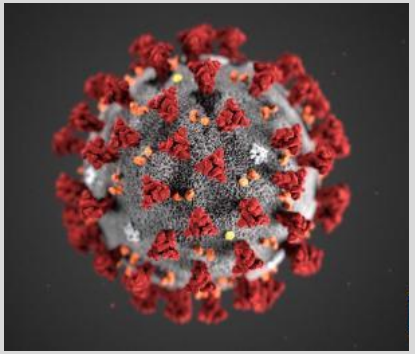
COVID-19: Clinical Best Practices in Physical Therapy Management



HOSTS:

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PRESENTERS:

Heidi Engel, Christiane Perme, Stephen Ramsey, Ellen Hillegass, Angela Campbell

ACADEMY OF ACUTE CARE PHYSICAL THERAPY

CARDIOVASCULAR & PULMONARY SECTION

American Physical Therapy Association

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Housekeeping

- All microphones are muted upon entrance
- Hosts will record your questions & comments
- Audience questions & comments will be shared after all speakers present
- Recording will be available on AACPT, HPA & CVP websites by Monday March 30
- Certificate awarded upon completion of post-webinar survey
- Thank you to

DISCLAIMER

This webinar is intended to educate clinicians. This is NOT A HOW-TO to train inexperienced clinicians to start treating COVID-19 in the acute care setting. The presenters feel strongly that, in general, we should be MINIMIZING our contact with COVID-19 positive patients, as the more bodies that enter these rooms the higher the likelihood of that body becoming a vector spreading the disease between patients, our families, and into the community. The seemingly simple process of donning/doffing PPE poses the biggest risk of transmission. *REPEATED* PPE training, fit testing, and credentialing within your institution is vital.

COVID-19 Pathophysiology Clinical Presentation & Medical Management

Ellen Hillegass, PT, PhD, CCS, FAPTA
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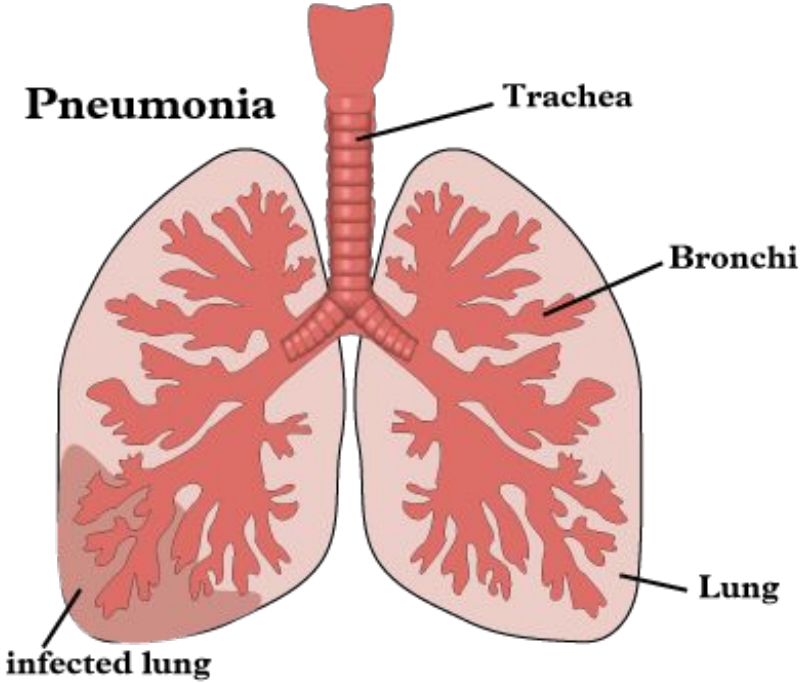
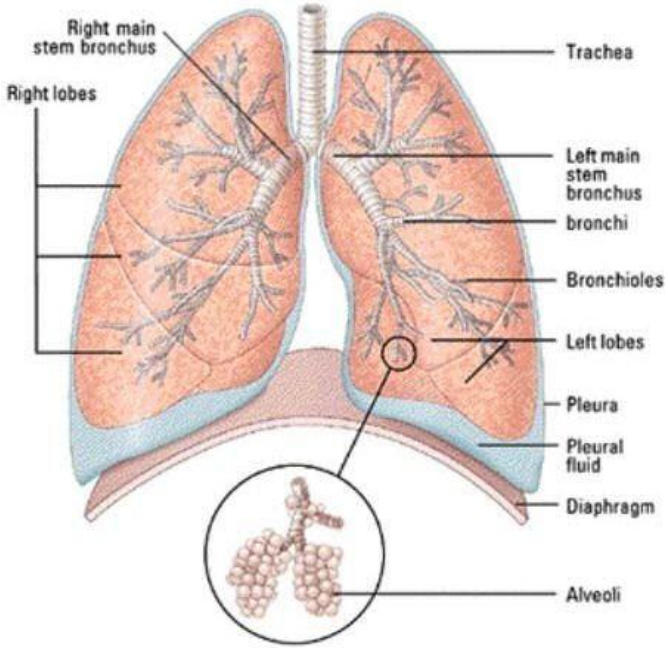
Overview of Pathophysiology and Clinical Presentation

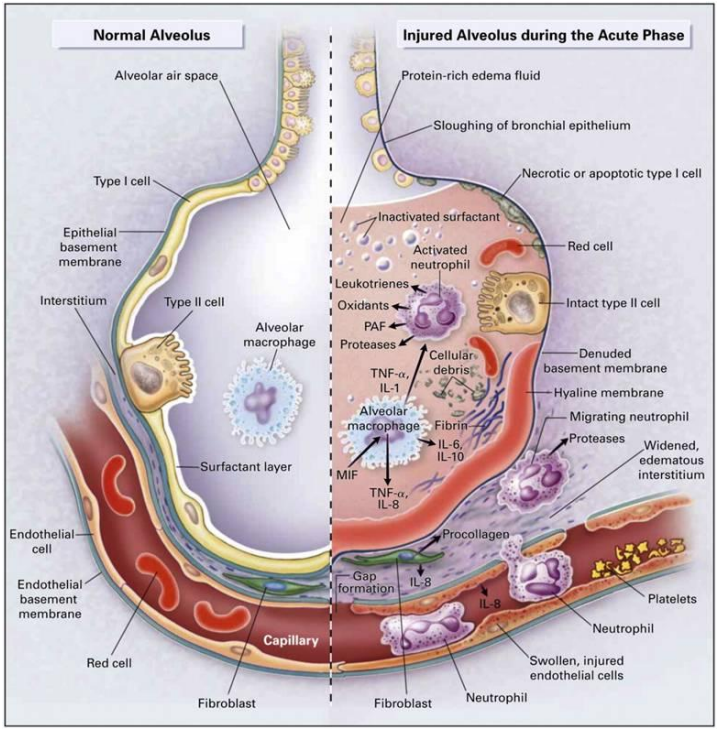
- Pathophysiology: Brief overview of ARDS versus true pneumonia
- Clinical Presentation
  - Patient demographics
  - Symptoms
  - Lab Values
  - CT/CXR
  - Multi-organ involvement
- Cardiac Involvement
  - Myocarditis:
  - lab values,
  - ECG
- Severe Vs Non ICU co-vid

Pneumonia



Acute Respiratory Distress Syndrome





From: Cancer therapy advisor

Symptoms of the Disease

- Common symptoms
  - Dry cough
  - Fever
  - Fatigue
  - Shortness of breath
- Uncommon symptoms
  - Headache
  - Sore throat
  - Nasal congestion
  - Chills
  - Nausea/vomiting/diarrhea

Severe Disease symptoms

High Fever

Coughing up blood

Decreased white blood cells

Kidney dysfunction/ difficulty with urination

From Seattle Intensivist:

Symptoms

- 65-80% **cough**
- 45% **febrile** on presentation (85% febrile during illness)
- 20-40% dyspnea
- 15% URI symptoms
- 10% GI symptoms

CT plus clinical findings

- While CT findings of COVID-19 may be similar to that seen in other viral pneumonias, correlation with clinical symptoms and exposure history is helpful for diagnosis

Symptoms	Coronavirus Symptoms range from mild to severe	Cold Gradual onset of symptoms	Flu Abrupt onset of symptoms
Fever	Common	Rare	Common
Fatigue	Sometimes	Sometimes	Common
Cough	Common* (usually dry)	Mild	Common* (usually dry)
Sneezing	No	Common	No
Aches and pains	Sometimes	Common	Common
Runny or stuffy nose	Rare	Common	Sometimes
Sore throat	Sometimes	Common	Sometimes
Diarrhea	Rare	No	Sometimes for children
Headaches	Sometimes	Rare	Common
Shortness of breath	Sometimes	No	No

Sources: World Health Organization, Centers for Disease Control and Prevention

TABLE 1: Demographic and Clinical Characteristics of Patients With Coronavirus Disease 2019 Pneumonia

Characteristic	Value
Sex, no. of patients/total patients	
Male	39/62
Female	23/62
Symptom, no. of patients/total patients	
Fever	54/62
Coughing and sputum	28/62
Fatigue	14/62
Shortness of breath	15/62
Muscle pain	20/62
Abdominal pain or diarrhea	9/62
Laboratory test finding, no. of patients/total patients	
Leukopenia	6/30
Decreased lymphocyte count	24/30
Decreased percentage of lymphocytes	15/30
Increased ESR	18/27
Increased hs-CRP level	27/27

ACR

doi: 10.2214/AJR.20.22975

COVID 19

CORONAVIRUS DISEASE 2019 (COVID-19)

SYMPTOMS* OF CORONAVIRUS DISEASE

Patients with COVID-19 have reportedly had mild to severe respiratory illness. Symptoms can include

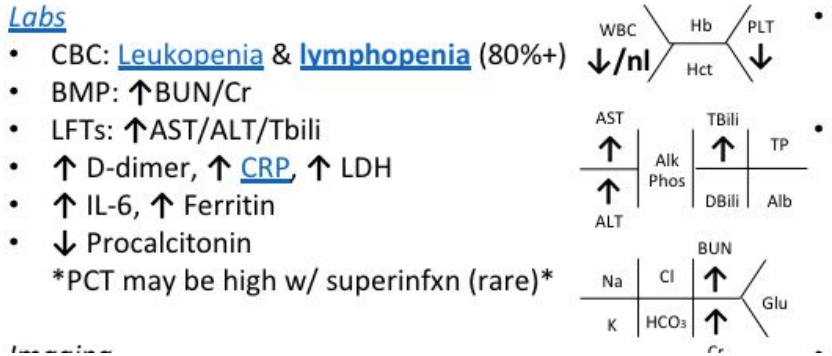
- Fever
- Cough
- Shortness of breath

*** Symptoms may appear 2–14 days after exposure. If you have been in China within the past 2 weeks and develop symptoms, call your doctor.**

www.cdc.gov/COVID19

Lab Values

- Increased C Reactive Protein (CRP)
  - Rises day 3-5, peaks day 14
- Decreased Lymphocytes
  - Decreases throughout first 14 days…lowest day 14
- Decreased Platelets
- Increased BUN/Cr
- Increased LFTs (AST/ALT/Total Bili)
- In typical ARDS we see increased PCT and Lactate…not finding this
- Increased ESR in over 50% patients
- Lab Value Info from Seattle Intensivist



