



SNS COLLEGE OF ALLIED HEALTH SCIENCES
SNS Kalvi Nagar, Coimbatore - 35
Affiliated to Dr MGR Medical University, Chennai



DEPARTMENT OF CARDIOPULMONARY PERFUSION CARE
TECHNOLOGY

COURSE NAME: CPB & Perfusion Technology - II

TOPIC : ECMO Commencement & Weaning



ASSEMBLING STEPS



- Fix oxygenator and bio pump head
- Open custom pack
- Connect the inlet of cone and then the outlet of the cone
- Connect the inlet and outlet of oxygenator
- Connect the arterial filter inlet and outlet
- Connect three ways and pressure monitoring line (200cms) in appropriate places
- Connect gas inlet





PRIMING THE ECMO CIRCUIT



- The preassembled circuit is usually mounted in ECMO Machine
- The two access ports are connected with quick prime lines in a sterile manner
- The priming solution usually preferred is isotonic Kabilyte or Normal saline. (1 litre)
- By applying a clamp between two access ports of the circuit (BLUE LINE) the ECMO circuit divides into inlet and outlet for the quick prime
- Heparin 1unit/ml of prime is added in a clear prime before adding into the circuit





PRIMING THE ECMO CIRCUIT



- The inlet of the quick prime is kept open and the clamp is initially primed under gravity
- Manoeuvre the cone and push the fluid air towards the oxygenator
- Once the pump is free of air, place it in the drive unit
- Ensure the inlet and outlets of the quick prime lines are kept open
- Start the pump and increase the RPM to 1500
- The prime is circulated through a reservoir bag or the same prime solution bag until all bubbles are removed.





PRIMING THE ECMO CIRCUIT



- All the recirculation line and three-way stopcocks are deaired.
- The aquatherm is connected to the heat exchanger of the oxygenator and turned on to warm the fluid to 36 degree.
- Once the inlet and outlet of the circuit is free of air the clamp that divides the circuit is removed
- Ensure the circuit is completely free of air and bubbles before commencing the ECMO.





PRIMING THE ECMO CIRCUIT



- We can add human albumin to provide coating on the ECMO circuit before blood exposure if it's a non coated circuit.
- For infants, packed RBC are added to bring the haematocrit to 30 – 35%
- For emergency cannulation, the prime can be crystalloid.





CIRCULATING



- Maintain a minimum of 1500 RPM before circulating
- Release the cone outlet clamp
- Deair the oxygenator, arterial filter and all recirculation lines, PM lines
- Check for leaks in the circuit and connections are secure
- Clamp the arterial and venous lines
- Maintain minimum rotations of the biopump
- Put on the gas flows to oxygenator if blood is used
- Ensure flow calibration is set to zero
- Check direction of the flow probe





ANTICOAGULATION FOR ECMO



➤ Before initiating ECMO check for,

- Bleeding state of patient
- Hb
- Platelet count
- APTT
- Fibrinogen
- ACT



➤ Unfractionated **Heparin 1 unit/ml** is added in prime.

➤ **5ml i.e., (5000 IU)** vials

➤ Systemic heparinization of **1mg/kg OR 50 – 100 units/ kg of body weight** at the time of cannulation is administered in the central line / peripheral line.



ANTICOAGULATION FOR ECMO



- For post cardiectomy cases, heparin infusion is not immediately started.
- Therapeutic anticoagulation Heparin is started at the rate of **20 – 50 units/kg/hour**.
- ECMO is maintained with the target **ACT of 180 – 220 seconds**
- For heparin resistance (antithrombin deficiency), FFP (**Fresh Frozen Plasma**)
- For HIT antibodies are positive, Direct thrombin inhibitors are preferred.
- **Bivalirudin** 1-1.5 mg/ kg or **Argatroban** 0.2 - 10µg/kg/min is started and maintained as infusion



ANTICOAGULATION FOR ECMO



- Beyond 24 hours, the APTT 4 times per day.
- A usual target for APTT in the non - bleeding patient with platelet count > 80,000 is 45-55 sec.

