

ICU Management of COVID-19

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1

Objectives

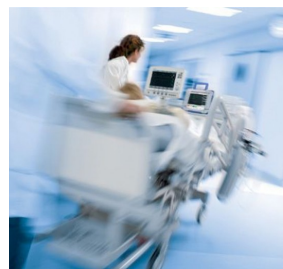
- Clinical syndromes and severity of COVID-19
- When to admit to the ICU
- Initial evaluation
- Respiratory failure and intubation
- ARDS management
- Treatment standards

2

Put on Your Own Mask First: COVID unknown



3



The Virus vs The Disease

4

Clinical presentation of critically ill COVID-19

- Characteristic Lancet Resp Med (n=52) JAMA (n=24) NEJM (n=25)
- Demographics
- Age (mean, SD or range) 60 (SD 13) 70 (43-92) 64 (23-97)
- Male 67% 52% 63%
- Symptoms
- Fever 98% 52% 50%
- Cough 77% 48% 88%
- Dyspnea 64% 76% 88%
- Comorbidities
- Chronic cardiac disease 10% 43% -
- COPD 8% 33% 4%
- Cerebrovascular disease 14% --
- Diabetes 17% 33% 58%
- OBES

Yang et al. Lancet Resp Med Published Online, February 21, 2020;
Arntz et al. JAMA March 19, 2020; Bhatnagar et al. NEJM March 30, 2020

5

Clinical presentation of critically ill COVID-19

Mild disease

- "influenza like illness" fever, fatigue, cough anorexia malaise, muscle pain sore throat dyspnea, nasal congestion or HA
- **decrease taste, GI upset, diarrhea, **ASYMPTOMATIC?!?!**

Pneumonia

- Adult with pneumonia on CXR, but no signs of severe pneumonia listed below
- Severe COVID/Pneumonia
- Suspected respiratory infection, plus elevated respiratory rate >30 with respiratory distress; or SpO₂<94% at rest on ambient air; PaO₂/FiO₂ ≤300mmHg

WHO Clinical Management of SARI when COVID-19 is Suspected, March 13, 2020

6

Clinical Syndromes and severity of COVID-19

ARDS

Bilateral opacities on CXR not fully explained by volume overload lobar lung collapse or nodules
 -not clinically fully explained by cardiac failure or overload
 -PaO₂: FiO₂ ratio <300 w/PEEP or CPAP >5
 - Mild ARDS: P:F ratio =200-300
 - Moderate ARDS: P:F ratio = 100-200
 - Severe ARDS: P:F ratio <100
 If PaO₂ not available, SpO₂/FiO₂ <315 suggests ARDS

JAMA 2020;323:2616-2628

7



• When to admit?

https://www.cdc.gov/media/releases/2020/s0507-covid-19-icu.html

8

Hospital vs ICU admission

Admit patients with evidence of pneumonia, oxygen requirement

- ICU admission
- Typical ICU admission criteria (respiratory failure, shock, etc.)
- Severe COVID pneumonia patients
- Evidence of cardiac disease due to COVID
- **Uncertainties**
- Should certain patients with higher risk features for poor outcomes be admitted if they present with mild disease only?
- How long should patients with non-severe pneumonia remain in the hospital before discharging home out of concern for worsening disease?

9

Evaluation

- Vital Signs: temp, HR, RR, BP, SpO₂, Glasgow Coma Scale (confusion)
- Early warning severity score calculated by SOFA at 24 and 48 hours
 - (respiratory variables, MAP, GCS, bilirubin, platelets, creatinine)
 - COVID Extended Review of Systems: **Fever (present in 99%)**; dyspnea; new O₂
 - requirement; dry cough; rhinorrhea; myalgias; fatigue; diarrhea (can precede resp sx); nausea/vomiting; contacts with sick individuals in past 3 week