CT/CXR findings

- CXR may be normal; recommend CT scans if possible
  - If abnormal: bilateral peripheral opacities
- CT : Ground glass opacities, crazy paving, consolidation
  - RARELY unilateral

CT findings

Table 3: CT Imaging Findings in 51 Patients with 2019 Novel Coronavirus (2019-nCoV) Pneumonia

Lesions	No. of Patients	No. of Lesions
Pure GGO	39 (77)	395 (30)
GGO with reticular and/or interlobular septal thickening	38 (75)	519 (39)
GGO with consolidation	30 (59)	238 (18)
Consolidation	28 (55)	172 (13)
Air bronchogram*	41 (80)	279
Reticulation*	11 (22)	20
Pleural effusion*	4 (8)	5
Pericardial effusion*	3 (6)	3
Lymphadenopathy*	3 (6)	6

Table 2: Distribution of the Lesions in 51 Patients with 2019 Novel Coronavirus (2019-nCoV) Pneumonia

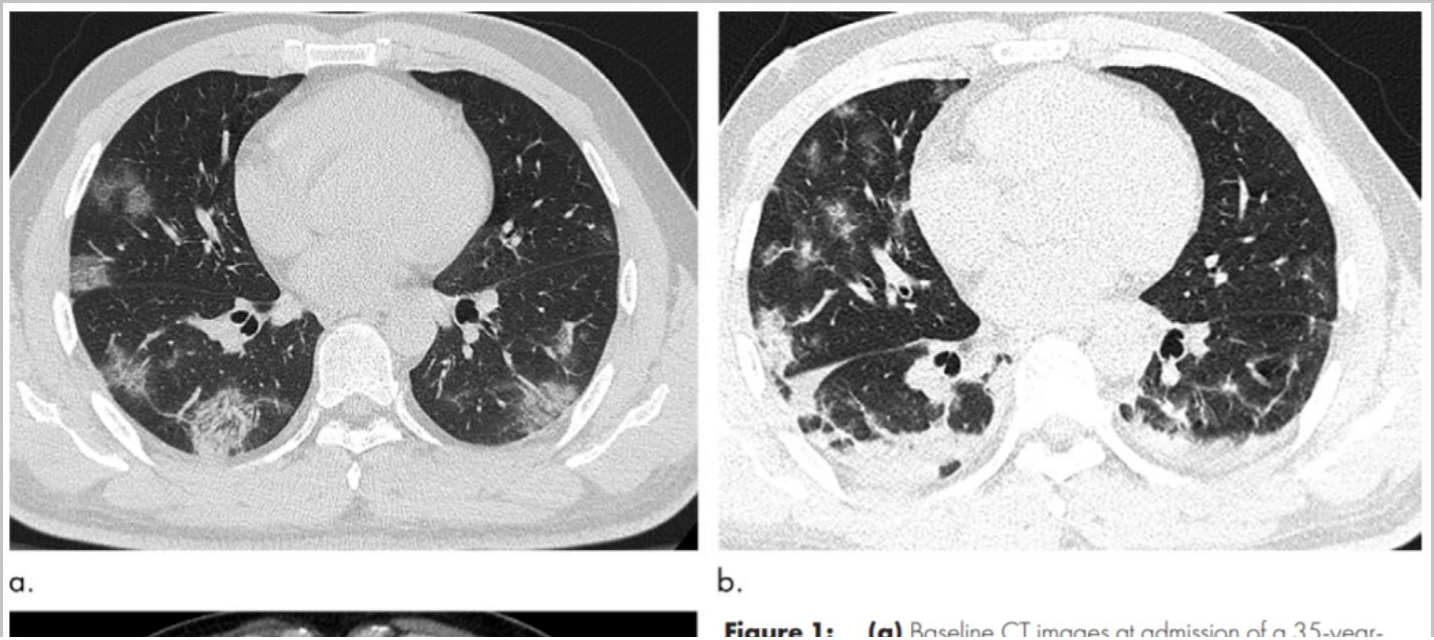
Finding	No. of Patients	No. of Lesions*
Unilateral lung	7 (14)	40 (3)
Bilateral lung	44 (86)	1284 (97)
One lobe	4 (8)	12 (0.9)
Two lobes	8 (16)	64 (5)
Three lobes	6 (12)	54 (4)
Four lobes	12 (24)	276 (21)
Five lobes	20 (39)	918 (69)
Involved lung zones		
Upper lobes	43 (84)	485 (37)
Middle lobe	30 (59)	136 (10)
Lower lobes	46 (90)	703 (53)
Predominant distribution		
Anterior	9 (18)	145 (11)
Posterior	41 (80)	1179 (89)
Peripheral	44 (86)	1198 (91)
Central	5 (10)	42 (3)
Both central and peripheral	1 (2)	84 (6)

Note.—Data in parentheses are percentages.
* Of 1324 chest CT lung abnormalities in 51 patients.

https://doi.org/10.1148/radiol.2020200274

https://doi.org/10.1148/radiol.2020200274

Radiology Ltd.



a.

b.

Figure 1: **(a)** Baseline CT images at admission of a 35-year-

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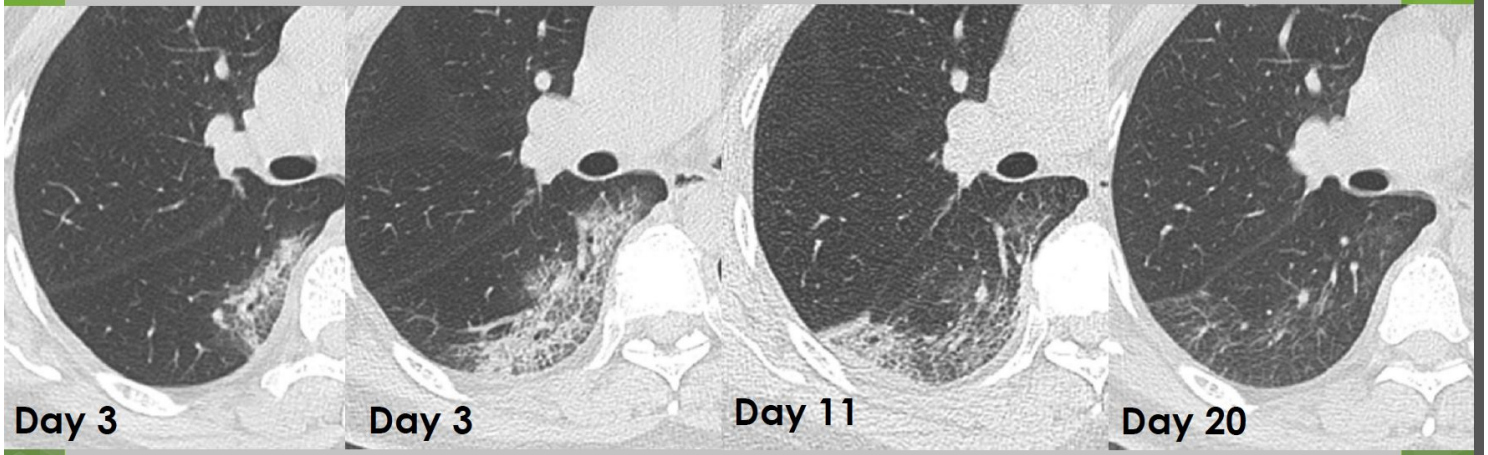
CT findings- progression over time



- **Early stage (0-4 days):** GGO
- **Progressive stage (5-8 days):** more diffuse GGO, crazy paving, early consolidation
- **Peak stage (9-13 days):** peak involvement with dense consolidation; GGO and crazy paving
- **Absorption stage (≥ 14 days):** improvement in consolidation and crazy paving; GGO improved, but may persist beyond 26 days

https://doi.org/10.1148/radiol.2020200370

Covid 19: Principal Feature of Severe Presentation

Development of ARDS: Acute Respiratory Distress Syndrome

ARDS: acute onset HYPOXEMIC respiratory failure with bilateral infiltrates

Infiltrates are NOT necessarily secretions but more leakiness from capillaries.

Guidelines EXIST for management of ARDS as well as Covid19

Conservative fluid strategies without shock

Early antibiotics if suspect bacterial co-infection

Lung protective ventilation (ARDS NET PROTOCOL…Low Tidal Volume Increased PEEP)

Prone positioning

Consideration of ECMO if cannot improve hypoxemia

Formal guidelines: management of acute respiratory distress syndrome

- Papazian L et al, Formal Guidelines for management of acute respiratory distress syndrome *Annals of Intensive Care* **volume 9**, Article number: 69 (2019)
- http://www.ardsnet.org/files/ventilator_protocol_2008-07.pdf
- Griffiths MJD. Guidelines on management of ARDS https://bmjopenrespres.bmj.com/content/6/1/e000420
- Fan et al: https://www.thoracic.org/statements/resources/cc/ards-guidelines.pdf
- http://www.apta.org/PTinMotion/News/2020/03/26/AcuteHospitalCOVIDGuidelines/

Covid: Cardiac Issues

- ACE-2 is the binding site for the CoV- virus and ACE – are found in cardiomyocytes
- Troponin rise common in acute respiratory and also correlated with disease severity
  - Abnormal troponin especially if using high sensitivy assay but does not mean MI…may indicate myositis
  - Hs-cTni significantly elevated in more than ½ patients who died.
- From ACC: **clinicians are advised to only measure troponin if the diagnosis of acute MI is being considered on clinical grounds** and an abnormal troponin should not be considered evidence for an acute MI without corroborating evidence.
- elevation of BNP or NT-proBNP is associated with an unfavorable course among patients with ARDS.
- Use of echocardiography or coronary angiography for COVID-19 patients with myocardial injury or elevated natriuretic peptide should be restricted to those patients in whom these procedures would be expected to meaningfully affect outcome.
- No data exist to suggest benefit from anti-platelet or anticoagulant therapy for those with acute myocardial injury with the exception of those with Type 1 MI.
- The HFSA, ACC, and AHA recommend continuation of RAAS antagonists for those patients who are currently prescribed such agents for indications for which these agents are known to be beneficial, such as heart failure, hypertension, or ischemic heart disease.

