**PRESENTATION**
- Any or all of fever, cough, myalgia, dyspnea, diarrhea, and/or worsening acute hypoxic respiratory failure of unclear etiology
- WBC can be high, low, or normal, frequently with lymphopenia
- May see elevated CRP, Ferritin, LDH, CKP and/or troponin but currently these do not add to diagnostic or management
- Chest imaging findings not sensitive nor specific for COVID-19 and can include an alveolar filling process, typically bilateral and peripheral in lower lobes, with ground glass opacities, or with without consolidations

**DIAGNOSTIC WORK-UP**
- COVID-19 PCR should be sent immediately and follow *Lifespan Algorithm to Assess for COVID* to maintain appropriate precautions. ID consult NOT required to send test. Negative tests should not be repeated in general, currently
- D-dimer for possible anticoagulation
- Co-infections possible, Respiratory Pathogen Panel (RPP) required
- ARDS – defined per Berlin Criteria to be acute (<1 week onset), bilateral opacities on chest imaging, ABG with P/F ratio < 300 mm Hg with minimum 5 SEEP, and must not be fully explained by cardiac failure or volume overload

**INITIAL RESPIRATORY MANAGEMENT**
Full *Airway Management Algorithm*
- Low threshold to consider intubation when acutely worsening (increasing FiO2 requirements, clinical deterioration, inability to maintain pulse ox at goal 92-96%)
- High flow nasal cannula (HFNC) can be used as first-line step-up therapy, however low threshold to intubate once requiring >15 L/min
- Non-invasive positive pressure ventilation (NIPPV), such as BIPAP/CPAP, can be used short-term if there is a tight face seal and in-line filters available (NS5 mask with face-shield if filter used on NIPPV device)
- When requiring intubation, it should be performed with CAPR and by anesthesiology using RSI. If emergent, the next most skilled provider should intubate

**CONSERVATIVE FLUID STRATEGY**
- Avoid maintenance fluids, LR bolus if needed for resuscitation
- Diuresis as hemodynamics and creatinine tolerate

**LUNG PROTECTIVE VENTILATION**
- *Two clinical phenotypes emerging – In order to differentiate, first trial High PEEP strategy (14-18) initially per usual ARDSnet. If no improvement in oxygen and/or worsening hemodynamics, then trial low PEEP (5-8) with same ox sat and TV goals and tolerate higher FiO2 than usual*
- Goal tidal volume 6 ml/kg **ideal body weight** (Low Tidal Volume Ventilation)
- Target SaO2 of 92-96%, PaO2 > 60mmHg
- Plateau Pressure < 30 and Driving pressure (Pplat-PEEP) < 15
- Beware of possible lung injury related to: increased work of spontaneous breathing, tachypnea, or large tidal volumes despite low pressure settings
- Consider deeper sedation goals in these patients, many appear to need multiple Rx
- Hypercarbia common especially late in course , titrate respiratory rate to tolerate pH 7-7.15 to maintain low tidal volumes

**PARALYTICS**
- Trial of bolus NMBA favored, but continuous NMBA recommended if significant vent dysrhythmies, proning, high plateau pressures, or requiring continuous deep sedation

**PRONE POSITIONING**
- Suggested for moderate to severe ARDS with hypoxemia, for a trial of 12-16 hours

**INHALED THERAPIES**
- Consider trial of inhaled epoprostenol if not meeting oxygenation goals, wean off if ineffective. Do not trial inhaled nitric oxide
- When failing above therapies, at discretion of MICU attending

**VENTILATOR LIBERATION**
- When passing SAT/SBT and can extubate to 6L NC (i.e. PSV 5/5 with FiO2 ≤ 25%)

**ECLS Consult**
- If worsening
- If improving

**OTHER MANAGEMENT CONSIDERATIONS**
- Many patients on ventilators appear to wean very slowly, often over weeks
- Shock – Goal MAP >65mmHg, first-line vasopressor is norepinephrine
- If worsening or refractory shock, consider cardiogenic shock with PClCUs, troponins, ECG, and ScvO2, but formal TTE if high concern for this for after discussion with cardiology
- Anticoagulation – For patients with D-dimer >1000, elevation of D-dimer from baseline, and evidence of clotting (such as central line clot), start therapeutic anticoagulation. All patients require DVT prophylaxis. Please refer to *COVID-19 Anticoagulation Protocol*
- Antibiotics – Empirc, broad spectrum antibiotics are recommended once patient requires mechanical ventilation
- Steroids – Only consider in mechanically intubated patients who meet criteria for severe ARDS, methylprednisolone 1-2 mg/kg
- Hemoglobin Transfusion goal of 6 to 6.5, depending on comorbidities

**INVESTIGATIVE MEDICATIONS**
- Remdesivir – Enrolling in trial for patients in ICU with clinical worsening, recommend early ID consult for aid in enrollment prior to intubation. Order daily LFTs and INR if on this.
- Hydroxychloroquine – Evolving guidelines, currently we do not recommend
- Statins, NSAIDs, lopinavir/ritonavir, and immunomodulatory medications are currently not recommended

**DIFFERENCES FROM USUAL CARE**
- Minimize staff in room, bundle bedside procedures
- Appropriate guideline-based isolation and CAPRs for aerosol generating procedures, including bronchoscopy, intubation, and extubation. (Do not extubate to aerosol mask). Avoid bronchoscopy.
- Minimize use of nebulizers, prefer MDIs
- Minimize excessive testing, no role for daily CXRs
- Avoid travel when possible. Use surgical mask on patient if < 6 L. If requiring >6 L NC, patient should travel on NIPPV with filter

**HELPFUL LINKS**
- *Lifespan COVID-19 Provider Information*
- *Airway Management Algorithm*
- *Lifespan Algorithm to Assess for COVID*
- *ARDSnet Protocol*
- *Surviving Sepsis Campaign COVID-19 Guidelines*
- *Oxygenation*
- *Therapeutic Management*

**Note:** this document was created by the Division of Pulmonary, Critical Care, and Sleep Medicine at Brown University and may be modified or updated as the COVID-19 situation evolves. Last update 4/16/2020 – Version 2