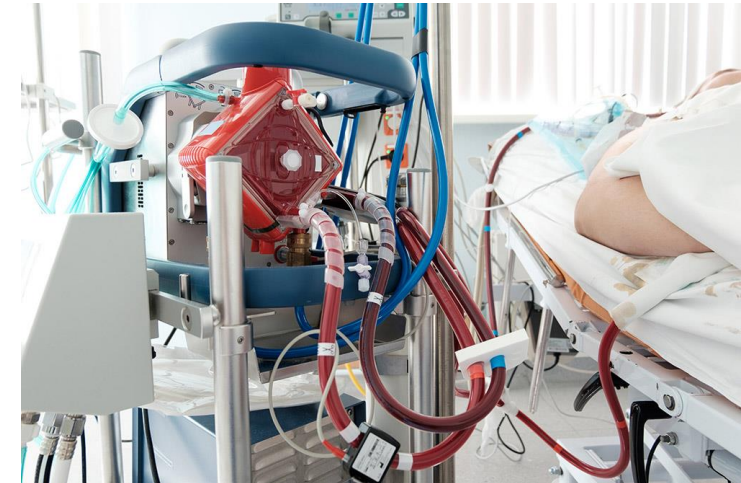




COMMENCEMENT OF ECMO



- Check **ACT** and ensure >200 seconds
- Ensure **O2** line is connected to oxygenator
- **Gas flow** should be commenced at a rate equal to or greater than the anticipated circuit blood flow (usually 2-4L/min) with 100 % O₂
- **Clean loop** is opened and handed to the cannulating physician
- The circuit is cut between two clamps allowing sufficient length on the access line and return line to prevent any tension on the circuit.
- Note the pump trolley is best kept at the “foot” end of the patient’s bed.
- Circuit is connected to cannulae ensuring no air is introduced
- Clamps removed as circuit flows are gradually





VENTILATORY SUPPORT



- Once adequate ECMO flows have been established
- Typical ventilatory goals would be:
 - ***FiO2*** < 0.7
 - ***PIP (Peak Inspiratory Pressure)*** < 35cmH2O
 - ***PEEP (Positive End Expiratory Pressure)*** < 15cmH2O
 - ***RR (respiratory rate)*** < 10bpm (V-A)





