Respiratory protocol for COVID-19

a. Goal O2 sat 92-96%. Higher and lower O2 associated with mortality.
   i. Initiate humidified nasal cannula (up to 6 lts/min).
   ii. For higher O2 requirements use non-rebreather mask (10-15 lts/min, titrate FIO2 up to 100%).
   iii. If O2 sats are persistently < 92% on 100% NRB mask, switch to high flow nasal cannula (HFNC) when available. Start HFNC at 30 lts/min, then increase FIO2 up to 100%, if still hypoxic increase flow rate by 10lts/min up to 60 lts/min to achieve goal sats. Patient should wear a surgical mask at all times. Remove humidification if possible to minimize aerosolization and place patient in negative pressure room when available.
   iv. Avoid using non-invasive ventilation (CPAP/BiPAP) in COVID-19 positive patients due to increased risk of aerosolization.

b. Perform awake prone ventilation multiple times a day as tolerated.
   i. Patient should be alert and able to do it voluntarily.
   ii. Tape NC to nose. Allow patient to lay prone in bed as tolerated.
   iii. Has shown improved oxygenation in COVID-19 patients regardless of ARDS due to improved aeration of dependent lung.

c. Call CCM in the following situations:
   i. Patient develops respiratory distress
   ii. Patient is unable to maintain O2 sats ≥ 88% on 100% non-rebreather mask or ≥ 90% on HFNC at 90% FIO2, 60 lts/min flow.

d. In both intubated and non-intubated patients, bronchodilators should be given as metered-dose inhalers as nebulizers increase aerosolization.

e. Nebulizer
   i. No indication in COVID-19 patients without asthma/copd history
   ii. Only use if there is no other option for drug delivery

f. Airway clearance
   i. Reports from China and Italy indicate that some patients develop copious thick secretions leading to mucus plugging and lung collapse. Options limited as bronchoscopy, nebulizers and airway clearance techniques are aerosol generating.
   ii. Airway clearance and nebulizers should be used only in select ventilated patients (closed circuit) with thick secretions to avoid lung collapse that would require bronchoscopy.
   iii. Can use nebulized hypertonic (3-7%) saline once daily in patients noted to have thick secretions. Will need to be done by a respiratory therapist.
      a. Side effects can include bronchoconstriction
      b. Pre-treat with albuterol 2.5mg just prior to delivery
      c. Start with 3% to assess response and bronchoconstriction
iv. Avoid N-acetylcysteine due to frequent dosing requirements.

v. Chest PT

vi. Avoid oscillating positive expiratory pressure and cough assist devices

Ventilator protocol for COVID-19

1. Ventilator Recommendations
   a. ARDSnet protocol
      i. Low tidal volume strategy (6 ccs/kg if IBW)
         ii. Goal O2 sat 92-96% (higher and lower sats associated with mortality).
         iii. Goal plateau pressure < 30 cms of H2O.
         iv. Goal pH > 7.3. If pH 7.15-7.30: Increase RR until pH > 7.30 or $PaCO_2 < 25$ (Maximum set RR = 35).
     
   b. Sedation: Goal RASS for intubated patients is 0 to -1. Goal is to minimize sedation while ensuring oxygenation along with keeping the patient from self-extubation.
c. Weaning
   i. Wean FiO\textsubscript{2} and PEEP based on table below. Preferentially wean FiO\textsubscript{2} first before PEEP to maintain sats between 92-96%. Discuss with pulmonary consult for clarification on questions.

<table>
<thead>
<tr>
<th>Score</th>
<th>Classification</th>
<th>(RASS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Combative</td>
<td>Overly combative or violent; immediate danger to staff</td>
</tr>
<tr>
<td>3</td>
<td>Very agitated</td>
<td>Pulls on or removes tube(s) or catheter(s) or has aggressive behavior toward staff</td>
</tr>
<tr>
<td>2</td>
<td>Agitated</td>
<td>Frequent non-purposeful movement or patient–ventilator dyssynchrony</td>
</tr>
<tr>
<td>1</td>
<td>Restless</td>
<td>Anxious or apprehensive but movements not aggressive or vigorous</td>
</tr>
<tr>
<td>0</td>
<td>Alert and calm</td>
<td>Spontaneously pays attention to caregiver</td>
</tr>
<tr>
<td>-1</td>
<td>Drowsy</td>
<td>Not fully alert, but has sustained (more than 10 seconds) awakening, with eye contact, to voice</td>
</tr>
<tr>
<td>-2</td>
<td>Light sedation</td>
<td>Briefly (less than 10 seconds) awakens with eye contact to voice</td>
</tr>
<tr>
<td>-3</td>
<td>Moderate sedation</td>
<td>Any movement (but no eye contact) to voice</td>
</tr>
<tr>
<td>-4</td>
<td>Deep sedation</td>
<td>No response to voice, but any movement to physical stimulation</td>
</tr>
<tr>
<td>-5</td>
<td>Unarousable</td>
<td>No response to voice or physical stimulation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FiO\textsubscript{2}</th>
<th>0.3</th>
<th>0.3</th>
<th>0.3</th>
<th>0.3</th>
<th>0.3</th>
<th>0.4</th>
<th>0.4</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEEP</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>14</td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

   ii. Conduct a Spontaneous Breathing Trial daily when:
       1. The cause of the respiratory failure has improved
       2. Patient awake and following commands
       3. Minimal secretions
       4. FiO\textsubscript{2} ≤ 0.40 and PEEP ≤ 5 and SpO\textsubscript{2} ≥ 90
       5. pH > 7.25
       6. Hemodynamic stability (no or low dose vasopressor medications)

d. Spontaneous Breathing Trial
   i. Trial of up to 120 minutes of spontaneous breathing with FiO\textsubscript{2} ≤ 0.40 and PEEP 5
   ii. Place on CPAP ≤ 5 cmH\textsubscript{2}O with PS 5
   iii. Assess for tolerance as below
       1. SpO\textsubscript{2} ≥ 90 and/or PaO\textsubscript{2} ≥ 60 mmHg
       2. Spontaneous tidal volume ≥ 4 mL/kg PBW
       3. RR between 12-35 pm
       4. No respiratory distress (≥ 2 of the following)
          a. HR > 120% baseline
          b. Marked accessory muscle use
          c. Abdominal paradox
          d. Diaphoresis
          e. Marked Dyspnea

   iv. If does not tolerate, resume pre-weaning settings
   v. If patient passes spontaneous breathing trial, consult pulmonary for consideration for extubation.