10

Labs in COVID-19

- Laboratory studies: All patients should have COVID testing according to updated
- CDC or VHA guidance as test availability evolves
- For patients with moderate or severe illness:
 - CBC w/differential, comprehensive metabolic panel (electrolytes, liver function tests), magnesium, PT/PTT/INR
 - Troponin, CRP, BNP; D-dimer (DIC panel); ferritin; LDH
 - **INFLAMMATORY MARKERS**
 - Chest X-ray; EKG
- For patients with severe illness, notify ICU team immediately

11

MICROBIOLOGY

- Initial microbiologic evaluation and antimicrobials
- **Nasopharyngeal swab** more sensitive than oropharyngeal
- Lower respiratory tract sample if feasible: but many labs don't have testing ability for this
- - Do not induce sputum
- - Avoid bronchoscopy: aerosolized
- - Endotracheal aspirate for intubated patient (keep circuit closed)
- Initial empiric antibiotics per CAP Guidelines
- Evaluate for other infections: influenza testing, consider respiratory
- virus panel, procalcitonin (if available), blood cultures

12

Complications

Complications Lancet Resp Med
(n=52) JAMA (n=21)

- ARDS 67% to 95%
- Mechanical ventilation 64% to 71%
- Acute kidney injury 29% to 19%
- Renal replacement therapy 17% Not reported
- Cardiac injury 23% to 33%
- Liver dysfunction 29% to 14%
- Died (28-days) 62% at 28 days 52% (38% still in ICU at time of publication)

Yang et al. Lancet Resp Med Published Online, February 21, 2020.
Arentz et al. JAMA March 19, 2020

13

Clinically observed phases of COVID-19 from colleagues at Emory Critical Care Center

- Phase 1 – “Viral prodrome” with non-specific symptoms, N/V, poor PO
- Phase 2 – “Slow, smoldering hypoxia” – pneumonia diagnosed at 4-5 days
 - More comfortable but hypoxic, difficulty mobilizing thick secretions
- Phase 3 - “The Struggle Bus”
 - Increasing oxygen requirements, more cough, secretions, and worsening CXR
- Phase 4 – “Respiratory Collapse”
 - Intubation, relatively normal compliance, thick secretions
- Phase 5 – “Rapid death or steady resolution”
 - MOSF, hyper-inflammatory state

14

Prognostication for poor outcomes?

- Older age
- Comorbidities (hypertension, CVD, diabetes, COPD)
- Immune and inflammatory markers
 - Lower lymphocytes counts (particularly of CD4+ T-lymphocytes)
 - Higher leukocytes counts and neutrophil-lymphocyte-ratio (NLR)
 - Elevated inflammatory markers (IL6, IL1, TNF-alpha)
- -Immunosuppressed (transplant)

15

Management in the ICU

- Bundle assessments to minimize personnel exposed, PPE used
 - Think before ordering: avoid “routine” imaging studies and other tests
- IV access
 - Recommend placement of PICC line early in clinical course to facilitate IV access, lab draws
- After intubation, place arterial line given potential for rapid development of hemodynamic instability.
- If patient does not have a PICC line, place central venous line at this time.

16

Non-invasive management of respiratory failure

- **Recommend early intubation** when requiring higher amounts of oxygen
 - HFNC/NIPPV may not prevent intubation but rather delay it, with potential for worse
 - Initial NIPPV may in particular yield worse outcomes (unpublished data from Italy)
- **Open systems may increase droplet dispersion** (risk to HCW) with poorly fitting interface
 - Proceed with early intubation if deteriorating respiratory, hemodynamic, or mental status to avoid emergent procedure
- Adequacy of resources (ventilators) may be a factor in some circumstances

17

Special considerations

- Patients who are DNI
 - - Keep flows **for HFNC <30L/min**; may trial increased FIO2/flow and consider transition to
- comfort measures if failing for those who are DNI
- Ventilatory failure as predominant pathophysiology – e.g. COPD exacerbation
 - - Use closed expiratory circuit mask/device with HEPA filter and ensure good mask seal
- CPAP – use by Helmet may further decrease aerosols (Not available at VA)
- Use airborne precautions if on HFNC or NIPPV
 - - **Negative pressure room**
 - - PAPR or N95s for staff

