COVID-19: YNHH ECMO for Acute Respiratory Failure Practice Guidelines

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Balancing the need of the community with resource intense & highly invasive therapy such as ECMO invariably puts onus on treating teams to rationalize care. This is an effort to maximize care for individual patients as well as community. It is imperative that we have a strategic plan during the pandemic and necessary input from specialty teams to maximize beneficial outcome. The purpose of this document is meant to be a guideline, with potential modification in the future. We need to prioritize COVID-19 patients who are likely to have the best chance of survival and meaningful recovery with utilization of this technology. Offering this therapy has implications not only for the individual patients but also to the care team.

Aim:

1. Identify patients who are likely to benefit from Veno Venous (VV) ECMO support in COVID-19 population.
2. Balance resources versus maximum benefit for community & individual at large.
3. Ensure protective safeguards for those caring for COVID-19 to prevent transmission and contracting COVID-19
4. Programmatic structure for decision making and institution of VV ECMO support

Team members:

1. MICU/Pulmonary team (Intensivist/APP/Resident/Fellow)
2. CTICU team (Intensivist/APP/Resident/Fellow)
3. CT surgeons
4. Perfusion
5. Nursing (MICU/CTICU/OR)
6. Respiratory team
7. OR team
8. Social worker
9. Transport team
10. Palliative care
11. Ethics team

Sequence of consultation for VV ECMO:

1. Consult initiation
   i) All external (outside of YNHH and YNHH affiliated campuses) referrals to contact MICU attending for any suspected COVID-19 patients with respiratory failure (Y-access to notify MICU attendings on call), this will be the first point of contact.
   ii) MICU ECMO attending to notify CTICU admitting and cardiac surgery ECMO attendings for impending arrival who might need VV ECMO.
   iii) No direct admits to CTICU from outside hospitals for ECMO without ECMO team consultation.
2. Consult initiation for internal YNHH MICU COVID-19 patients
   i) All internal potential need for VV ECMO: MICU ECMO attending to notify CTICU admitting attending and cardiac surgery VV ECMO within 24 hours of a pending need, avoid emergency consultation and institution to minimize risk and errors.

ii) Discussion between MICU/CTICU/CT surgery and above stakeholders as needed prior to instituting VV ECMO.

iii) Daily discussions to discuss potential candidates and need for CTICU beds.

Indications:

1. Serology positive COVID-19 status in an adult (>18 years age) including pregnant females, and pediatric patients too big for pediatric ICU by size criteria (BSA>1.2m2 or weight >25 Kg which will need an adult circuit).
2. Hypoxic failure necessitating ARDSnet protocol nearing 48 hours (PAO2:FiO2 ratio <100).
3. Severe hypercarbia in presence of hypoxia with pH <7.2 non amenable to ventilatory adjustments or renal adjustments.
4. Presence of above in spite of pulmonary vasodilators chemical paralysis, prone positioning, ARDSnet protocol, nearing 12 hours with plateau pressure greater than 30 and respiratory rate >35.

Contraindications:

1) Absolute:
   a) *Salvage ECMO as an emergency*
   b) *Non-recoverable neurologic injury*
   c) *Cardiac arrest*
   d) *Age>65 years*
   e) *Preexisting malignancy (excluding prostate cancer or cured cancer with survival free of cancer >5 years), currently receiving chemotherapy, immunosuppression therapy, coagulation disorder (thrombotic or blood dyscrasia)*
   f) *Pre-existing severe advanced pulmonary disease*
   g) *Liver fibrosis, liver failure, portal hypertension*
   h) *Advanced dementia, extreme frailty, failure to thrive prior to COVID-19*
   i) *Uncontrolled blood stream infection*
   j) *Multisystem organ failure with more than 2 systems failure*
   k) *BMI >45*

2) Relative:
   a) *Duration of intubation or high flow nasal cannula or non rebreather or non invasive positive pressure ventilation >7 days*
   b) *Neurological event (stroke/ich/SDH) except recovered prior non-disabling stroke/neurological event in <50 year old (with no pre-existing conditions that will preclude ECMO)*
   c) *Chronic renal failure needing HD*
   d) *Liver dysfunction except stable synthetic hepatic function*
   e) *Age 60-65 years*
   f) *Shock on high dose pressors or > 1 vasopressor*