PUMP FLOW RATES

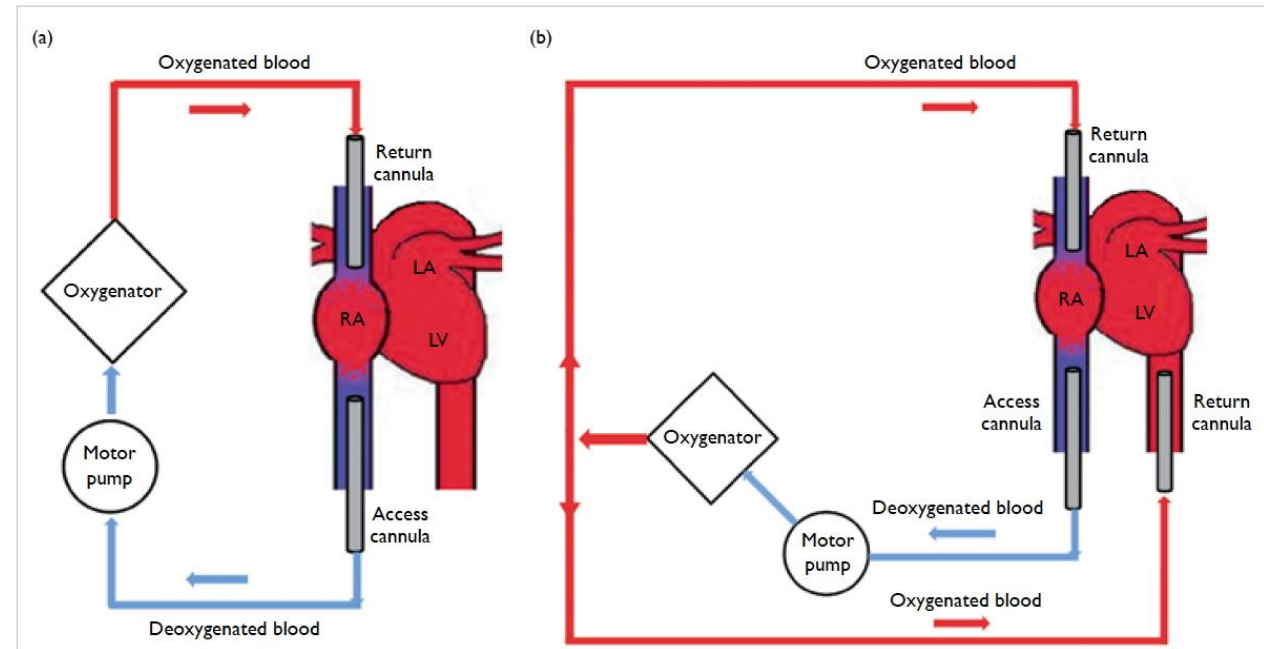


V-V

- 2/3 of pt's cardiac output, minimum 50% of patient's cardiac output
- O₂ flow rate twice ECMO flow rate
- Avoid increasing fluids to maintain pump flow as this may decrease respiratory function
- Lowest SaO₂ 85-90% or PaO₂ of 55-60