18

When and how to intubate

- Early intubation – e.g. once requiring >6L NC
- Avoid bag mask ventilation
- Maximize pre-oxygenation with NC, simple FM, or non-rebreather
- RSI with video laryngoscopy by most experienced provider
- Preferred PPE: PAPR with shroud, gown, and gloves that extend over gown cuffs

19

ARDS management: LPV

- Low tidal volume ventilation with 4-6 cc/kg of ideal body weight
 - Up to 8 cc/kg allowed* if needed for breath stacking, dyssynchrony
- Remember, IBW is based on HEIGHT and sex, not actual weight
- Keep plateau pressures <30*
- Target Spo2 92-96%
- Start with standards ARDSnet PEEP ladder
- Consider high PEEP strategy for more severe ARDS
 - Particularly with low compliance, recruitable lung
- Monitor hemodynamics – MAP may drop (decreased venous return-> cardiac output)

20

ARDS Management continued

- **Proning** for moderate-severe ARDS for 12-16 hours a day recommended per SCCM
 - guidelines for care of critically ill patient with COVID-19
- Severe ARDS (P:F <150 mm Hg), PEEP of ≥ 0.6 , PEEP of ≥ 5 cm of water, and TV of 6 cc/kg of IBW¹
- Incorporate staff expertise, time, resources (use of PPE), and staff exposure in risk/benefit ratio
- Reports of high compliance ARDS – high PEEP and proning may not be as beneficial
 - Possible role of inhaled pulmonary vasodilators (e.g., Flolan)
- Neuromuscular blockade not of benefit in general in ARDS
 - May be used in cases with severe/refractory hypoxemia, hypercarbia, or ventilator dyssynchrony
- Conservative fluid management and diuresis

1. Guerin et al. NEJM 2013; 368:2669-68
2. SCCM Guidelines for Care of the Critically Ill COVID-19 Patient

21

Monitoring for and treating cardiovascular complications

- Consider baseline TTE to document cardiac function given risk for COVID-19 cardiomyopathy: **Especially in COVID-19 intubated patient**
 - Daily EKG, particularly if on hydroxychloroquine +/- azithromycin
 - Monitor daily troponin, BNP
- Troponin elevation is common, potentially due to:
- Myocardial injury or MI (type I plaque rupture vs. type II, stress)
 - Stress cardiomyopathy - Viral cardiomyopathy
- Increasing troponin and CK or decreasing ScvO2 could indicate development of cardiomyopathy/myocarditis
 - Can appear late in the course, even after patients are recovering from ARDS
 - May respond to dobutamine

22

Other systems affected

- Renal: AKI not related to any hemodynamic or volume status/early ATN
- Liver: Mild transaminitis
- Heme: Elevated D-Dimer – consideration of anticoagulation (Italy)
- Neurologic: **Marked encephalopathy with agitation and high sedation**
- requirements has been observed (encephalitic component?) (Emory)
- Pulmonary recovery has preceded neurological recovery
- SAT to tolerate SBT is rate limiting step
- Avoid/minimize use of benzodiazepines: **Propofol shortage!**
- **-skin, pressure ulcers, restraints, critical illness weakness**

23

Therapies ? This has changed every week ☺

Stage 1 “Early infection”

- - Supportive care

• Stage 2 “Pulmonary phase”

• Stage 3 “Hyperinflammation phase”

- NIH recommends against using hydroxychloroquine out side of clinical trials!
- buzz around Remdesivir just FDA approved
- steroids? IVIG? Again what is the evidence?

24

Considerations

- Limited family presence
- Code protocols
- Palliative care
- Rehabilitation
- Tracheostomy
- Is it fact or an opinion
- Goal directed therapies
- Stigma
- Testing
- Self care

25

Comprehensive Approach to reducing burnout and emotional symptoms

re·sil·ience:

the ability to bounce back when faced
with stress or pressure.

26

THANK YOU FOR ALL YOU DO!!



27