ATS Critical Care Training Forum

Management of Patients with Severe ARDS Due to COVID-19 with ECMO

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Case 1: RB
54yo man with hypertension presented to an outside hospital with fever x 2 weeks, progressive SOB and cough x 1 week, found to have COVID pneumonia.

• **HD #1:** SpO2 70s on arrival -> started on HFNC. Given Ceftriaxone, azithromycine, remdesivir, convalescent plasma, and therapeutic enoxaparin.

• **HD #2:** Episode of 30cc hemoptysis – enoxaparin discontinued. Hypoxemia requiring intubation. Bronchoscopy - old blood in the LLL - no active bleeding.

• **HD #3:** Worsening hypoxemia and poor compliance. Cannulation by UCSD mobile ECMO team.
ECMO Cannulation

DRAINAGE: 25 Fr venous drainage cannula in R femoral vein
RETURN: 21 Fr return cannula in Right internal jugular vein
ECMO flows at 4.25 L/min with negative venous pressure of -60 mmHg
ECMO Sweep: 3L/min

PRE ECMO ABG: 7.3/68/58
POST ECMO ABG: 7.48/32/303

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Physical Exam on Arrival

VS: T 97.2 | HR 64 | RR 12 | BP 127/80 on norepi 6 mcg/min | SpO2 100%
Vent: VTPC FiO2 1.0, PEEP 12, Vt 350, RR 12, PIP 26
ECMO: Flow 4.12L/min, FdO2 100%, sweep 3L/min

General: intubated, sedated
CV: RRR without murmur or rub
Lungs: coarse BS on left
Abdomen: soft, no organomegaly
Extremities: no edema, warm
Lines: ECMO cannulas without oozing, Left PICC clean
Skin: Vitiligo both hands and feet
Neuro: RAAS -4, on versed + fentanyl, Pupils symmetric, 3 mm
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Lung Protective Ventilation on ECMO

**Pressure Control Ventilation**

- Respiratory Rate 10
- Driving Pressure 10 – *resulting tidal volumes of 50 ml*
- PEEP 10
Labs on Arrival

**ABG:** 7.48 / 32 / 293 / 26 / 100%

**CBC:**
- WBC 10.2 (72% Segs, 1% lymphs)
- Hgb 10.5 (MCV 95.2)
- Plts 146

**BMP:** 138 / 4.5 / 103 / 21 / 13 / 0.6 < 114

**LFT:** AST 48 / ALT 48 / AlkPhos 129 / Tbil 1.1 / TP 4.8 / Albumin 2.5

**Coags:** INR 1.4 / PT 15.4 / PTT 32

CK 994
LDH 568
D-dimer 25,144 (<241)
**Labs on Arrival**

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**CK** 994

LDH 568

D-dimer **25,144 (<241)**
Complete consolidation of the lungs, compatible with diffuse alveolar damage/ARDS.

Trace volume bilateral effusions.
Hospital Course

HD #1
- ECMO cannulation.

HD #8
- Lower GI bleed. Heparin held.
- Ileus, thought related to fentanyl.

HD #11
- Able to work with PT, dangle at edge of bed.

HD #12
- Bedside tracheostomy by interventional pulmonary team.

HD #15
- Agitation and vent dyssynchrony requiring propofol, fentanyl, precedex, and ketamine with midazolam pushes and haldol as needed.

HD #18
- Epistaxis. Heparin held again. Required initiation of paralytics and esmolol for HR over 80.
- TV improved to ~200cc on same settings.

HD #19
Unable to participate in PT due to desaturations and tachypnea.

Re-paralyzed due to desaturations and vent dyssynchrony.

CT head showed small left frontal subarachnoid hemorrhage. Heparin held. Bleed stable on serial CT.

CT chest shows hydropneumothorax – conservative management, PEEP decreased.

Able to work with PT.

Shock requiring vasopressors and concern for VAP. Bronchoscopy with BAL showed purulent secretions.

Femoral cannula re-positioned due to frequent suction events.
Hospital Course

HD #32
2u PRBC for occult bleed.

HD #33-39
Mental status improves and patient regularly works with PT. Sweep challenges.
TV improved – 400-500cc.

HD #41
Decannulated from ECMO.
Pressure support trial.
Able to walk with PT. Tolerating trach collar during the day.

HD #44
Transferred back to acute care hospital near his home.

HD #45
Transferred back to acute care hospital near his home.

Last update...

Discharged to SNF
Total Hospital Course – 45 Days
Case 2: CE
HPI – May 2020

44yo woman with obesity working as a nurse in a SNF who presented to an outside hospital with 2 days of shortness of breath and fever.

