ECMO FUNDAMENTALS by Nick Mark MD & Jonah Rubin MD

PURPOSE & DEFINITIONS:
- ExtraCorpooreal Membrane Oxygenation (ECMO) provides prolonged pulmonary and/or circulatory support by removing venous blood, pumping it across an artificial lung (oxygenator or membrane lung) for gas exchange, & returning it to the pt.
- VV ECMO: artificially oxygenated venous blood is returned to the venous side (right atrium), providing no circulatory support, & adding the artificial lung in series with the native lung.
- VA ECMO: artificially oxygenated venous blood is returned to the arterial side (aorta), providing circulatory support, and adding & artificial lung in parallel with the native lung.

SETTINGS/MANAGEMENT:
- Cannula size/positioning
- Pump speed (RPM, flow)
- Sweep / Gas flow
- $F_{O_2}$
- Alarm settings
- Anticoagulation strategy
- Transfusion/Fluid goals
- Ventilator settings (to minimize VILI & prevent atelectasis)

DIFFERENT DRAINAGE & RETURN configurations are possible. Choice depends on mode (VV vs VA), flow requirements, & patient anatomy. The configuration here is VV ECMO. (R femoral vein drainage and R J vein return)

ULTRASONIC BUBBLE DETECTOR is an important safety device that detects air bubbles in the circuit. Pressure transducer ports can also be used to sample blood.

The CENTRIFUGAL PUMP moves blood through the ECMO circuit. PUMP RPM determines the BLOOD FLOW RATE. Along with $F_{O_2}$, blood flow determines PaO2. In VA, the pump RPM also determines CO & MAP.

The OXYGENATOR performs gas exchange (oxygenation, CO2 removal) and regulates blood temperature with a HEAT EXCHANGER. This can be used for TIM or and it can mask a fever.

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$P_{VENOUS}$ is the negative suctioning pressure applied to extract blood via the drainage cannula.

$P_{PRE-MEMBRANE}$ (also called $P_{INTERNAL}$) is the positive pressure propelling blood through the oxygenator.

$F_{O_2}$ (fractional delivered $O_2$) & BLOOD FLOW RATE determines oxygenation. Initially usually set at 100% and decreased if PaO2 is above goal. SWEEP GAS FLOW determines CO2 removal.

OXYGENATION

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PH / PCO2 / PaO2 / HCO3

VENTILATION

To decrease PCO2 or increase pH, increase the SWEEP / GAS FLOW

OXYGENATION

To increase PaO2, increase RPM / PUMP FLOW RATE or $F_{O_2}$

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