

ECLS in COVID-19 PATIENTS

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SCHOOL OF MEDICINE

Goals

- Sedation
- Ventilator
- Hypoxemia
- Volume management
- Dialysis

Disclosures

I have no disclosures

Sedation on ECMO

- Goal
 - Prevent negative patient-circuit interactions
 - Allow to wake/rehab
- Sedation requirements remarkable
 - Oxygenation requirements
 - Poor enteral tolerance

Sedation on ECMO



- Drugs are sequestered on ECMO
 - Lipophilic drugs (octanol/water >2)
 - High protein binding (>70%)
- What do we choose and why?
 - Dilaudid/morphine, oxycodone, ketamine



Shekar, J Crit Care 2012

Sedation on ECMO

Drug	Protein Binding	Octanol/ Water Partition Coefficient	Published Information
Fentanyl	80-87%	4.05	97% drug loss at 24 hrs Has been shown to irreversibly bind to the ECMO circuit
Midazolam	97%	3.89	87% drug loss at 24 hrs
Precedex	94%	3.39	~40% loss in circuit at 60 min
Propofol	97-99%	3.79	70% loss in circuit at 45 min Higher doses needed may predispose patients to PRIS
Morphine*	20-35%	0.9	Minimal to moderate sequestration Neonates given morphine received significantly less supplemental analgesia and had lower rates of withdrawal after therapy compared to fentanyl recipients
Ketamine	47%	2.9	Data published at BJH noted decreases in vasopressor (11 of 26 patients) and sedation-analgesia (9 of 26 patients) requirements within 2 hours of initiation
Diazepam	98%	3	~50% drug loss in circuit at 60 min
Lorazepam	~91%	2.4	~10% drug loss in circuit at 60 min
Hydromorphone	8-19%	1.6-1.8	Published data is lacking
Oxycodone	38% - 45%	1.2	
Methadone	85%	3.93	
Quetiapine	83%	2.1	
Phenobarbital**	20-45%	1.47	

*active metabolites, accumulation and toxicity concerns with renal dysfunction, histamine release & hypotension

** CYP450 inducer and multiple drug-drug interactions

Sedation on ECMO

- Other considerations
 - Propofol
 - Oxygenator lifespan
 - Hypertriglyceridemia
 - Dexmedetomidine
 - Helps tachycardia
 - High volume of NS



Ventilation

- ELSO:
 - (PPLAT) $\leq 25\text{cm H}_2\text{O}$
 - RR 4–10
 - PEEP 10–15cm H₂O
 - Drive pressure $< 15\text{cm H}_2\text{O}$
 - FiO₂ $< 50\%$
 - SpO₂ $\geq 80\text{-}85\%$