- Resources:
  - JAMA Insights: Care for Critically Ill patients with covid 19 by S Murthy March 11 2020
  - www.acc.org

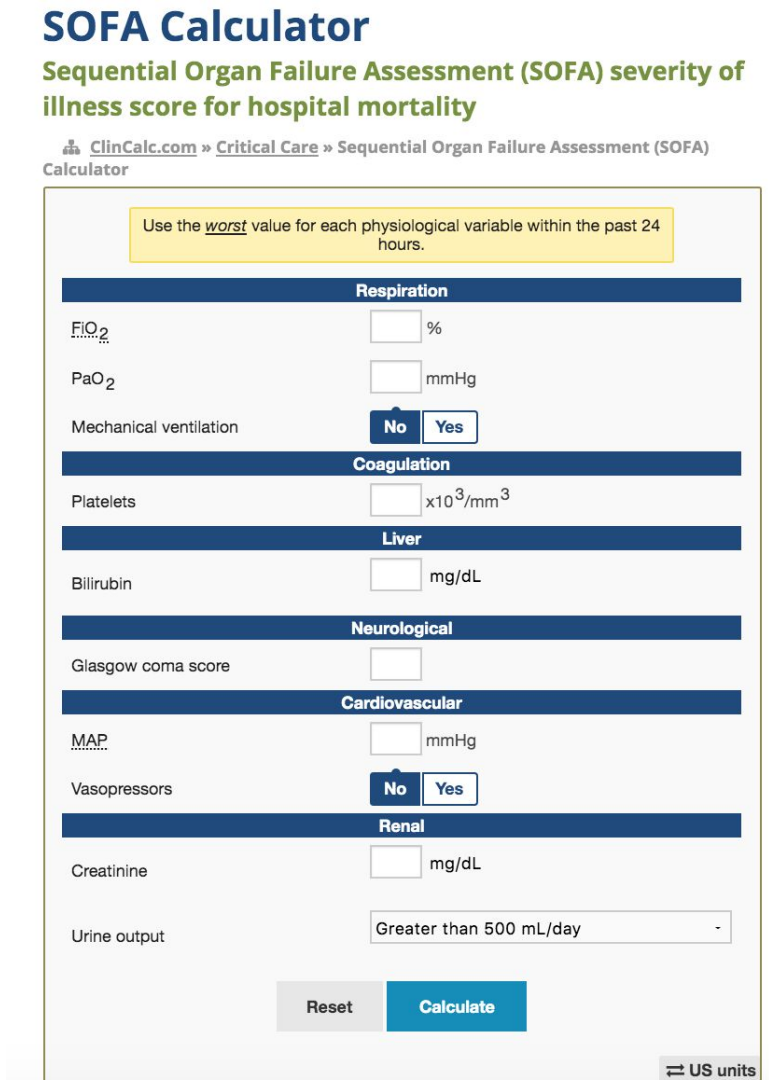
Bottom line on Cardiac Issues from ACC

- If elevations in Troponin, BNP or proBNP look for other documentation of cardiac injury
  - ECG, symptoms, arrhythmias, Echo
- Patients demonstrating heart failure, arrhythmia, ECG changes or cardiomegaly should have echocardiography
- If have evidence of true acute MI (symptoms, ECG, troponins), or evidence of myocarditis and also have history of CVD or angina or high risk for CVD, TREAT like MI..await decreases in troponins and other enzymes, await hemodynamic stability and then MONITOR hemodynamics and symptoms with all activities

Prognosis: SOFA score

https://clincalc.com/IcuMortality/SOFA.aspx

Prognosis related to:
AGE and comorbidities: DM, CVD, COPD
SOFA score
Also lab findings:
Inc Ferritin
Inc D Dimer
Inc Troponin
Inc Myoglobin
Watch for secondary infection: VAP and cardiomyopathy



SOFA Calculator

Sequential Organ Failure Assessment (SOFA) severity of illness score for hospital mortality

ClinCalc.com » Critical Care » Sequential Organ Failure Assessment (SOFA) Calculator

Use the *worst* value for each physiological variable within the past 24 hours.

Respiration

FiO_2 %

PaO_2 mmHg

Mechanical ventilation: No / Yes

Coagulation

Platelets x10^3/mm^3

Liver

Bilirubin mg/dL

Neurological

Glasgow coma score

Cardiovascular

MAP mmHg

Vasopressors: No / Yes

Renal

Creatinine mg/dL

Urine output: Greater than 500 mL/day

Reset | Calculate

US units

Other data from ACC on prognosis

- Case fatality rates for comorbid patients are materially higher than the average population:
- Cancer: 5.6%
- Hypertension: 6.0%
- Chronic respiratory disease: 6.3%
- Diabetes: 7.3%
- Cardiovascular disease: 10.5%

Non Severe CoVID

- FOLLOW DISEASE TRANSMISSION PROTOCOLS AND DO NOT SEE THESE PATIENTS UNLESS TAKE THESE PROTOCOLS AND PREFERABLY LAST PATIENTS OF DAY
- Assess Oxygen status…CoVID is a hypoxemic disease
- Assess cardiac stability: look at ECG, Enzymes, Echo
- Assess hemodynamic stability with activity

ACE inhibitors
ARDS
Airway Clearance
& Covid-19

SPRINGFIELD COLLEGE

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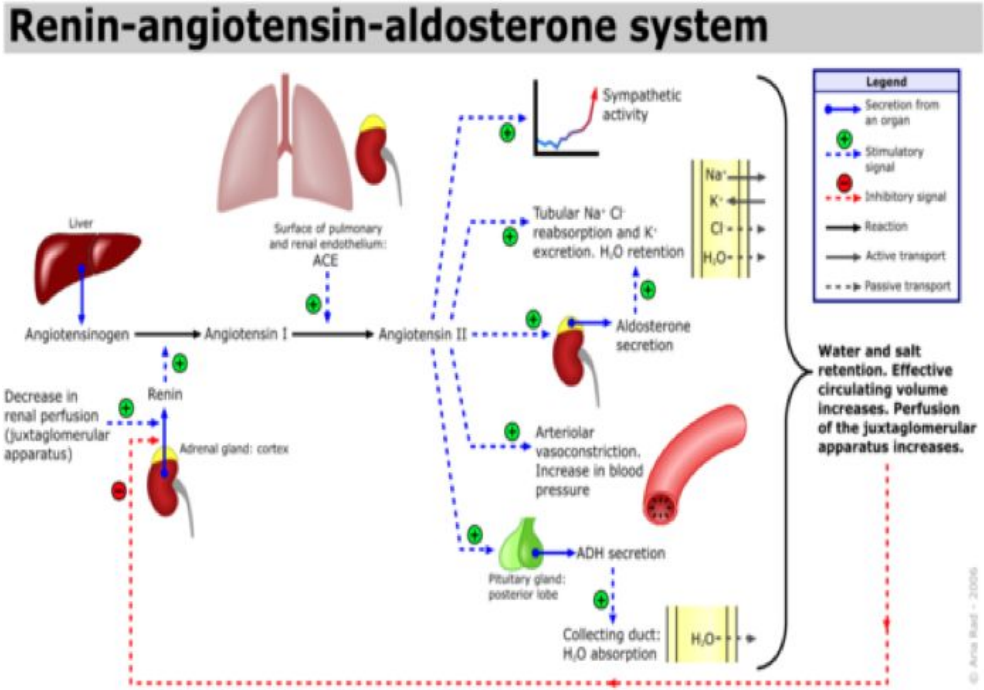
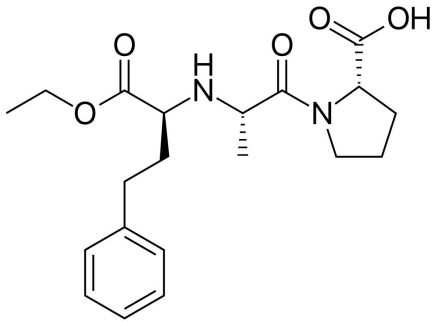
RAAS: Renin-Angiotensin-Aldosterone-System & Covid-19

- ACEi / ARB & Covid19 risk factor?
- Non-productive cough
- ACE2 is Covid-19 co-receptor
- ACE2 receptor upregulation
- ACEi/ARB use in elderly
- ACE genotype



ACE2, ACEi, ARB & Covid-19



- ACEi often drug of choice for HTN in elderly
  - Appears to preserve muscle function/ reduce sarcopenia
- ACE2 receptor upregulation:
  - ACEi/ ARB use
  - Diabetes
  - Ibuprofen/ NSAID use

- AHA/ACC advise patients currently to not stop ACE-/ ARB as research is lacking and clinical anecdotes vary
- Current guidelines recommend acetaminophen for fever reduction in Covid-19, but do not explicitly caution against NSAID use

ARDS: Acute Respiratory Distress Syndrome

- Leading cause Covid-19 mortality
- Subgroup appear to develop cytokine storm
  - Labs: ESR & ferritin
  - Corticosteroids might be indicated
- Mechanical ventilation
  - Minimize barotrauma
  - Moderate to high PEEP
- Prone positioning
- ECMO

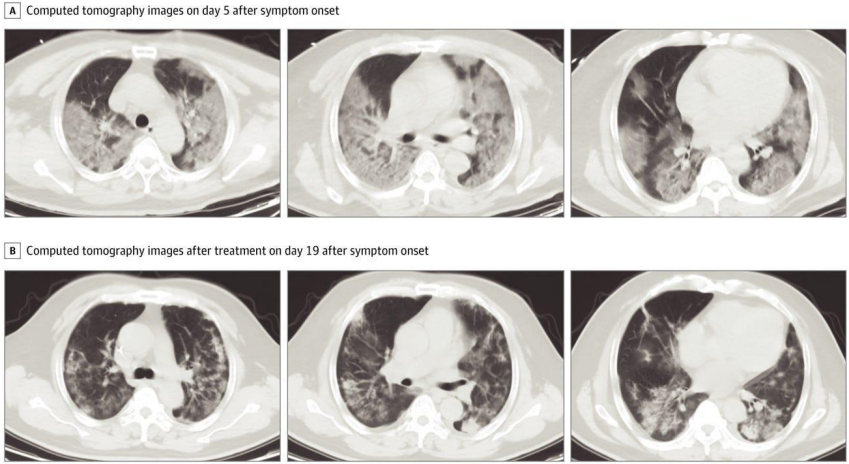
Prone Positioning

- Optimizes gas exchange/ improves oxygenation
- Prone positioning 16-18h
- Ventilated & non-ventilated
- Prone teams
- Sedation (+ inflammation) → CAW/ CIP

Rev Med Hosp Gen Mex. 2018;81:47–58

Airway Clearance Techniques (ACT) for Covid-19?