3) Procedural contraindications:
   a) *Very poor access for ECMO (including conversion to VA cannulation from VV configuration*

b) Relative - BMI>40 due to inability to meet the oxygenation needs by traditional ECMO circuit

4) Logistic and support related contraindications:
   a) Lack of consent or next of kin not available
   b) POA/Living will precluding ECMO or Tracheostomy/PEG or prolonged invasive ventilation
   c) DNR status
   d) Exceptions to above (a)
      i) Attendings from two different services agree upon emergency consent.
      ii) Age < 40 year old with non- contactable/unavailable/out of state family

Institution/technical details/logistics

1. All ECMO primary site: CTICU
2. Secondary site: MICU
3. Tertiary site: SPOR15
4. A) Procedural:
   i) ECMO cart outside of room
   ii) Ultrasound/TEE for guidance
   iii) Surgeon, intensivist/APP/Nurse/Perfusion in room (with PPE)
   iv) FiO2: 100%, maximize/initiate pressors/inotropes/paralytics and sedation as needed for procedural conduct
   v) Heparin 5000 Units prior to cannulation (PTT goal of 60 to 80 seconds post procedure with aspirin 81 mg if not contraindicated)
   vi) Usual sterile cannulation sequence as per surgeon preference/comfort and clinical need
   vii) CXR for confirmation of position of cannulation before de-scrubbing (in case of adjustment of cannulas)
   viii) Conclusion of case: discard disposables and sterilize equipment by appropriate criteria

   B) Post procedural (nursing, wound care, Circuit care)
   i) Minimize dressing changes unless soiled, no need for daily dressing change
   ii) Circuit inspection: Flow, potential kinks or any alarms to be notified to perfusion staff
   iii) Consider remote access to continuously collected ECMO data (eg. Viper) and input of ABG parameters remotely using "Viper Live"
   iv) Every eight to twelve hours inspection and interrogation by perfusion team
   v)Turning/wedging per nursing guidelines for COVID-19 patients

   C) Post procedural radiography:
   i) Every 48-72 hours chest radiograph.
   ii) Blood: PTT/ABG every six hours or with ventilator changes when necessary based on clinical picture

Rounding structure/responsibilities:

1. Primary service: CTICU
2. Consult service: Pulmonology critical care (PCC) or MICU and as needed
3. Daily rounds to be led by CTICU intensivist with CT surgery, MICU/PCC input
4. Overall team assessment at 1 week interval for recovery and potential need for further support
5. At 3 weeks post support, if minimal recovery, discussions with above team members and family for futility or planned further duration of support

6. Daily updates to family/next of kin
7. Offer palliative consult at 1 week mark

Weaning/removal:

1. Consider weaning and removal based on decreasing ECMO support with improving ABG and radiographic as well as clinical evidence of recovery.
2. Minimal support (Capping or room air) for 24 hours followed by decannulation in CTICU room, with same personnel (albeit less considering need for minimal equipment)
3. Maintain patient for 24 hours in CTICU post ECMO decannulation
4. Consider MICU transfer post 24 hours ECMO decannulation or based on institutional bed availability for ongoing weaning from ventilation

Withdrawal/removal:

1. Current criteria for discontinuing ECMO due to
   i) Bleeding related adverse events contraindicating anticoagulation therapy (ICH, uncontrollable bleeding that needs holding off anticoagulation >24 hours or needing >4 packed cells, 4 FFP, 4 platelets in 24 hours period),
   ii) Non recoverable adverse events (Overwhelming sepsis not responding to current medical therapy, non recoverable stroke, other system involvement, MSOF)
   iii) Procedural issues precluding adequate gas exchange (which may need invasive central cannulation)
2. Non-meaningful recovery of pulmonary status
3. Palliative care input and assistance in goals of care discussion
4. Consider continuing ECMO on a weekly basis if no MSOF after 4 weeks of ECMO support.

Record keeping/database and dissemination:

1. Ongoing record of COVID-19 patients on ECMO (adults +Children) by perfusion
2. Sharing of data with ELSO as appropriate
3. Communicating significant findings through medical/scientific forums within the framework of scientific guidelines
4. Post-CTICU discharge status to be followed and recorded (death within hospital, withdraw of ventilation support, unexpected death etc.
5. Weekly follow-up updates to learn which patients are benefitting and adjust criteria accordingly for ECMO support.

Please contact MICU, CTICU or CT Surgery leadership with any questions related to these practice guidelines.

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