

## Perfusionists' Pointers for ECMO

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Director, Clinical Perfusion

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### Pointers

- ▶ Manpower
- ▶ Preparing for ECMO
- ▶ Checklists
- ▶ Communication
- ▶ Air embolism, CVVH
- ▶ Power Loss, trouble shooting
- ▶ VV to VA conversions
- ▶ Weaning from pump

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### Manpower for ECMO

- ▶ Requires 24/7 coverage
- ▶ Perfusionist expected by bedside
- ▶ Small center: cripples cardiac program
- ▶ Modify bedside management
- ▶ Use portable equipment
- ▶ Advocate for transfer
- ▶ Training of ECMO team

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## Model for Collaboration

- ▶ Set up the rounding for every 2 to 4 hours
- ▶ Make ICU nurses comfortable with perfusion equipment before using this model
- ▶ Be readily available by beeper
- ▶ Respond immediately to calls

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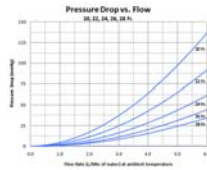
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## Preparing for ECMO

- ▶ Have supplies readily available for set up
  - Cannulae appropriately sized (duplicates)
- ▶ Checklist for emergencies
- ▶ Checklists and supply bag for transport
- ▶ Have perfusionists trained and ready
  - Competency reviews
- ▶ Train nursing ICU team
  - 80% (200)



## Initiation Checklist

INITIATION OF CPR	PUMP	OXYGENATOR
HEPARIN IN / ACT ADEQUATE	SPEED CONTROL / HAND CRANK	NO DEFECTS NOTED
PUMPS IN FORWARD MODE	OCCUSION / ZEROED	VENTED TO AIR
ALARMS SET & FUNCTIONING	ELECTRICAL CONNECTIONS	GAS ON
PUMP TUBING, NO KINKS, DIRECTION	ALARMS SET / FUNCTIONING	DEBUBBLED
SYSTEM DEBUBBLED	TUBING	MISC. EMERGENCY SUPPLIES
GAS ON / OXYGENATOR VENTED	NO KINKS, DIRECTION	OXYGEN TANK CHARTING COMPLETE
DRUGS AVAILABLE / IN	DEBUBBLED	QC% PERFORMED
HEATER COOLER ONSET	CONNECTIONS BANDED	
CARDIOTOMY DUBL CLAMPED	HEAT EXCHANGER	

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## PUMP (centrifugal)

- ▶ Speed control
  - Rotaflow – hand crank
  - Centrimag – battery backup
- ▶ Occlusion
  - Zeroed
- ▶ Electrical connections
- ▶ Alarms set
- ▶ Tubing
  - No kinks
  - Coatings
    - Connections banded




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## Shift Checklist

- ▶ Complete all chart parameters at each shift change [Situation](#)[Background](#)[Assessment](#)[Recommendation](#)
- ▶ Date/time
- ▶ Visual inspection of circuit
  - Flashlight inspection for clot formation
  - Need to inform next perfusionist
  - Discuss with surgeon options for change outs

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# Shift Checklist

SHIFT CHECKLIST	Complete all chart parameters at each shift change	Date/Time
HEPARIN IN / ACT ADEQUATE	SPEED CONTROL / HAND CRANK	NO DEFECTS NOTED
PUMPS IN FORWARD MODE	OCCCLUSION / ZEROED	VENTED TO AIR
ALARMS SET & FUNCTIONING	ELECTRICAL CONNECTIONS	GAS ON
PUMP TUBING, NO KINKS, DIRECTION	ALARMS SET / FUNCTIONING	DEBUBBLED
SYSTEM DEBUBBLED	TUBING	MISC.
GAS ON / OXYGENATOR VENTED	NO KINKS, DIRECTION	EMERGENCY SUPPLIES
DRUGS AVAILABLE / IN	DEBUBBLED	OXYGEN TANK
HEATER COOLER ON/SET	CONNECTIONS BANDED	CHARTING COMPLETE
CARDIOTOMY DUBL CLAMPED	HEAT EXCHANGER	QC% PERFORMED

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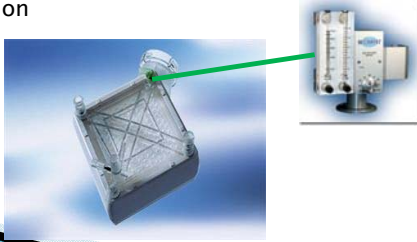
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# Oxygentor

- ▶ Vented to air
- ▶ Gas line connected to blender
  - Transport, Xray, Bronchs
- ▶ Desaturation




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# Extra Supplies Available

- ▶ Emergency supplies: stocked cart for bedside
  - Extra of everything
- ▶ Oxygen tank w/ regulator
- ▶ Point of Care Testing
  - ISTAT

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## Keep the circuit simple

- ▶ Closed circuit bypass has negative pressure from the centrifugal pump.
- ▶ Prevention of air embolism in a closed circuit bypass is of the utmost importance.
- ▶ Consider keeping a cardiotomy near by if accidental air entrainment.