www.else.org, Brower NEJM 2000, Combes NEJM 2018

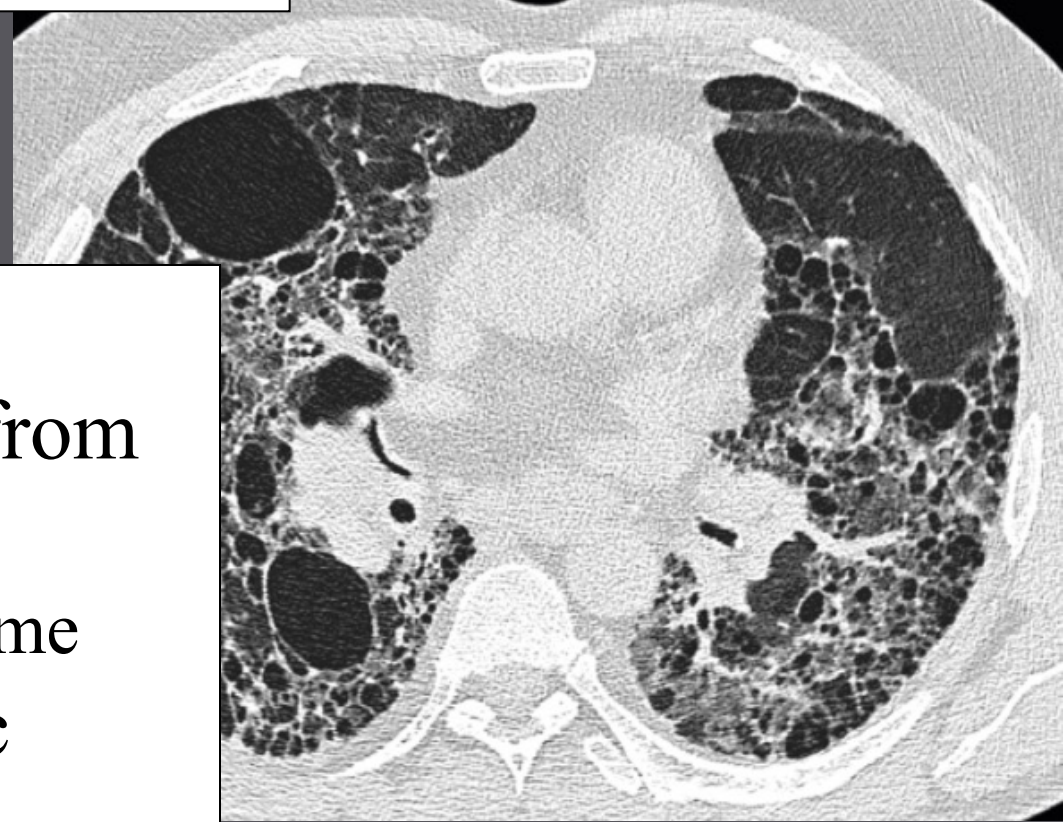
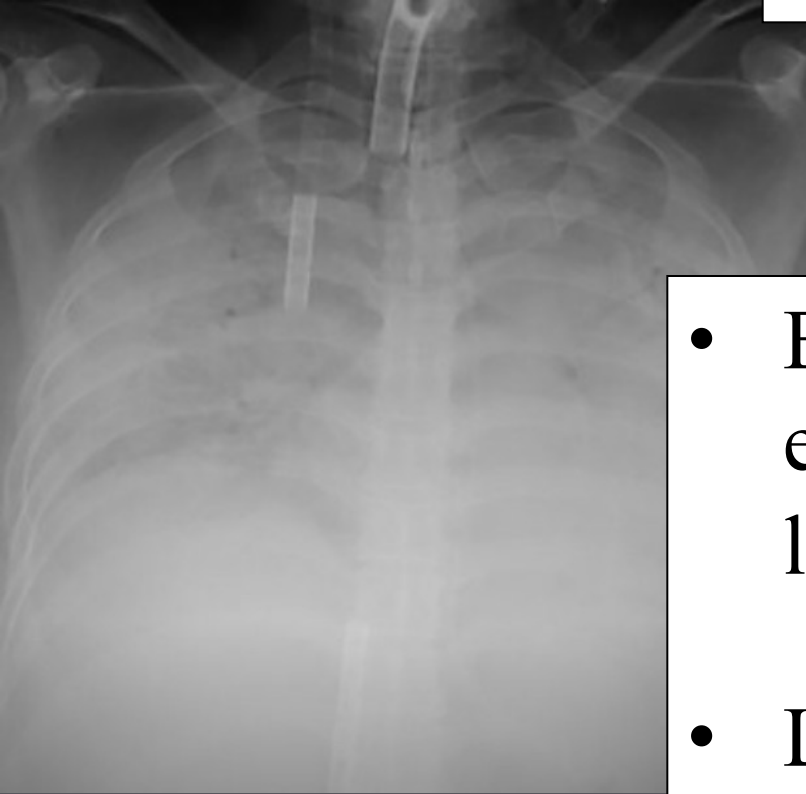
Hypoxemia Management

$SpO_2 > 80-85\%$

- ECMO flows
- Cannula position
- Oxygenator Function
- Treat negative patient-circuit interactions
- Control cardiac output
- Control fever

Volume Management

- Early: Remove extravascular water from lungs
 - Circuit needs volume
- Later stages: Fibrotic lungs
 - Limit to benefits with volume removal