- Exudate/ excess mucus less common
- Cough & ACT - Aerosol Generating Procedures (APGs)
  - ↑ Risk transmission
  - N95 mask advised
- ACT generally not recommended
  - Unless compelling condition
  - Severe pulm edema (e.g. ARDS) is relative contraindication*



Physiotherapy management for COVID-19 in the acute hospital setting: Recommendations to guide clinical practice

- Multi-national CPG endorsed by APTA, AACPT & APTA CVP (http://www.apta.org/PTinMotion/News/2020/03/26/AcuteHospitalCOVIDGuidelines/)
- Staffing/workforce, screening, PPE, interventions
- “Respiratory physiotherapist” distinction

Thomas P, Baldwin C, Bissett B, Boden I, Gosselink R, Granger CL, Hodgson C, Jones AYM, Kho ME, Moses R, Ntoumenopoulos G, Parry SM, Patman S, van der Lee L (2020): Physiotherapy management for COVID-19 in the acute hospital setting. Recommendations to guide clinical practice. Version 1.0, published 23 March 2020

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HOUSTON Methodist LEADING MEDICINE

COVID-19: Considerations for Mechanical Ventilation

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COVID-19: Oxygenation Strategies

- **Clinical considerations:** Understand the spectrum of disease severity:
  - Asymptomatic infection: 80%
  - Mild upper respiratory illness:15%
  - Severe viral pneumonia with respiratory failure and/or death: 5%
- What is the SpO2 target?
  - **Recommendation: SpO2 92-96%**

Thomas P et al. (2020): Physiotherapy management for COVID-19 in the acute hospital setting. Recommendations to guide clinical practice. Version 1.0, published 23 March

COVID-19: Can intubation be avoided by High-flow nasal cannula (HFNC) and non-invasive positive pressure ventilation (NIPPV) ?

➔ **Recommendation: Avoid HFNC/NIPPV for patients with ARDS!**

➔ **General consensus at this point suggests HFNC/NIPPV:**

- May delay but not avoid invasive ventilation in patients with rapid progression of disease
- May be used in selected patients in early stages and milder forms of acute hypoxemic respiratory failure
- May increase the risk of viral transmission

COVID-19: Common ventilator settings for patients with ARDS

- **Recommendation: Patients should be managed with lung-protective strategies to minimize ventilator injury (ARDSnet)**
- **Ventilation:**
  - Tidal volume (Vt): 4-6 ml/kg predicted body weight
  - Plateau pressures (Pplateau) < 30 cmH2O
  - RR: 16-24 (May increase to 35 as needed if acidosis present)
  - Mode of ventilation: Volume Control (AC/VC)
- **Oxygenation:**
  - PEEP: Moderate to high levels as needed
  - FiO2: 100% on intubation, rapidly wean to SpO2 92-96%

COVID-19: Physical Therapy considerations for patients on mechanical ventilation

- ➔ Able to clearly understand:
  - ◆ Severity of illness in ICU
  - ◆ Medical management of the patient
  - ◆ Difference between “ early mobility”, “ early physical therapy”, and ‘early rehab” in ICU
  - ◆ Importance of a “safety screen” prior to any physical therapy intervention
  - ◆ Absolute and relative contraindications for out of bed activities
  - ◆ Interdisciplinary collaboration

COVID-19: Can we implement simple strategies for early mobility/exercise in ICU which can be used and sustained for every patient...every day... in any ICU in the world?

- **Early Mobility:**
  - Every patient in ICU gets out of bed at least once/daily, EXCEPT the ones who should not be out of bed!
- **Early exercises:**
  - 100 leg lifts/day!
  - 100 arm lifts/day!

COVID-19:Take home messages

- ➔ Mobility and exercise MUST be a priority in the plan of care for every patient in ICU!
- ➔ Early mobility and exercise in ICU is everyone's job!
- ➔ Prevention of muscle weakness in ICU is much better than any treatment currently available!

COVID-19: Resources for clinicians with limited ICU experience

- Hodgson CL et al. **Expert consensus and recommendations on safety criteria for active mobilization of mechanically ventilated critically ill adults**. Crit Care. 2014 Dec 4;18(6):658 PMID:25475522.
- Perme C, Chandrashekar R. **Managing the patient on Mechanical Ventilation in ICU: Early Mobility and Walking Program.** Acute Care Perspectives. Spring 2008, Vol 17, Number 1, 10-15.
- Perme C, Chandrashekar **R. Early mobility and walking program for patients in intensive care units: creating a standard of care.** Am J Crit Care. 2009 May; 18(3):212-21. PMID: 19234100.

COVID-19: Resources available

- **ICU Liberation Bundle (ABCDEF)**
  https://www.sccm.org/ICULiberation/ABCDEF-Bundles
- Devlin JW et al. **Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU. Crit Care Med**. 2018 Sep;46(9):e825-e873.PMID: 30113379.
- Thomas P et al. (2020): Physiotherapy management for COVID-19 in the acute hospital setting. Recommendations to guide clinical practice. Version 1.0, published 23 March
- STAT Pearls/NCBI Bookshelf: **Ventilator Management** - https://www.ncbi.nlm.nih.gov/books/NBK448186/
- Society of Critical Care Medicine: **Critical Care For Non- ICU Clinicians** - https://www.sccm.org/covid19

Extracorporeal Membrane Oxygenation (ECMO) for Novel COVID-19

Stephen Ramsey PT, DPT

Board Certified Specialist in Cardiovascular and Pulmonary Physical Therapy

Outline

- Review of ECMO
- Use of ECMO in recent Pandemic/Epidemics
- Use of ECMO in ARDS
- Evidence regarding mobilization of patients on ECMO
- Current/existing evidence for the use of ECMO for COVID-19
- Considerations for the role of PT for ECMO patients with COVID-19
- Suggested Strategy for PT involvement for ECMO patients with COVID-19

What is ECMO?

- ECMO (ECLS) is the use of mechanical devices to support heart and/or lung function in severe heart or lung failure, unresponsive to optimal conventional care.
- Works by draining blood from the body (venous system) into a pump that directs the blood through the membrane lung (oxygenator) and back into the patient.
- In the membrane lung exists a network of thousands of small hollow fibers made of a material that allows diffusion of oxygen(O2) and carbon dioxide (CO2) across a gradient. Oxygen is diffused into the blood, and CO2 is extracted out. The blood is returned to a venous circulation, arterial circulation, or both. [1]

Types of ECMO[1]

VenoVenous (VV)

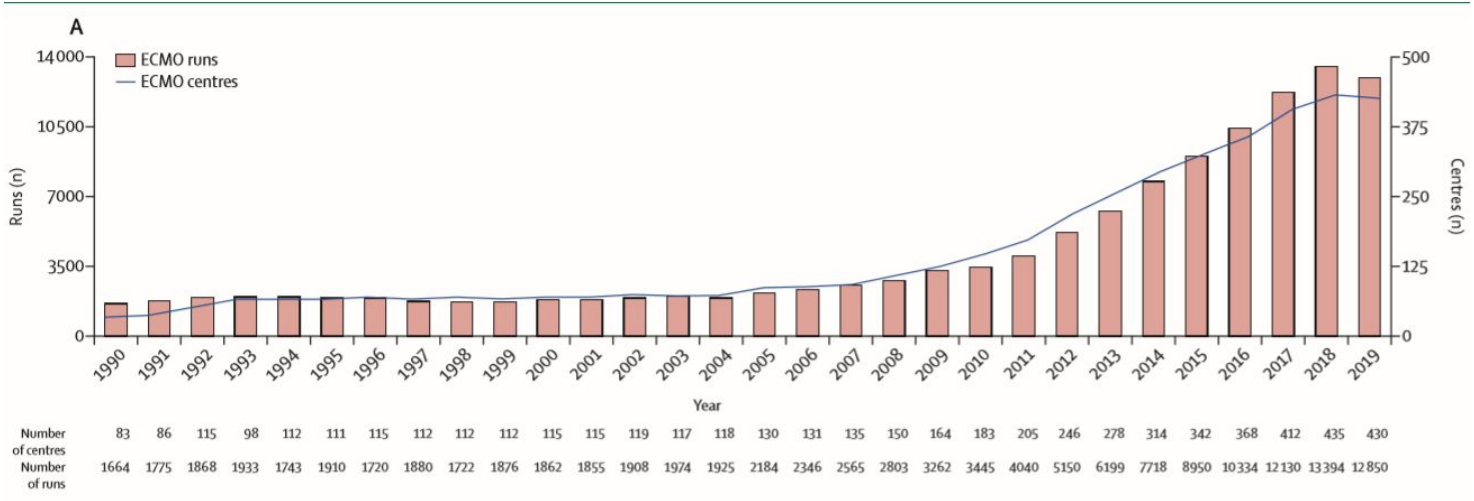
- Drains from vein: Returns to vein
- Functionally bypasses lungs
- Still reliant on native cardiac function for systemic perfusion
- Peripheral saturation of O2 may be low secondary to mixing in venous system with very little oxygenation occurring in native lungs
  - SpO2 as low as 70's at rest.
- **Can "rest" lungs**

VenoArterial (VA)

- Drains from vein: Returns to artery
- Functionally bypasses lungs and heart
- Native CO ↓ as flow through ↑ circuit
- Increases systemic perfusion
- Allows for wean of inotropes/pressors
- **Can "rest" heart/lungs**

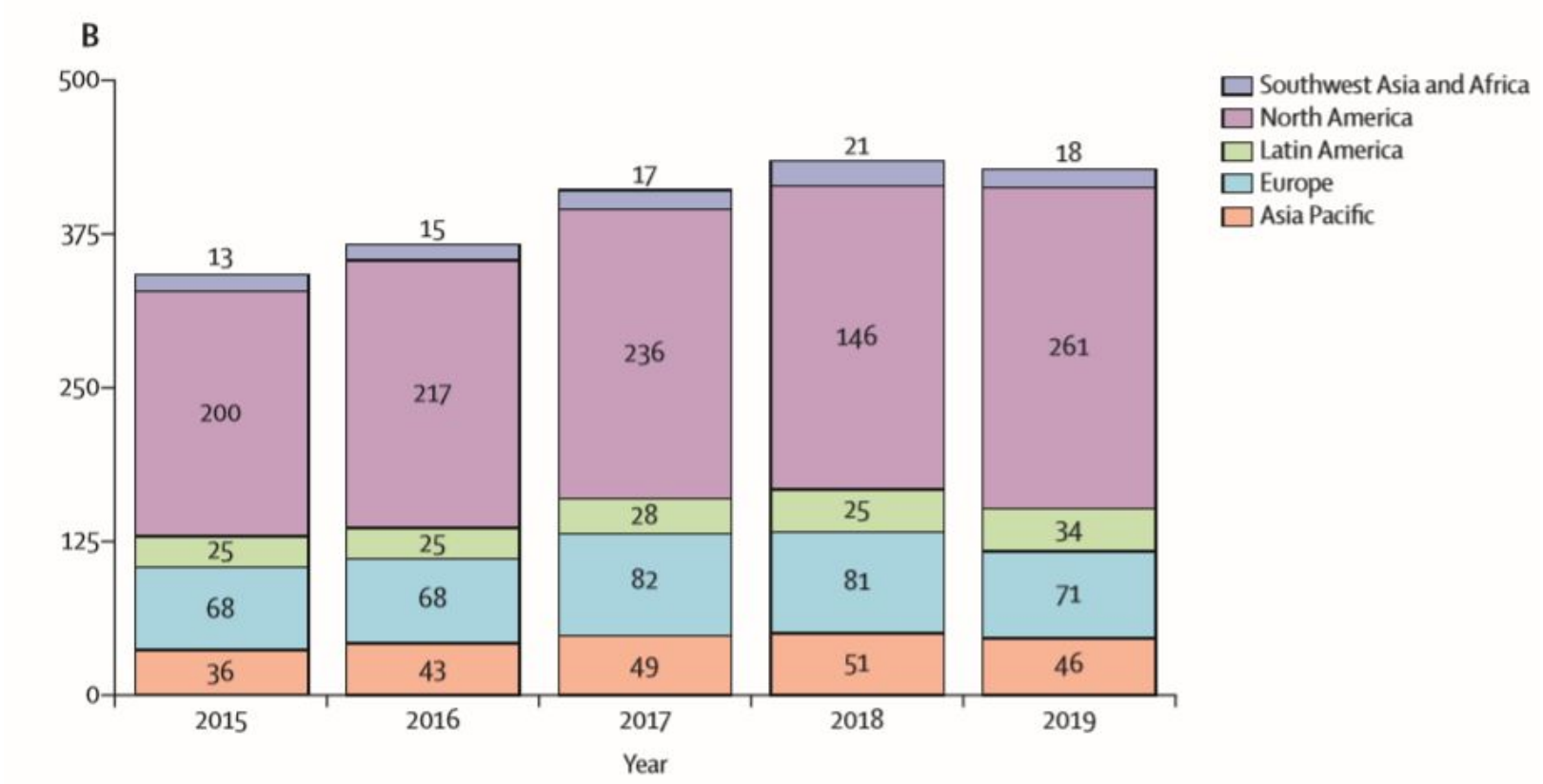
Use of ECMO in Recent Epidemics and Pandemics