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## Conversion to Closed Circuit



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## Pump Inlet Pressure

- ▶ Pump flows that exceed venous return
  - Increase negative pressure
- ▶ Chattering: intermittent
  - acceleration/deceleration of blood.
- ▶ Monitor venous inlet press
  - $< -100\text{mmHg}$

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## Possibilities for air entrainment

- ▶ Stopcocks on the negative pressure side of circuit or patient
- ▶ Central lines
- ▶ CVVH
- ▶ Cracked components
- ▶ Sampling ports
- ▶ Infusion lines into pump tubing

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## Hemofiltration: **NO ACCESS**

- ▶ Goals
  - Remove volume
- ▶ Circuit access
  - CVVH
  - Inlet pressure negative (pre pump)
  - Outlet pressure positive (post pump)
- ▶ Stand alone systems
  - Best to use positive to patient
  - System is capable of pumping against pressure

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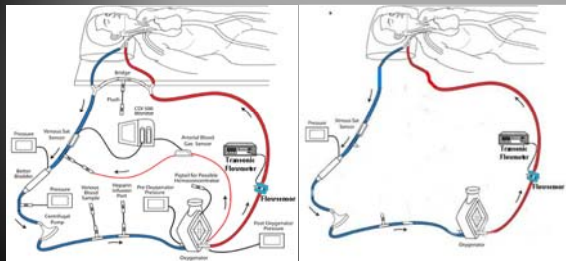
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## Circuit Levels of Complexity



Complex

Simple

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## CVWH



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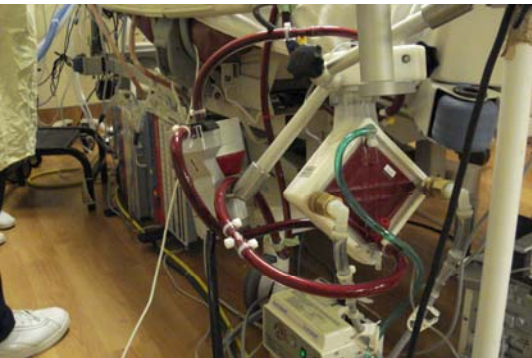
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## Pressure Drop

- ▶ All oxygenators exhibit resistance to flow
- ▶ The difference between the inlet and outlet pressure is pressure drop
- ▶ Pressure in > pressure out



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## Factors affecting pressure drop

- ▶ Tubing length
- ▶ Cannula size
- ▶ Flow rate
- ▶ Blood viscosity, hematocrit
- ▶ Temperature
- ▶ Patient resistance
- ▶ Do not be alarmed by the absolute number but rather changes in pressure drop over time.
- ▶ CALL THE PERFUSIONIST!!!

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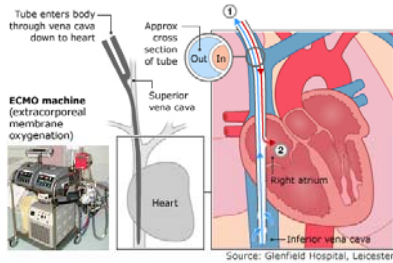
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## V-V to V-A conversions



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## Power Failure

- ▶ Pump back up
  - 60 minutes of operation
  - Common with centrifugal pumps
- ▶ Hand crank system
- ▶ Retrograde flow (VA)
  - Reverse flow arterial to venous with power failure
  - Alarm or one way valve

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## Trouble Shooting

Trouble	Possible Cause	Action
Blood leak	Displaced tubing	Clamp, reconnect tubing (air free) Resume Flow
Oxygenator blood leak	Broken fiber (slow leak)	Contact perfusionist for change out
Blood not oxygenated	Check gas lines from wall and blender	Reconnect, call perfusionist
Pressure drop change	Possible oxygenator failure	Contact perfusionist
Pressure/temp alarm/ pressure temp out of range	Check heater/cooler	Call perfusionist

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## Weaning from ECMO V-V

- In coordination with the intensivist
- V-V: **Maintain** device flows
  - Decrease sweep → increase minute ventilation
    - Check compliance & ABG
  - Decrease FiO<sub>2</sub> ECMO → increase FiO<sub>2</sub> on ventilator
    - Check compliance & ABG

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## Weaning from ECMO V-A

- In coordination with the intensivist
- V-A: **Decrease** device flows; **Maintain** FiO<sub>2</sub>
  - Decrease ECMO flow ↑ minute ventilation
    - Check compliance, ABG, hemodynamic assessment
      - Limit decrease in ECMO FiO<sub>2</sub> to avoid putting lower oxygenated blood into the arterial system
  - Decrease sweep ↑ minute ventilation
    - Check compliance & ABG

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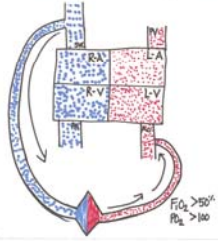
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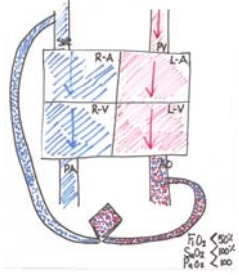
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# Veno-arterial

**VENOUS / ARTERIAL EcmO**  
- Bypass Heart and Lungs  
- To WEAN, MUST ↓ PA and Adjust VENT



**VENOUS / ARTERIAL EcmO**



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