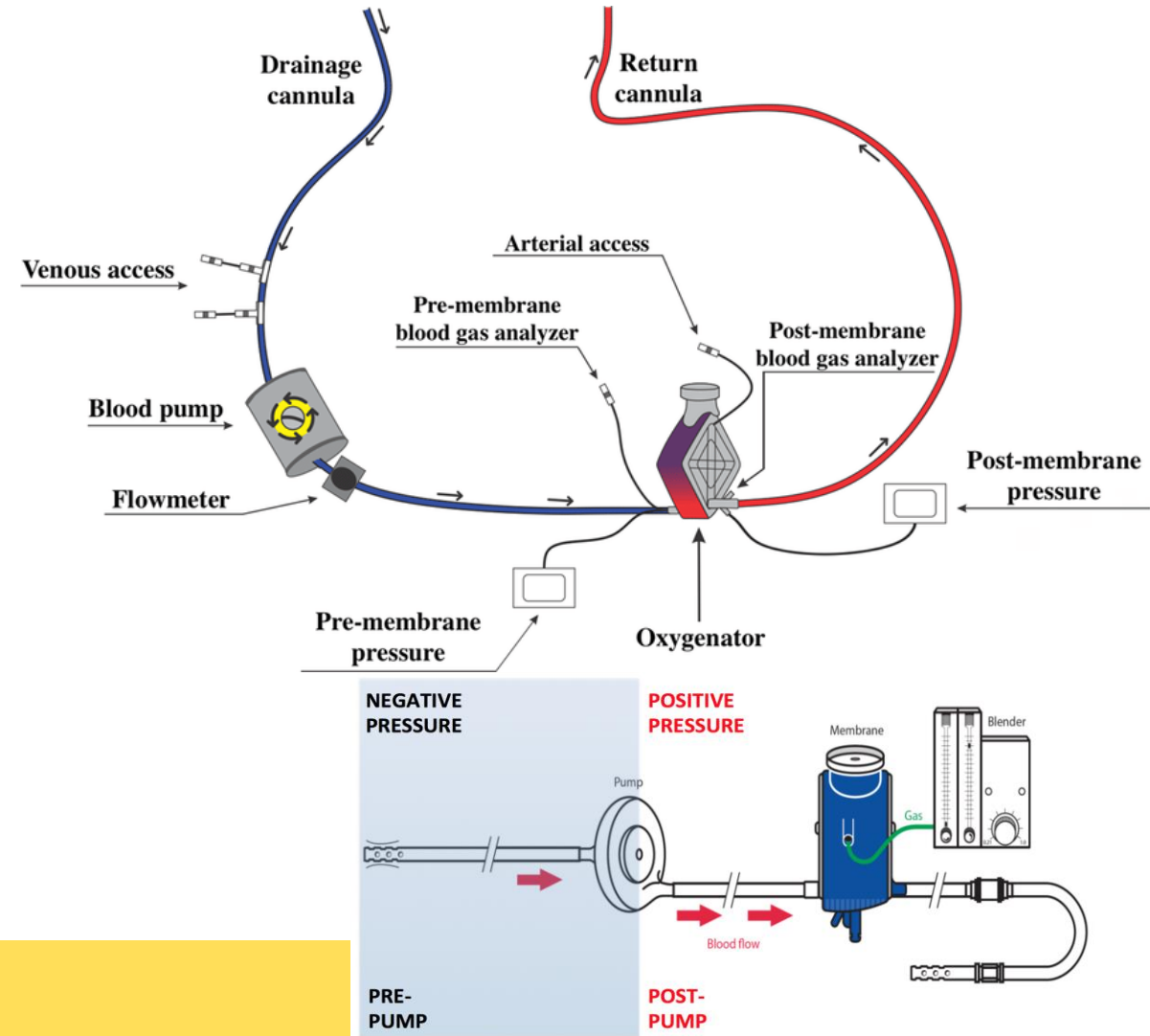
V-A

- Flow rate 2.1- 2.4l/min/m²
- ECMO flows less than 2litres for long periods should be avoided to prevent clots in circuit



OXYGENATOR & TEMP SETTINGS

- Pre-membrane pressure <math>< 300\text{mmHg}</math>
- Trans membrane gradient normal <math>< 50\text{mmHg}</math>, if > 150mmhg consider circuit change
- Normothermia, set heater cooler at 37degrees





INVESTIGATIONS OF PATIENTS ON ECMO



- Daily **CXR**
- **Daily bloods:** CBC, Electrolytes,
- **Clotting:** ACT first 24 hours then APTT 6 hourly
- **Plasma free Hb** is performed when clinically indicated. The safe range for this is $< 0.1\text{g/L}$.
- **Blood cultures** 3 times per week or as indicated.
- **Samples** should be taken from the circuit or through existing lines. Do NOT perform venipuncture.



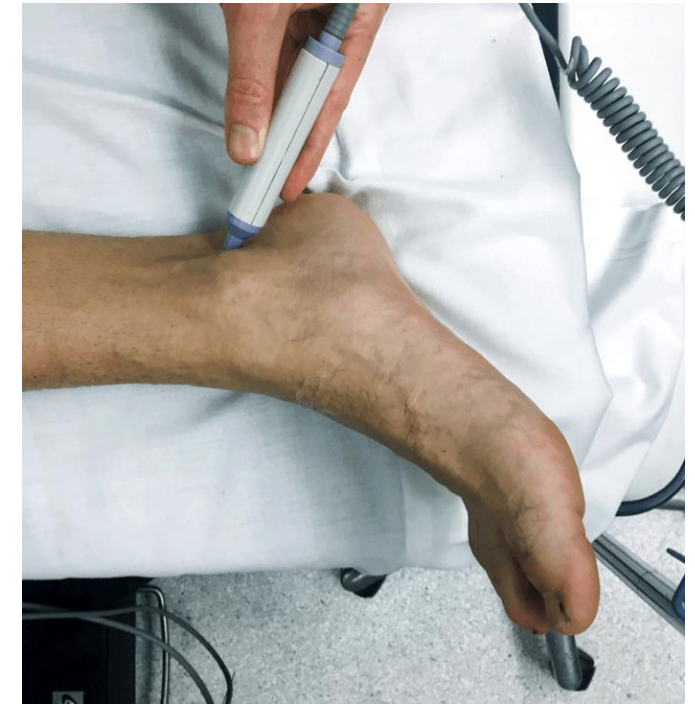
HOURLY OBSERVATIONS



Related to Patient

- Temperature
- CVP/MAP
- Haematuria
- Circulation
- Limb temperature
- Limb color
- Pedal pulses
- Capillary refill
- Neuro-obs
- Pain assessment

