MECHANICAL VENTILATION DURING VV ECMO

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DISCLOSURES

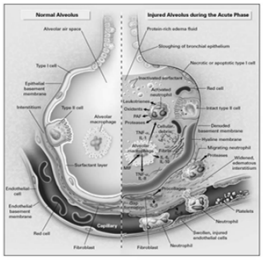
- None of a financial nature
- I'm a believer in ECMO
- But I try and keep a healthy dose of skepticism (realism?/pessimism?)

ARDS

- Results from diffuse alveolar damage
- Injury causes release of pro-inflammatory cytokines (TNF, IL-1, 6 and 8, etc)
- Cytokines recruit neutrophils to the lungs that release toxic mediators (proteases and reactive oxygen species)
- Damaged capillary epithelium leaks protein
- Fluid pours into the interstitium
- Air sacs fill with bloody proteinaceous edema fluid and debris
- Surfactant is lost

UpToDate.com accessed 5/2019

OBLIGATORY SLEEP INDUCING SLIDE



NEJM.org

GOAL OF ARDS CARE

Provide adequate oxygen delivery and ventilation WITHOUT further damaging already injured lungs.

INDICATIONS FOR VV ECMO

- ELSO guidelines:
  - In hypoxic respiratory failure due to any cause (primary or secondary) ECLS should be considered when the risk of mortality is 50% or greater, and is indicated when the risk of mortality is 80% or greater.
  - CO2 retention on mechanical ventilation despite high Pplat (>30 cm H20)
  - Severe Air leak syndromes
  - Need for intubation in a patient on lung transplant list
  - Immediate cardiac or respiratory collapse (PE, blocked airway, unresponsive to optimal care)

Extracorporeal Life Support Organization (ELSO) Guidelines for Adult Respiratory Failure August 2017. www.elso.org. Accessed 5/2019

CESAR TRIAL INDICATIONS FOR ENROLLMENT

- Murray Score ≥ 3 or
- Uncompensated hypercapnia (pH < 7.2)
- Age 18-65
- Potentially reversible respiratory failure

GJ Peek, et al. Efficacy and economic assessment of conventional support versus extracorporeal membrane oxygenation for severe adult respiratory failure (CESAR): a multicentre randomised controlled trial. The Lancet 2009;374:9698):1351-1363

EOLIA TRIAL

- PaO2:FiO2 < 50 mmHg for > 3 hours despite optimization of MV and potential use of various usual adjunctive therapies (iNO, prone position, HFOV, almitrine infusion) or
- PaO2:FiO2 < 80 mmHg for > 6 hours plus other criteria noted above or
- pH < 7.25 with PaCO2 ≥ 60 mmHg > 6 hours (with RR 35) resulting from MV settings adjusted to keep Pplat ≤ 32

A Combes, et al. Extracorporeal membrane oxygenation for severe acute respiratory distress syndrome. N Engl J Med 2018:378:1965-75. Supplementary Appendix

BASICS OF ARDS CARE

- Low tidal volume ventilation
- Ppl < 30
- High vs low PEEP?
- Severe ARDS (P/F < 150 when studies done)
  - Neuromuscular blockade
  - Prone positioning

GOAL OF VV ECMO

LUNG REST

GOAL OF VV ECMO

- ECMO is not a treatment of ARDS
- It is a means to minimize the negative effects of positive pressure ventilation

WHAT'S THE BEST MODE TO USE WHILE ON VV ECMO?

HERE'S THE PUNCHLINE:

No one knows

MODES OF MECHANICAL VENTILATION

- There is no consensus on the 'best' mode or settings
- CESAR trial used pressure cycled ventilation
- EOLIA used either volume cycled or APRV

BACK TO BASICS

- The goal of VV ECMO is 'lung rest'
- Allows for minimization (elimination?) of deleterious effects of MV
  - Ultra-low tidal volumes (< 4 cc/kg IBW)
  - Low pressure
  - Decreased FiO2
  - ?less sedation
  - ?vent liberation

10/10/10

- Pressure control
  - Low driving pressure
  - Low respiratory rate
  - Modest PEEP
- Increasing tidal volumes = improved lung compliance

BE PATIENT

- Use the circuit for gas exchange – NOT the vent!
- IF oxygen delivery is too low:
  - Increase flow
  - Increase carrying capacity
  - ?recirculation
  - ?Lower oxygen demand

SUMMARY

- There is no 'perfect' mode of ventilation on ECMO
- Use sound basic principles for ARDS supportive therapy
- Target 'lung rest'
- Use the circuit!