Management of Critically Ill COVID-19 Patients in Low Resource Settings

William Checkley, MD, PhD - Johns Hopkins University (Pulmonary and Critical Care)
Aditya Kasarabada, MD, MPH - INOVA Fairfax (Pulmonary and Critical Care)

Summary/Key Points:

**Severity**

- COVID-19 severe cases can be complicated by arterial hypoxemia, Acute Respiratory Distress Syndrome (ARDS), sepsis/septic shock, and multiorgan failure
- Risk factors for disease severity include cardiovascular disease, respiratory disease, hypertension, diabetes, and cancer
- In-hospital markers include older age, co-morbid disease, higher SOFA scores, D-dimer $>1\mu g/L$, people with HIV

**Initial Management**

<table>
<thead>
<tr>
<th>Mild: Symptomatic; self-quarantine; return precautions</th>
<th>Moderate: Symptomatic support; self-quarantine; empiric antibiotics if pneumonia; if bronchodilator use MDI; no systemic steroids; return precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe: Admit; Use supplemental $O_2$ to achieve $SpO_2 &gt; 92%$ (Nasal cannula: 24-40% oxygen, $O_2$ dose 1-5 L/min; Simple face mask: 40-60% oxygen, $O_2$ dose 6-10 L/min; Non-rebreather face mask: 60-90% oxygen, $O_2$ dose 10-15 L/min; High-flow nasal cannula: 30-100% oxygen; 30-60 L/min); transfer to higher level of care when $O_2$ requirements are $\geq 6$ L/min</td>
<td>Critical: Intubate (done by most senior physician), RSI, NRB for pre-oxygenation, no bagging; mechanical ventilation; ECG/labs; co-infections; anticoagulation; IVF resuscitation (2-4 L, be cautious of fluid overload) and vasopressors if shock persists after IVFs; ventilator triage</td>
</tr>
</tbody>
</table>

Resource page prepared by Sarah Rapaport
• Death most often results from complications from multi-organ failure; low incidence seen of sudden cardiac death/myocarditis at day 10-14 of critical illness

**Hypoxemia Considerations**

- “Silent Hypoxemia” presents without dyspnea (more common in elderly patients)
- WHO recommends SpO₂ > 94% for COVID-19 patients
- Experience now suggests delaying intubation as much as possible without compromising patient safety (opposed to initial thought of early intubation)
  - Pragmatic approach to keep SpO₂ > 88-92% with non-invasive oxygen delivery system while watching the work of breathing and clinical status → has led to lower intubations
  - Pre-intubation oxygenation strategies: nasal cannula or simple/non-rebreather masks (1-15 L/min), high flow nasal cannula (30-60 L/min), awake non-ventilated proning, non-invasive ventilation with continuous positive airway pressure or bilevel ventilation (caution: high risk of aerosolization of virus, may be possible in negative-pressure rooms).

**Intubation & Mechanical Ventilation**

**Intubation**

- Performed by trained and experienced provider using airborne precautions
  - Use of PAPR and N95 (preferred) including gown and double gloves or appropriate PPE (according to institutional guidelines) prior to intubation
  - Pre-oxygenate with 100% FiO₂ for 5 minutes via face mask with reservoir bag, bag-valve mask, HFNC
  - After an airway assessment identifies no signs of difficult intubation, a rapid sequence intubation is appropriate
  - Use fiberoptic or video assisted intubation to maximize distance between patient and provider

**Ventilation**

- Keep tidal volumes and airway pressures as low as possible to avoid lung injury
- Avoid spontaneous modes of ventilation as they may lead to tidal volumes >8 mL/kg of predicted body weight (PBW) and cause injury
- Titrate tidal volumes and FiO₂/PEEP according to ARDS Network Protocol (http://www.ardsnet.org/files/ventilator_protocol_2008-07.pdf)
  - Use volume assist/control mode to dial a specific tidal volume and monitor airway pressures
  - Start at 8 mL/kg PBW and aim for V̇ₜ 4-6 mL/kg PBW
  - Keep airway pressures low by lowering V̇ₜ (aim for plateau pressures < 30 cm H₂O)
  - Consider neuromuscular blockers early if dysynchrony
  - Recommend using the lower PEEP/higher FiO₂ table to encourage protocolized care (shown below)
Keep arterial PaO₂s between 55-80 mmHg
Prone positioning for any intubated patient with an FiO₂ ≥ 0.6 and PEEP ≥ 10 cm H₂O.
• Stick to a consistent protocol for management of intubated COVID-19 patients in which you limit volume and pressure used with the ventilator to ensure the best outcomes
• Be patient! COVID-19 patients have had prolonged courses on mechanical ventilation
• Do daily spontaneous breathing trials and extubate at the earliest possible time

Other Considerations
• Imaging cannot make a diagnosis but can show extent of disease and assist in developing A differential diagnosis

Surviving Sepsis Campaign:
• For the acute resuscitation of adults with COVID-19 and shock:
  • Recommend using crystalloids over colloids and suggest using buffered/ balanced crystalloids over unbalanced crystalloids
• For adults with COVID-19 and shock:
  • Use norepinephrine as the first-line vasoactive agent; if unavailable use epinephrine
  • Recommend against using dopamine if norepinephrine is available
  • Suggest adding vasopressin as a second-line agent if target mean arterial pressure (MAP) cannot be achieved by norepinephrine/epinephrine alone
  • Suggest titrating vasoactive agents to target mean arterial pressures of 60-65 mmHg

Therapeutics
• Not many treatment options -mostly supportive care to prevent secondary infections and complications
• Advise against using investigational drugs until rigorous randomized controlled trials demonstrate a clear benefit