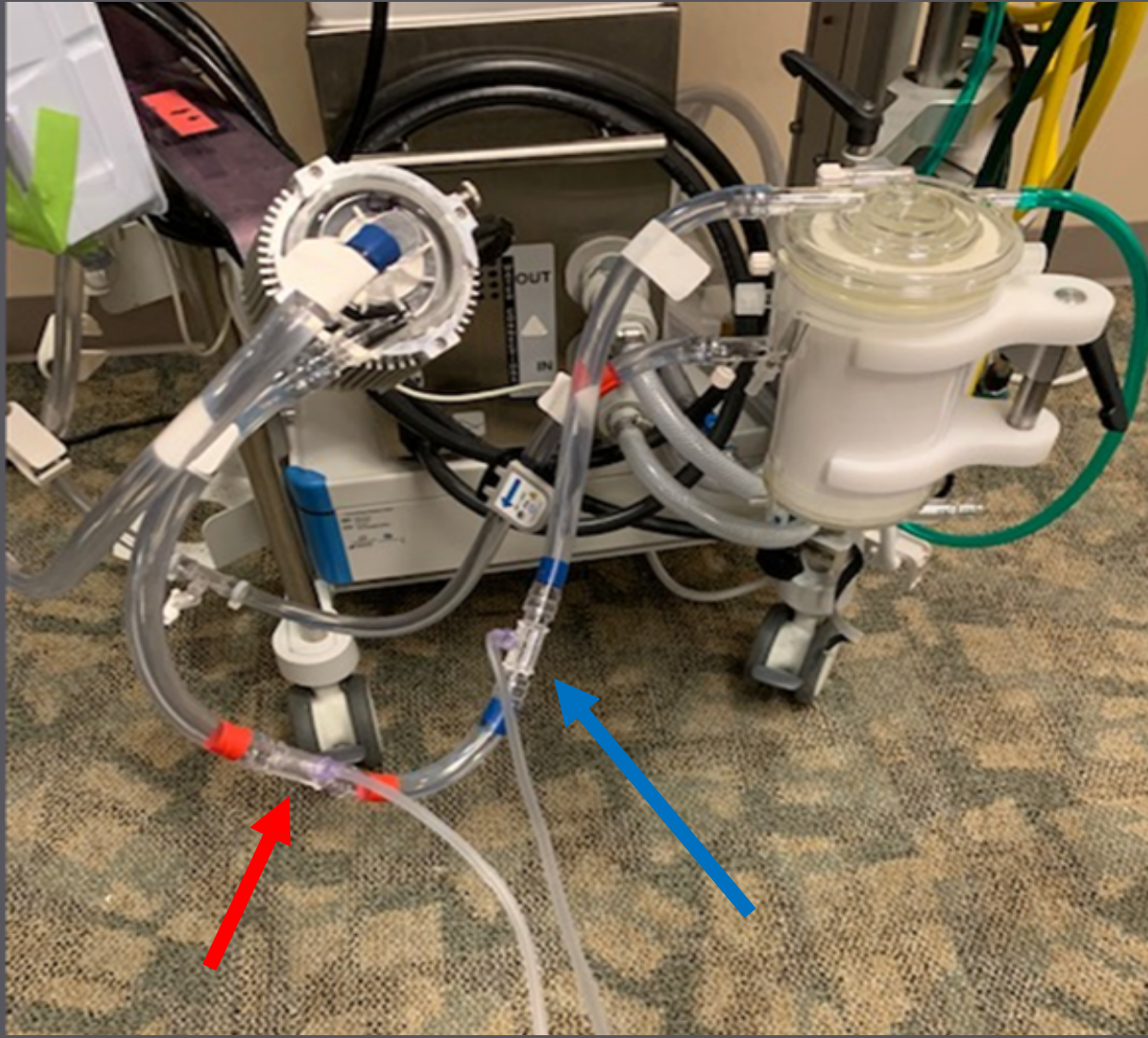


CRRT through the ECMO Circuit

- High incidence of renal failure in severe COVID (30%)
- Access is post pump, pre membrane
- Works for flows up to about 4.5 LPM
- Higher flows: Need separate dialysis

Cummings, Lancet 2020

ECMO Circuit Add Ins: Positive Side Only



- Centrimag circuits set up for CRRT integration
- Post Pump & Pre-Membrane
- Post-Pump pigtail = **“RED”**
- Pre-Membrane pigtail = **“BLUE”**
- Minimize risks/sentinel events

Summary

- Sedation with drugs that are less lipophilic (dilaudid, ketamine)
- Ultra lung protective ventilation
- Hypoxemia management
 - SpO₂ >80-85% (ELSO)
 - Optimize ECMO
 - Decrease oxygen use, shunt
- Gradual volume removal
 - CRRT through ECMO

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