- In previous infectious diseases, advanced modalities such as ECMO were used for many patients with severe acute respiratory distress syndrome (ARDS).
- Data from H1N1 [2]- 2009
  - ECMO utilization 2.6%
  - Avg Age: 34 yo
  - Avg duration of ECMO: 10 days
  - Case Fatality Rate 21%
  - ICU Survival 71%[3]
- Data from MERS [4]- 2015
  - ECMO utilization 5.8%
  - Avg duration of ECMO: 8 days



Proliferation of ECMO Programs

Planning and provision of ECMO services for severe ARDS during the COVID-19 pandemic and other outbreaks of emerging infectious diseases Ramanathan, Kollengode et al. The Lancet Respiratory Medicine, Volume 0, Issue 0



Planning and provision of ECMO services for severe ARDS during the COVID-19 pandemic and other outbreaks of emerging infectious diseases Ramanathan, Kollengode et al. The Lancet Respiratory Medicine, Volume 0, Issue 0

ECMO for ARDS

- CESAR Trial[5]: 63% disability-free survival at 6 months in 90 patients who were randomized to receive ECMO
- EOLIA Trial[6]: Early ECMO showed no significant difference in 60 day mortality when compared to control group (ventilator, NMB, prone therapy). Did show:
  - Lower relative risk of treatment failure 0.62 (95% CI, 0.47 to 0.82; P<0.001)
    - Treatment failure was defined as death by day 60 in patients in the ECMO group, and as crossover to ECMO or death in patients in the control group
  - Lower risk of Renal replacement therapy (RRT) at day 60 (50 vs. 32 days; median difference, 18 days; 95% CI, 0 to 51)
  - Underwent less prone position therapy

Mobilization of Patients on ECMO

- Growing pool of data regarding safety and feasibility of mobilization of both VV and VA cases, with various cannulation techniques.
- Safety/feasibility
  - VV: International Survey of 209 ECMO centers[7]
    - 84% of centers mobilize patients. Just over 40% initiated PT within 72 hours of cannulation.
    - 22% of centers reported routine ambulation
  - VA: Small retrospective cohort studies [8-9]
    - Successful ambulation with femorally placed VA ECMO with no adverse events.
- Outcome Data
  - Decreases in mechanical ventilation days, ICU and total hospital length of stay in patients participating in PT while awaiting lung transplantation. [10]
  - Possible association between mobilization and decreased overall hospital mortality. [11]

COVID-19

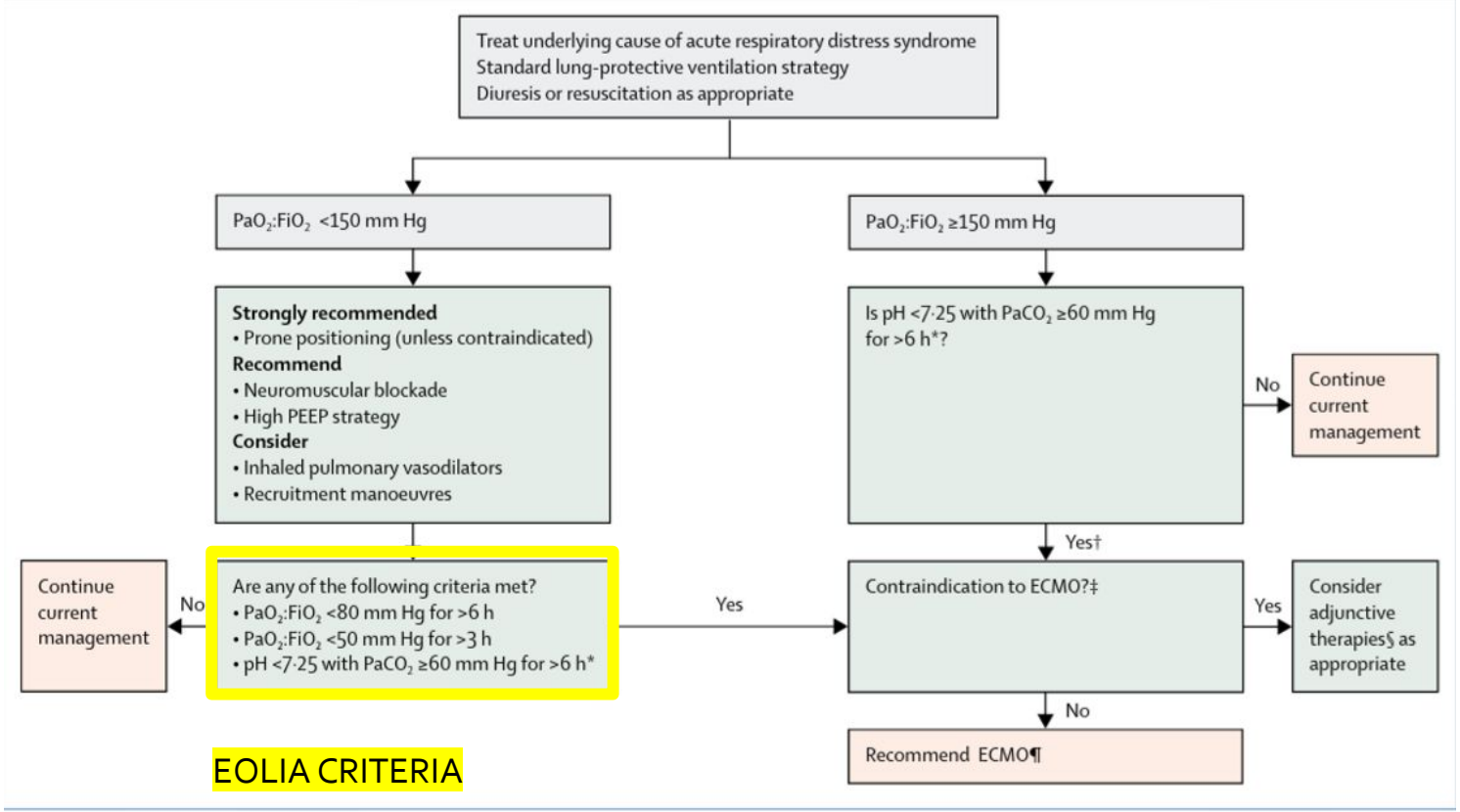
- The pathological features of COVID-19 greatly resemble those seen in SARS and Middle Eastern respiratory syndrome (MERS) coronavirus infection. [12]
- Disease that leads to increase in capillary vascular permeability. Protein rich edema escapes from plasma into interstitial space and subsequent alveolar (epithelium and endothelium) injury.
  - 15-30% of cases develop ARDS
    - 4-15% mortality amongst ARDS group

Recommendations for ECMO in COVID-19

- Disclaimer: This is a highly dynamic situation. No one truly knows if ECMO is the right answer!
- WHO: Interim guidelines for the management of suspected COVID-19 recommend administering venovenous (VV) ECMO to eligible patients with COVID-19-related acute respiratory distress syndrome (ARDS) in expert centers with sufficient case volumes to ensure clinical expertise. [13]

Recommendations for ECMO in COVID-19

- Use pre-existing Criteria for candidacy
  - Use of EOLIA?
- What about the patients who develop cardiac dysfunction?
  - VA or VAV ECMO may be indicated



EOLIA CRITERIA

ELSO Guidance Document: ECMO for COVID-19 Patients with Severe Cardiopulmonary Failure

Recommendations for ECMO in COVID-19

- In inexperienced Centers: ECMO is not a therapy to be rushed to the front lines when all resources are stretched during a pandemic.
- Summary: ECMO may have a role in the management of some patients with COVID-19 who have refractory hypoxemic respiratory failure. However, much about the virus is unknown, including the natural history, incidence of late complications, viral persistence, or the prognoses indifferent subsets of patients.[14]

Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study

Fei Zhou*, Ting Yu*, Ronghui Du*, Guohui Fan*, Ying Liu*, Zhibo Liu*, Jie Xiang*, Yeming Wang, Bin Song, Xiaoying Gu, Lulu Guan, Yuan Wei, Hui Li, Xudong Wu, Jiuyang Xu, Shengjin Tu, Yi Zhang, Hua Chen, Bin Cao

- 3/9/20
- N 181 (28% total mortality)
  - 31% developed ARDS (93% mortality)
    - Avg onset 12 days
  - 23% HF (64% mortality)
  - 20% septic Shock (100% mortality)
    - Avg onset 9 days
  - **3 on ECMO**
    - **No survivors**

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges

Chih-Cheng Lai[a], Tzu-Ping Shih[b], Wen-Chien Ko[c], Hung-Jen Tang[d], Po-Ren Hsueh[e,f,*]

[a] Department of Internal Medicine, Kaohsiung Veterans General Hospital, Tainan Branch, Tainan, Taiwan
[b] Department of Family Medicine, Kaohsiung Veterans General Hospital, Tainan Branch, Tainan, Taiwan
[c] Department of Medicine, College of Medicine, National Cheng Kung University, Tainan, Taiwan
[d] Department of Medicine, Chi Mei Medical Center, Tainan 71004, Taiwan
[e] Department of Laboratory Medicine, National Taiwan University Hospital, National Taiwan University College of Medicine, Taipei, Taiwan
[f] Department of Internal Medicine, National Taiwan University Hospital, National Taiwan University College of Medicine, Taipei, Taiwan