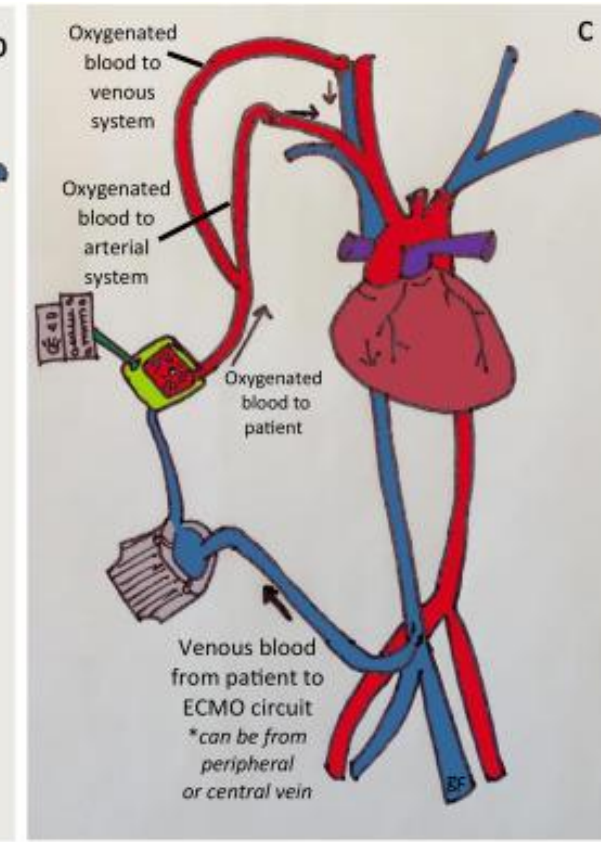
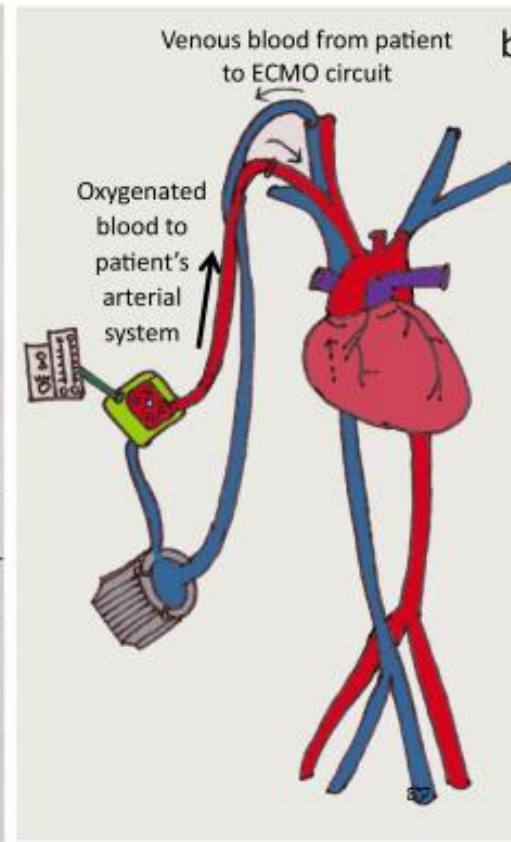
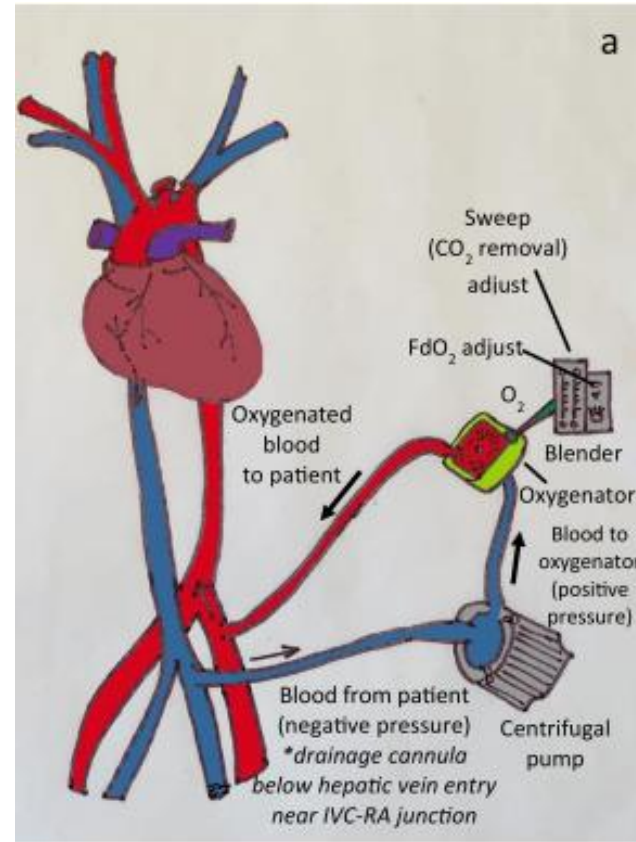
- CPOT (Critical Care Pain Observation Tool)