HD #1
COVID PCR positive. CXR with patchy peripheral opacities. Placed on HFNC.

HD #2
Intubated on PC with PS 15-20, PEEP 20, FiO2 100%, Proning, paralytics, and iNO were started. Remdesivir and empiric heparin drip started.

HD #3
Some improvement with proning. Remdesivir stopped due to developing AKI. Received convalescent plasma.

HD #4
Progressive rise in Scr and oliguria.

HD #5
Started on CRRT.

HD #6
Cannulation by UCSD mobile ECMO team.
ECMO Cannulation

DRAINAGE: 21 Fr venous drainage cannula in R femoral vein
RETURN: 19 Fr return cannula in Right internal jugular vein
Achieved flows at 4.25 L/min with negative venous pressure of -115 mmHg

PRE ECMO ABG:  7.11/110/60
POST ECMO ABG: 7.41/60/88

Some difficulty with R femoral access.
SpO2 ~80 while proning prior to cannulation.
Physical Exam on Arrival

**VS:** T 97.7 | HR 99 | RR 10 | BP 159/74 on norepi 20 mcg/min | SpO2 88%

**Vent:** VTPC FiO2 1.0, PEEP 15, Vt 300, RR 10, PIP 35

**ECMO:** Flow 4.21L/min, speed 3165 rpm, FdO2 100%, Sweep 6L/min

**General:** intubated, sedated, paralyzed

**HEENT:** conjunctival edema. Pupils 2mm bilaterally and round. Anicteric sclera

**CV:** RRR, no murmurs

**Lungs:** decreased breath sounds

**Abdomen:** soft, obese

**Extremities:** +pulses on doppler bilaterally.

**Skin:** No rash
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**Skin:** No rash
Labs on Arrival

**ABG:** 7.55 / 36 / 114 / 32 / 99%

**CBC:**
- WBC 6.9 (80% Seg, 28% Lymph, 2% Eo)
- Hgb 5.8 (MCV 77.6)
- Plt 105

**BMP:** 146 / 3.5 / 102 / 27 / 54 / 6.58 > 114

**LFT:** AST 176 / ALT 41 / AlkPhos 108 / Tbil 0.81 / TP 5.1 / Albumin 2.7

**Coags:** INR 1.9 / PT 20.4 / PTT 173

Anti-Xa 0.57
Labs on Arrival

**ABG:** 7.55 / 36 / 114 / 32 / 99%

**CBC:**
- WBC 6.9 (80% Seg, 28% Lymph, 2% Eo)
- Hgb **5.8** (MCV 77.6)
- Plt **105**

**BMP:** 146 / 3.5 / 102 / 27 / **54** / **6.58** > 114

**LFT:** **AST 176** / ALT 41 / AlkPhos 108 / Tbil 0.81 / TP 5.1 / Albumin 2.7

**Coags:** **INR 1.9** / PT 20.4 / **PTT 173**

Anti-Xa 0.57
Hospital Course

• HD #1:
  • PEEP maintained at 15 given low PaO2. Vasopressors given for shock. Given 2U PRBC for Hgb of 5.8 – thought possibly related to blood loss from ECMO cannulation. CRRT was re-started.

• HD #2:
  • Stroke code called at 12:50pm for uneven pupils. Left pupil 6mm, irregular, and non-reactive to light. R pupil 3 mm, round and sluggish to light. Patient was given hypertonic saline and taken to CT scan.
Multifocal parenchymal hemorrhages involving both frontal lobes, the left temporal lobe, and left occipital lobe.

Mass effect - 17 mm of left to right midline shift and effacement of the left lateral ventricles.

Subarachnoid hemorrhage layering within the bilateral frontoparietal sulci. No aneurysm appreciated.
Hospital Course

• Neurosurgery and neurocritical care teams were consulted.
• Due to the extent of the bleed, surgery was not recommended.
  • Infarcts and bleed thought to be sub-acute.
• Transitioned to comfort care and compassionately extubated after family visited.
• She expired on HD #2.
Reflections from 2 ECMO Cases

• Patients may require long ECMO course
  • Bleeding and infectious complications
  • Sedation and delirium management

• Imaging may not prognosticate outcome

• Anticoagulation not always necessary with adequate ECMO circuit blood flow and it is possible to use lower PTT goals 40-60

• Physical therapy is feasible

• The benefit of empiric anticoagulation for COVID-19 (without confirmed VTE) remains unknown
  • Risks associated – intracranial hemorrhage