- 2/11/20
- N 278 (8.5% mortality)
  - 20% developed ARDS
  - 9 total on ECMO (3.2%)

JAMA Internal Medicine | Original Investigation

Risk Factors Associated With Acute Respiratory Distress Syndrome and Death in Patients With Coronavirus Disease 2019 Pneumonia in Wuhan, China

Chaomin Wu, MD; Xiaoyan Chen, MD; Yanping Cai, MD; Jia'an Xia, MD; Xing Zhou, MD; Sha Xu, MD; Hanping Huang, MD; Li Zhang, MD; Xia Zhou, MD; Chunling Du, MD; Yuye Zhang, BD; Juan Song, BD; Sijiao Wang, BD; Yencheng Chao, MD; Zeyong Yang, MD; Jie Xu, MD; Xin Zhou, MD; Dechang Chen, MD; Weining Xiong, MD; Lei Xu, MD; Feng Zhou, MD; Jinjun Jiang, MD; Chunxue Bai, MD; Junhua Zheng, MD; Yuanlin Song, MD

- 3/13/20
- N 201 (21% total mortality)
  - 41.8% developed ARDS (52.4% mortality)
  - **1 total on ECMO**

Available Data for ECMO in Italy

- 1500 ICU admissions in Italy as of 3/20/20, 5 patients received ECMO, 30% proned on NMB.
- Awaiting outcome date

Adapted from Webinar: "Preparing to Support Patients COVID-19 patients on ECMO"

Available Data for ECMO in Japan/Korea

- Seeing a slightly younger population. More ECMO utilization than China.
- >50 COVID19 cases reported on ECMO, with survivors, with many still receiving treatment.
  - Japan: 20 patients as of 3/10.
  - Limited capacity, only 300 circuits in all of Japan!
  - Using judiciously
- Awaiting full data reports any day and anticipate this will guide recommendations for ECMO going forward

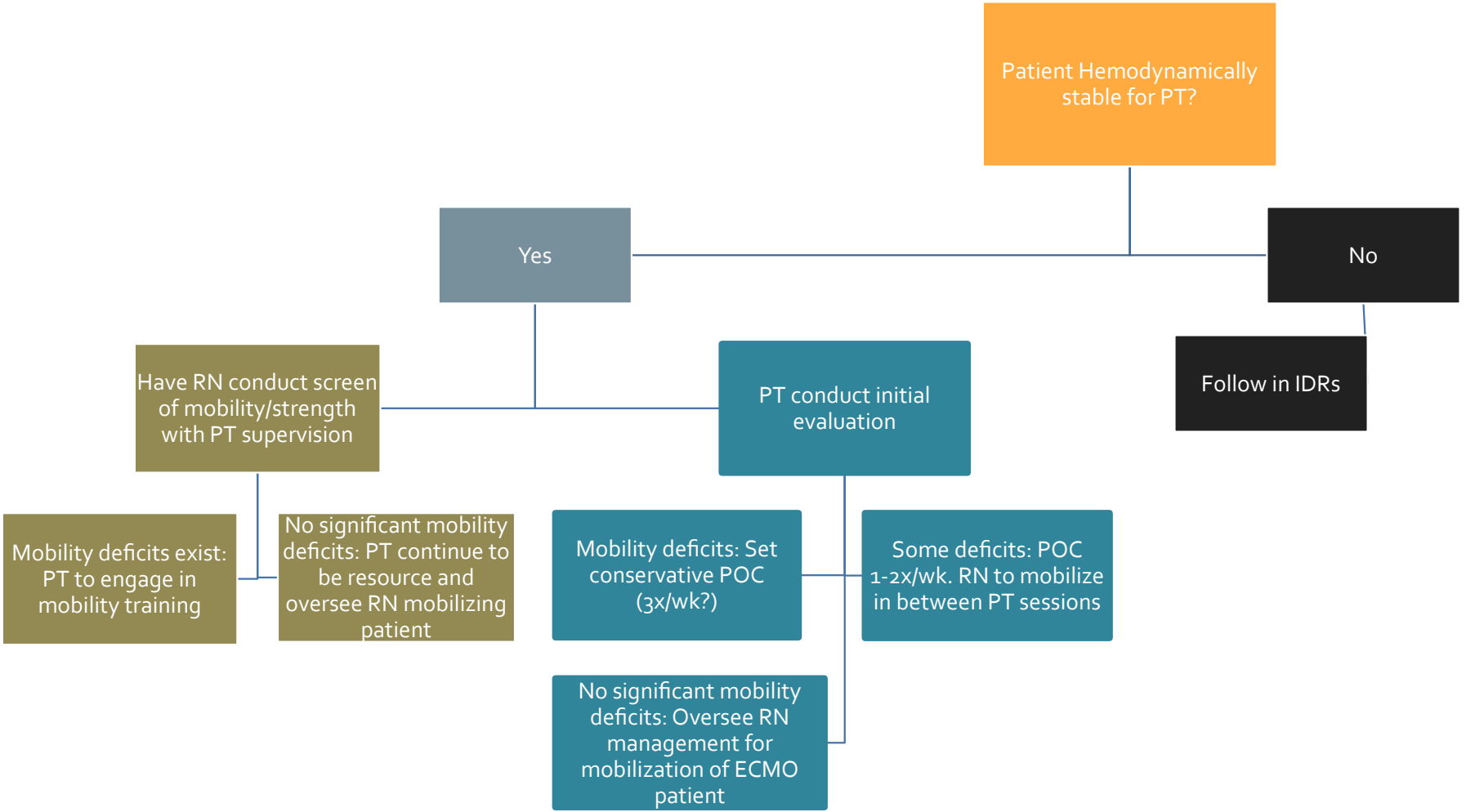
Adapted from Webinar: "Preparing to Support Patients COVID-19 patients on ECMO"

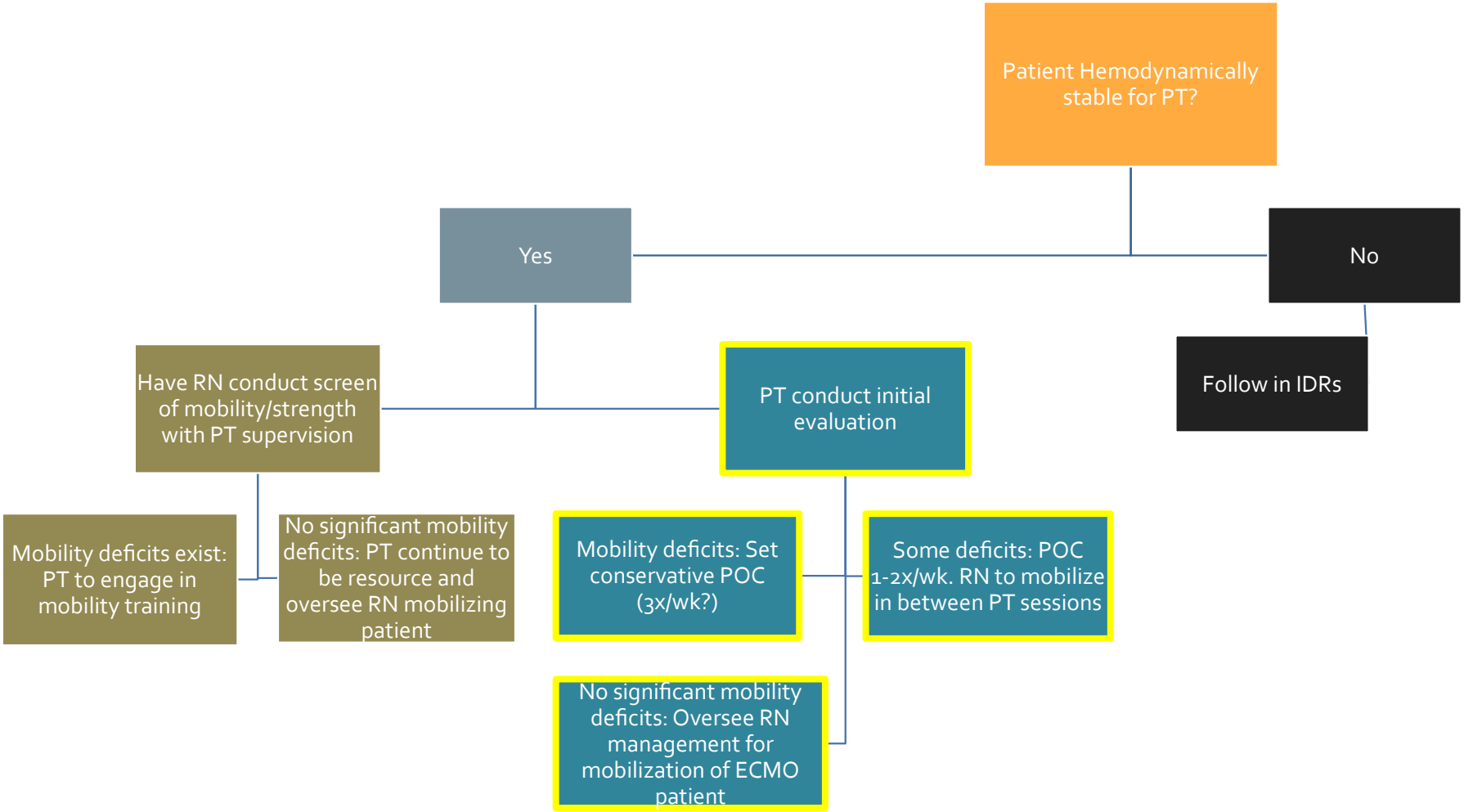
Available Data for ECMO in US

- ELSO Registry data: 40 patients on ECMO with confirmed COVID-19
  - This is only registered centers who are reporting currently
  - Likely much more
- “If these epicenters of infection occur in sophisticated health care systems with preexisting ECMO programs, this will provide vital information about the utility of ECMO and help anticipate global demand. “
- “Should the initial experience be encouraging, it is likely that non-ECMO centers will refer early to ECMO centers in anticipation of impending clinical deterioration. This will disproportionately affect hospitals with ECMO programs, even when ECMO is not required.[14]

Considerations for Mobilization in COVID-19

- Resource management
  - PPE
    - Could be a daily assessment based on your facility's supply
- Heavy staff burden
  - Often requires RN, Perfusion, +/- RT
  - Do I feel comfortable possibly going in with skeleton crew?
- Pathophysiology of disease
  - Will mobility help?- Probably
  - Are ACT/AGP indicated?- Maybe not
- What can we delegate in our attempt to conserve resources?
  - Do we always have to be in room touching patient?
  - What about standing at door and directing care?


