turns
 - Specialty beds
 - Mobility

V-V MANAGEMENT

- Recirculation
 - ECMO blood flow being delivered returns to ECMO circuit and not completely mixed with native circulation
 - All Veno-Venous ECMO has some degree of recirculation
 - Causes of recirculation
 - Cannula placement
 - Too high RPM/ECMO blood flow
 - Decreased cardiac output
 - Hypovolemia
 - Diagnosing recirculation
 - Increased SvO₂ and decreased SpO₂
 - Pre-oxygenator blood gas closely resembles Post-oxygenator gas
 - Relatively close PvO₂ and PaO₂
 - Minimal color change in drainage versus return lines
 - Corrective actions
 - Decrease flow, radiologic or ultrasound studies, volume, pressors or inotropes

RECIRCULATION



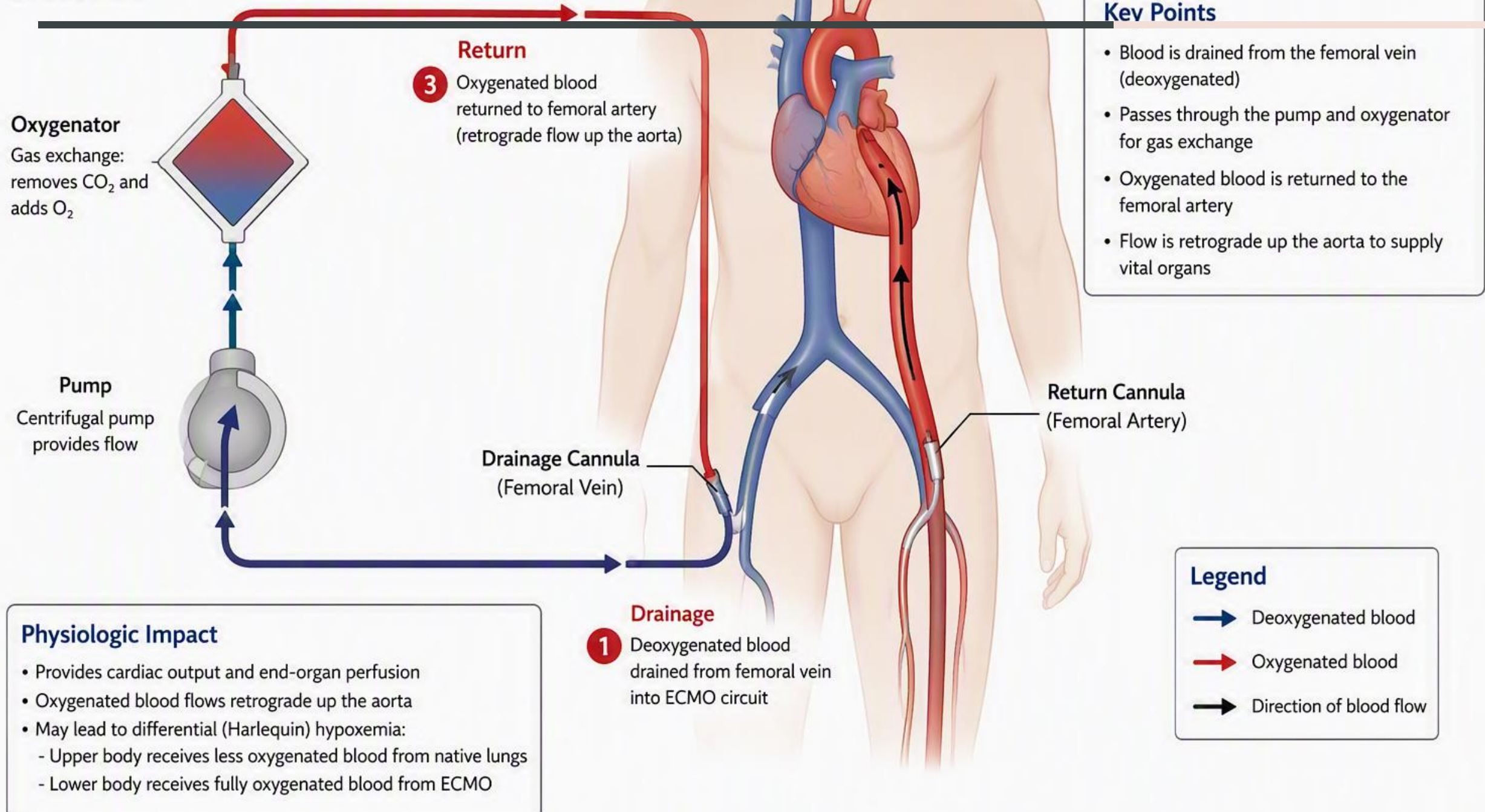
V-V MANAGEMENT

- Oxygenation
 - Systemic arterial oxygenation
 - Determined by blood flow and cardiac output
 - Consumption and delivery
 - Optimizing oxygen delivery
 - Hemoglobin
 - ECMO flow
 - Blender settings
- Ventilation strategies
 - Rest settings
 - Pressure
 - Volume
- Pulmonary toilet
 - Therapies
 - CPT
 - Mobilization

V-A MANAGEMENT

- Left ventricular distension
 - Retro-grade (backward) flow from the return cannula into the aorta increases the workload (afterload) on a failing left ventricle.
 - Monitor pulsatility
 - Increased ejection emptying left ventricle
 - Venting strategies
 - Impella
 - Ballon pump
 - Surgical vent
- Dual circulation
 - Differential hypoxemia or North-South syndrome
 - Peripheral femoral cannulation
 - Native versus mechanical circulation
 - Management
 - Increase ECMO blood flow
 - Conversion to VV
 - Conversion to Veno-Arterial Venous (V-AV) cannulation strategies

Circuit Flow



V-A MANAGEMENT

- Distal perfusion
- Perfusion to lower extremities during V-A peripheral cannulation
- Decreased blood flow due to return cannula obstructing antegrade flow
- Palpable or Doppler pulses
- Color of extremity
- Temperature of extremity
- Limb ischemia
- Loss of limb
- Treatment
- Distal perfusion catheter provides antegrade flow to lower extremity

ECMO MANAGEMENT

- In summary
 - Total patient care is necessary and essential for proper management
 - Multi-disciplinary teams provide the best care for the patient
 - Critical care provider
 - Specialty provider
 - Cannulator
 - CV surgery, ED provider, Critical care
 - Nursing
 - Respiratory therapy
 - Physical therapy
 - Care manager
- Clear and unified discussions must be provided to family