HOURLY OBSERVATIONS

Related to Circuit

- Oozing
- Kinking
- Leakage
- Jerks or shakes
- Anchors/Dressings
- Pre & post membrane
- pressure
- Oxygen flow to oxygenator
- Flow on oxygen outlet





HOURLY OBSERVATIONS



Paraphernalia

- Ventilator
- CVVHD (Continuous Veno – Venous Hemodialysis)
- PA Cath
- PiCCO (Pulse Index Contour Cardiac Output)
- IABP
- SVO₂
- Lactate



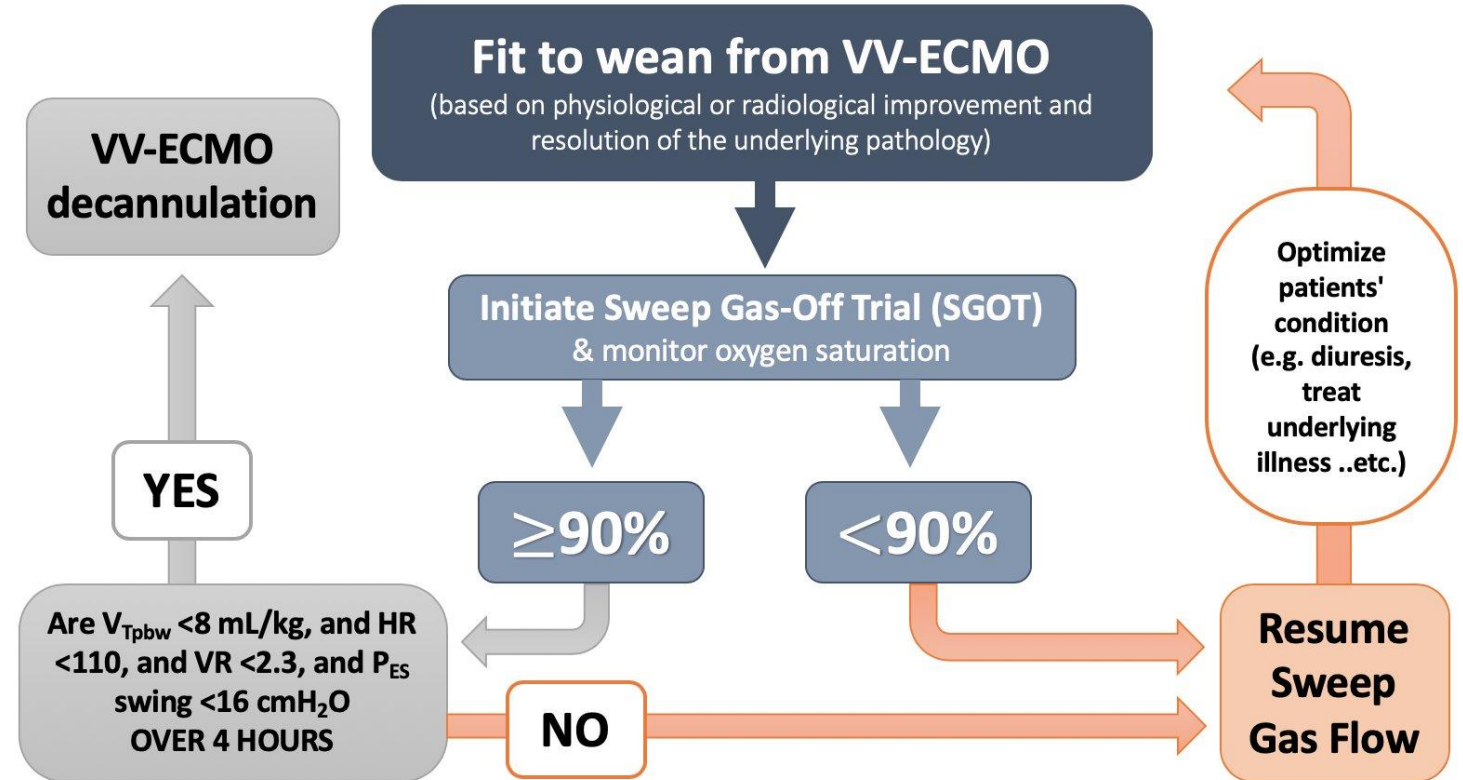


WEANING OF ECMO



V-V

- Maintain ECMO flow rate
- Re-establish pt's full ventilation
- Turn off O₂ to oxygenator
- 6hr stability then de-cannulation



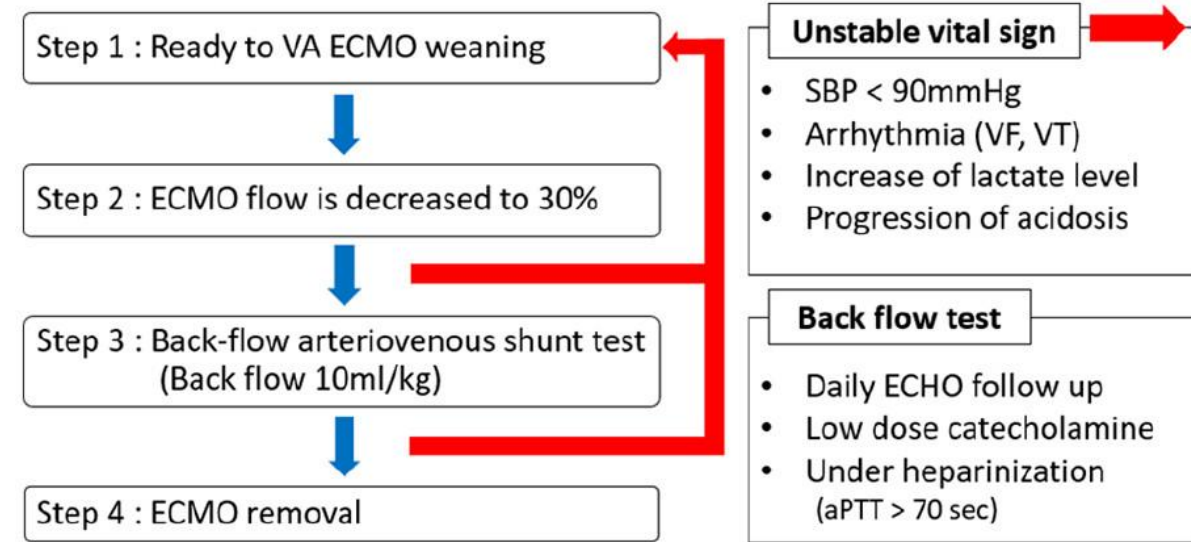


WEANING OF ECMO



V-A

- Heparin so ACT >400 to decrease risk clotting
- Decrease pump flow 1litre while ventricular function assess by TOE
- Period of low flow ECMO before decannulation
Respiratory function is a concern.
- – If adequate oxygenation and CO₂ removal can be maintained in the presence of this shunt it is likely that respiratory failure can be managed without ECMO.
- If O₂ good & CO₂ managed by ventilation consider decannulation





THANK YOU



References:

ECMO Manual – Narayana Institute of Medical Sciences

<https://ecmo.icu/daily-care-nursing-routine-crrt-and-plasmapheresis-connection/>

[http://icuecmo.ca/icuECMO_content/icuECMO ECMO circuit.html](http://icuecmo.ca/icuECMO_content/icuECMO_ECMO_circuit.html)