Patient Hemodynamically stable for PT?
Yes
No
Follow in IDRs
Have RN conduct screen of mobility/strength with PT supervision
PT conduct initial evaluation
Mobility deficits exist: PT to engage in mobility training
No significant mobility deficits: PT continue to be resource and oversee RN mobilizing patient
Mobility deficits: Set conservative POC (3x/wk?)
Some deficits: POC 1-2x/wk. RN to mobilize in between PT sessions
No significant mobility deficits: Oversee RN management for mobilization of ECMO patient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12. Pathological findings of COVID-19 associated with acute respiratory distress syndrome. Xu, Zhe et al. The Lancet Respiratory Medicine, Volume 0, Issue 0
13. Planning and provision of ECMO services for severe ARDS during the COVID-19 pandemic and other outbreaks of emerging infectious diseases Ramanathan, Kollengode et al. The Lancet Respiratory Medicine, Volume 0, Issue 0
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Acute Care Physical Therapy with COVID-19

UCSF Health

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Goals for Physical Therapy in Acute Care with COVID-19

- Don’t be a vector of COVID
- Prioritize your list of patients- the COVID negative minimum assist or moderate assist elderly, comorbidity or immunocompromised patients need to get home ASAP
- Understand the complex needs of hospitalized COVID + patients, be holistic, creative, comprehensive

COVID Overview UCSF School of Medicine You Tube Channel

Jennifer Babik, MD, PhD

Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Early Release / Vol. 69
March 18, 2020

Severe Outcomes Among Patients with Coronavirus Disease 2019 (COVID-19) — United States, February 12–March 16, 2020

Key Point
Adults ≥65 years are:
- 31% cases
- 45% hospitalizations
- 53% ICU admissions
- 80% deaths

Case Distribution by Age (n=4226)

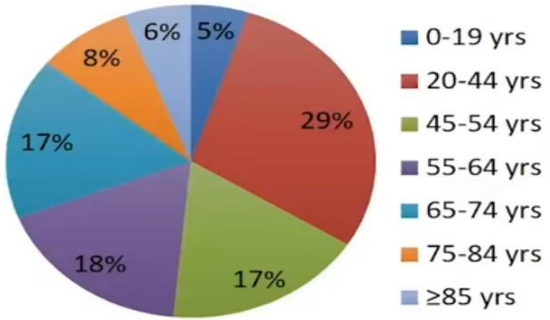

TABLE. Hospitalization, intensive care unit (ICU) admission, and case–fatality percentages for reported COVID–19 cases, by age group — United States, February 12–March 16, 2020

Age group (yrs) (no. of cases)	%*		
	Hospitalization	ICU admission	Case-fatality
0–19 (123)	1.6–2.5	0	0
20–44 (705)	14.3–20.8	2.0–4.2	0.1–0.2
45–54 (429)	21.2–28.3	5.4–10.4	0.5–0.8
55–64 (429)	20.5–30.1	4.7–11.2	1.4–2.6
65–74 (409)	28.6–43.5	8.1–18.8	2.7–4.9
75–84 (210)	30.5–58.7	10.5–31.0	4.3–10.5
≥85 (144)	31.3–70.3	6.3–29.0	10.4–27.3
Total (2,449)	**20.7–31.4**	**4.9–11.5**	**1.8–3.4**

MMWR, March 18, 2020

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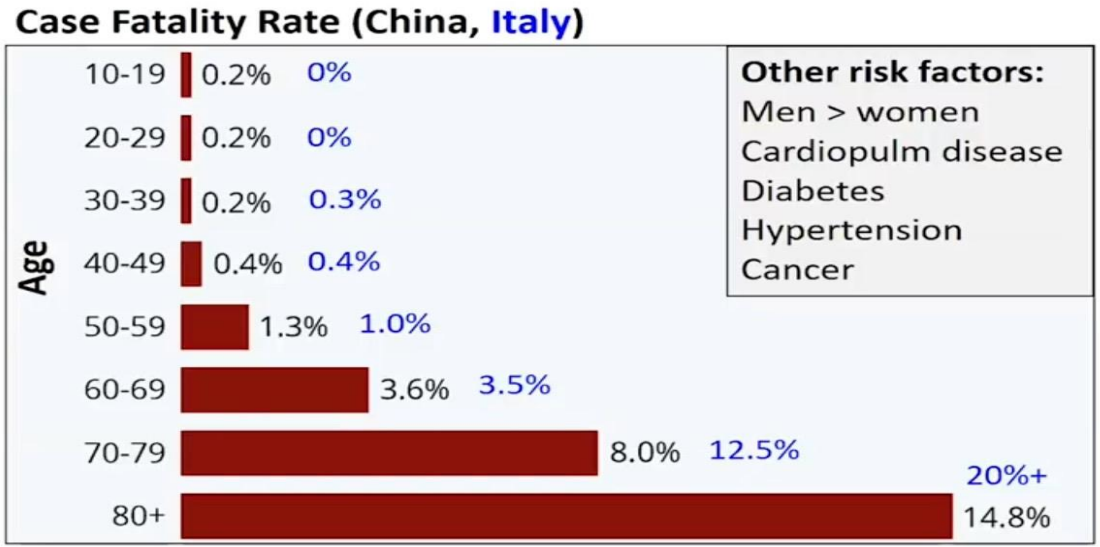
Case Fatality Rates

- Case Fatality Rates
  - 2.3-3.8% in China
  - 7.2% in Italy
  - 0.5% in Korea
- Older age is the main risk factor for death in multivariate analyses



WHO, Feb 2020, China CDC, Feb 2020, Korea CDC, March 2020, Italy Public Health Service, March 2020, Wu et al, JAMA IM; Zhao et al, Lancet

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Clinical Presentation

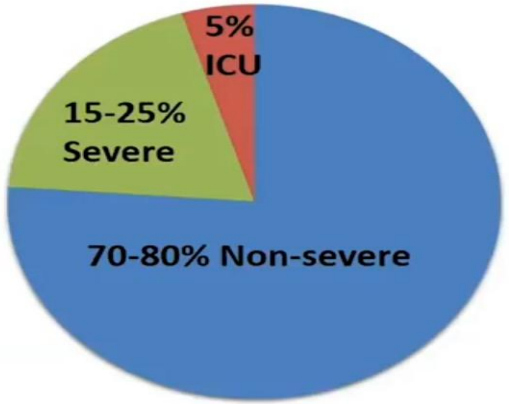
Common Symptoms

- Fever in >75% at some point (~50% on admission)
- Cough 45-80% (dry or productive)
- SOB 20-40%
- Myalgias 10-50%
- Triad of fever, cough, SOB in only 15%

Less Common Symptoms

- URI symptoms (HA, sore throat, rhinorrhea) <15%
- GI symptoms: N/V <10%, diarrhea <25%

Disease Categorization



Huang et al, Lancet; Yang et al, Lancet Resp Med; Xu et al, BMJ; Wu et al, CID; Chen et al, Lancet; Wang et al, JAMA; Yang et al, J Infection; Tian et al, J Infect; Li et al, NEJM; Guan et al, NEJM; Qin et al CID; Zhou et al, Lancet; Ching et al, NEJM; Young et al, JAMA; Tay et al, CID; Lin et al, Sci China Life Sci; Wang et al, CID

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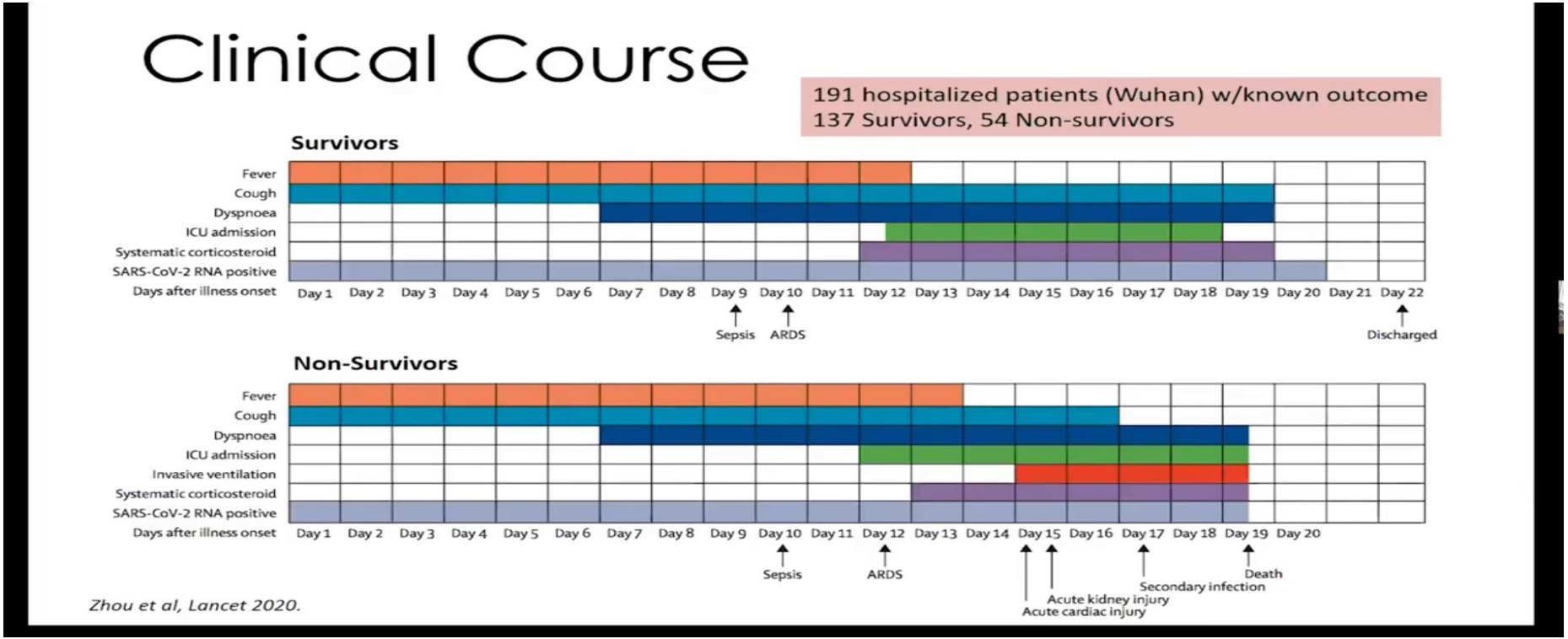
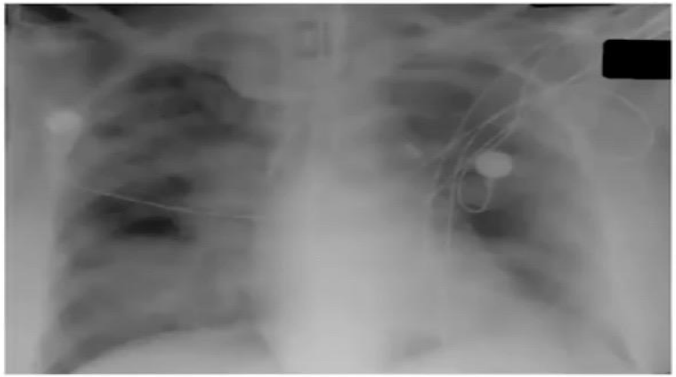
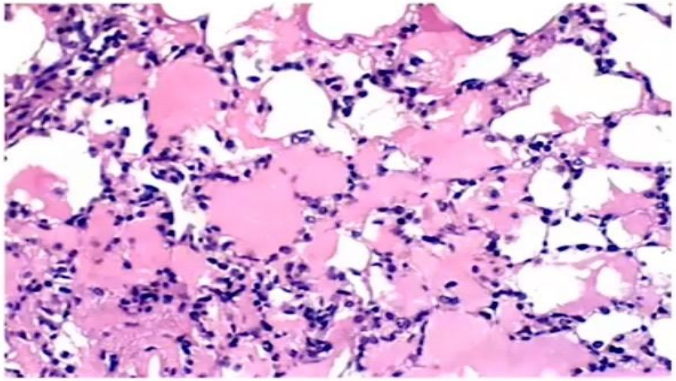


