COVID ECMO
Preparation & Experiences In Washington

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Seattle Hot Zone- Overview

Past:

• First patient diagnosed in US (Washington): January 21st
• Outbreaks at communal living areas: first death February 29th
• Unsuccessful attempts to isolate spread
• Rapid development of hospital protocols, UW Virology Lab testing capabilities
Seattle Hot Zone- Overview

Present:

- Sustained community spread: 4806 cases, 195 deaths in Washington
- Aggressive rapid test. Positive: 4.4% symptomatic staff, 10% admitted/high risk patients
- Offloading hospitals at capacity
- Tents for patient entry into ED, cohorting admitted COVID patients
Seattle Hot Zone-Overview

Future:

- Goal to remain at contingency care
- Planning for surge (8 days): deployment of reinforcement staff to ED, ward, ICU
- Regional coordinating center using Microsoft platform for inter-hospital patient movement
- Protocols for crisis capacity

Conventional Capacity:
Ordinary use of resources (spaces, staff, and supplies) and standard of care

Contingency Capacity:
Disruption of ordinary use of resources and practices, but care provided is functionally equivalent to usual standards

Crisis Capacity:
Disruption to standard of care due to inadequate resources, but goal is sufficiency of care (provide the best possible care given the circumstances)
IHME Surge Modeling

https://covid19.healthdata.org/projections

Institute for Health Metrics and Evaluation (IHME)
Regional ECMO organization

- No hospital should reach crisis capacity alone in a region
- Load share capacity & referrals for ECMO
- Uniform ECMO patient selection
- Share supplies
- Communicate, share patient management experiences
<table>
<thead>
<tr>
<th>Adult</th>
<th>Washington Locations</th>
<th>Routine Capacity</th>
<th>Max Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providence St. Vincent, Oregon Health &amp; Science University, Legacy Emanuel</td>
<td>UW Montlake, UW Harborview, Swedish Med Cntr</td>
<td>24</td>
<td>29</td>
</tr>
<tr>
<td>Pediatric</td>
<td>Doernbecher Children’s Hospital, Randall Children’s Hospital</td>
<td>9</td>
<td>11</td>
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Total: 33
Total: 40
Preparation for COVID ECMO within the Hospital

Space:
- Cohort COVID patients, reduce nosocomial spread
- Individual negative airflow rooms vs negative airflow unit

Staff:
- COVID ICU team (new to ECMO)
- ECMO consult team (newly built)
- Float ECMO RN/RT specialists to COVID ICU

Stuff:
- Pumps & ventilator screen in anti-room
- Video conferencing to hear alarms, visualize pump screen and communicate inside room
- Cardiohelp (self resolving alarms)
  - Limited supply chain
- Airborne PPE, batch trips into rooms
Regional COVID ECMO Transfers

Considerations:
- Weigh benefit to individual patient vs. risks of disease spread & risk to transport staff
- Potential risk of overwhelming tertiary centers vs. benefit of cohorting salvageable patients at ECMO centers

Process:
- Screen ECMO candidate, case by case basis
- Capacity relief needed for referring hospital?
- Capacity available at receiving hospital?
  - Conference call: staff, stuff and space for another ECMO patient?
- Available capacity at other ECMO centers within region?

Mobile ECMO:
- Reduce unnecessary transfers to “hub”, maximally utilize “spokes”
- PPE protocols for team
Patient Selection: Indications for VV Referral

- Severe reversible hypercarbic respiratory failure (pH < 7.2)
- Severe reversible hypoxemic respiratory failure (PaO2:FIO2 < 100) due to ARDS despite maximal medical therapy, to include (unless contraindicated):
  - Low tidal volume ventilation
  - PEEP optimization
  - Prone positioning
  - Consideration of inhaled vasodilators
  - Consideration of neuromuscular blockade
Patient Selection: Contraindications

**Absolute Contraindications**

- Age >60
- Prolonged mechanical ventilation >7 days
- Significant chronic comorbidities including: chronic kidney disease, cirrhosis, dementia, disseminated malignancy, systolic heart failure, underlying advanced lung disease (e.g., COPD, ILD, CF), uncontrolled diabetes (e.g., with neuropathy, gastroparesis, retinopathy, etc), severe deconditioning or protein calorie malnutrition, severe peripheral vascular disease, any other pre-existing life-limiting medical condition
- Refractory shock requiring >0.5 mcg/kg/min norepinephrine or equivalent
- Decompensated acute heart failure, i.e., significant septic/stress cardiomyopathy or myocarditis with need for VA ECMO support— we will not offer VA ECMO for patients with COVID-19
- Acute liver injury with synthetic dysfunction (elevated INR)
- Active bleeding and inadequate hemostasis, contraindications to anticoagulation, or inability to accept blood products
- Active intracranial hemorrhage, cerebral vascular accident, poor neurologic exam
- Ongoing CPR / recent cardiac arrest – we will not offer E-CPR for COVID-19 associated cardiac arrest

**Relative Contraindications**

- Obesity BMI >35
- Immunocompromise
- No DPOA or legal medical decision maker available
Cannulation

- Beside in ICU
- Two cannulas (higher flow for severe hypoxemia) RIJ + fem or Bifem
- Supplies checklist prior to entering room
- Ultrasound epigastrium to site wires and femoral cannula(e) depth
- Two cannulators, 1 nurse, 1 ECMO specialist
## COVID ECMO Patients in Seattle

<table>
<thead>
<tr>
<th>PATIENT #1 UWMC:</th>
<th>PATIENT #2 UWMC:</th>
</tr>
</thead>
<tbody>
<tr>
<td>41 M, no PMHx</td>
<td>47 M, PMHx HTN</td>
</tr>
<tr>
<td>Transferred, PEEP 16, prone, NMB, inhaled epoprostenol</td>
<td>Transferred, PEEP 16, prone, NMB, inhaled epo, bronchopleural fistula from traumatic intubation 20% airleak</td>
</tr>
<tr>
<td>Cannulated RIJ &amp; fem vein on day 3 of mechanical ventilation</td>
<td>Cannulated bifem on day 2 mechanical ventilation</td>
</tr>
<tr>
<td>Ventilator settings during ECMO: pressure control, PEEP 18—&gt; 14, PIP 30—&gt; 24, FiO2 40%</td>
<td>Ventilator settings during ECMO: pressure control, PEEP 16—&gt; 10, PIP 26—&gt; 20, FiO2 40%</td>
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<tr>
<td>Organ failure: none, enterobacter VAP</td>
<td>Organ failure: LVEF 40-45%, no vasopressors</td>
</tr>
<tr>
<td>Therapies: remdesivir RCT, hydroxychloroquine</td>
<td>Therapies: tocilizumab, hydroxychloroquine, remdesivir RCT,</td>
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<tr>
<td>Anticoagulation: heparin 60-80 PTT</td>
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</tr>
<tr>
<td>Transitioned to comfort measures only and died ECMO day 15</td>
<td>Ongoing ECMO day #8, airleak resolved, Vt improving (200), flow 3.8, sweep 7</td>
</tr>
<tr>
<td>(worsening gas exchange and Vt, increasing vasopressor requirements, failing membrane lung)</td>
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