The Acute Respiratory Distress Syndrome (ARDS)





- ARDS is non-cardiogenic protein-rich pulmonary edema
- $Pa0_2/Fi0_2$ < 300 mmHg with bilateral infiltrates (Berlin)
- Approximately 200,000 cases per year in the US
- Mortality - 20-45%, depending on initial degree of hypoxemia
- Clinical disorders - pneumonia, sepsis, aspiration, & trauma

A Work In Progress

- Learning as we go
- Testing problems-
  - 5,000 tests/million Korea
  - 100 test/million USA
  - 25% false negative for swab tests
- Supply chain problems
  - Don/doff infectious problem
- WHO has 392 registered treatment trials
  - Including multi-center studies for close contact prophylaxis

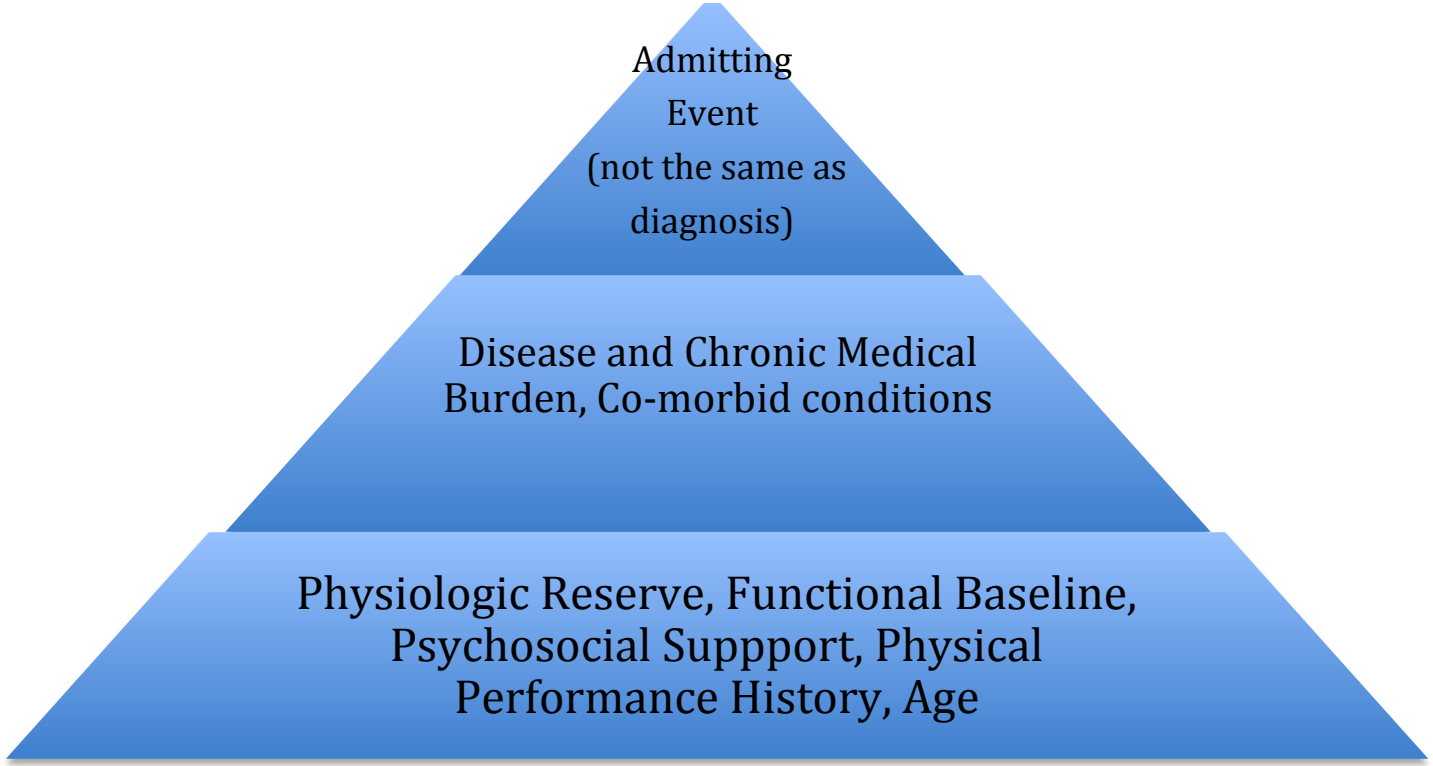
Goals for Physical Therapy in Acute Care with COVID-19

- Don’t be a vector of COVID , geographic contained and flex scheduled assignments

- Prioritize your list of patients- the COVID negative minimum assist or moderate assist elderly, comorbidity or immunocompromised patients need to get home ASAP

- Understand the complex needs of hospitalized COVID + patients, be holistic, creative, comprehensive

When looking at each individual patient, the needs and capabilities of the patient can be assessed as follows:



Acute Patient Needs 1 to 2 weeks

- Isolation Psychosis
- Delirium
- Communication issues
- Dyspnea/Work of breathing
- Fatigue
- Pain
- Disempowered identity
- Fear
- Prevention of eminent muscle wasting

Acute/Chronic Needs~ d 14+

- As inflammatory process increases (and this may be rapid sudden surprising overwhelming onset)
  - Muscle wasting, muscle catabolism, ICU Acquired Weakness (ICUAW)
  - Low endurance
  - Fatigue
  - Pain
  - Depression

After Returning Home

- Restoring the life they knew, reconciling new body with identity, movement as empowerment and understanding

- Moving past the trauma of the hospital stay

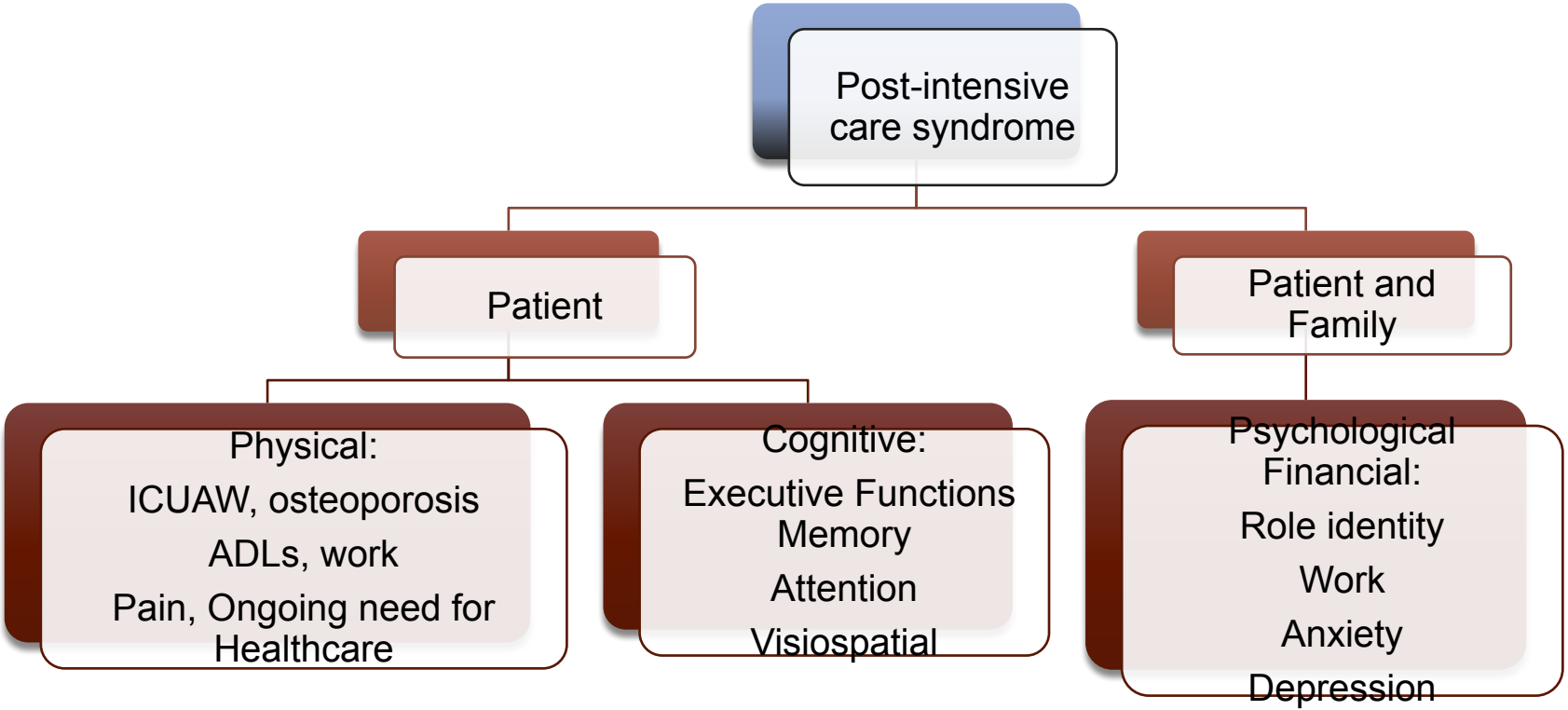
Look to the evidence produced for geriatric, oncology, and endurance athletic populations

Basic physiologic principles still apply

Educate patient and family for long term reconditioning, strength training

Inpatient and Outpatient collaborations, creative home based solutions

PICS: SCCM THRIVE- myicucare.org



Resources available

- Academy of Acute Care Physical Therapy. COVID-19 Resources, Link to March 21, 2020 webinar with APTA Health Policy & Administration Section. https://www.acutept.org/page/COVID19
- American College of Cardiology. ACC CLINICAL BULLETIN COVID-19 Clinical Guidance For the CV Care Team. https://www.acc.org/~/media/665AFA1E710B4B3293138D14BE8D1213.pdf Published 6 March 2020. Accessed 23 March 2020.
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- Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected. https://apps.who.int/iris/bitstream/handle/10665/331446/WHO-2019-nCoV-clinical-2020.4-eng.pdf Published 13 March 2020. Accessed 25 March 2020.