



COVID 19 and Lung Disease

Juantina Johnson, M. D.

Chief Medical Officer

Indian Health Service Nashville Area

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OBJECTIVES

- Discuss Lung Disease Associated With COVID 19
- Review Pathology Seen on Imaging
- Strategies to Prevent Chronic Lung Disease Associated COVID 19
- Discuss evaluation/Followup on Patient with COVID 19



COVID 19 and Lung Injury

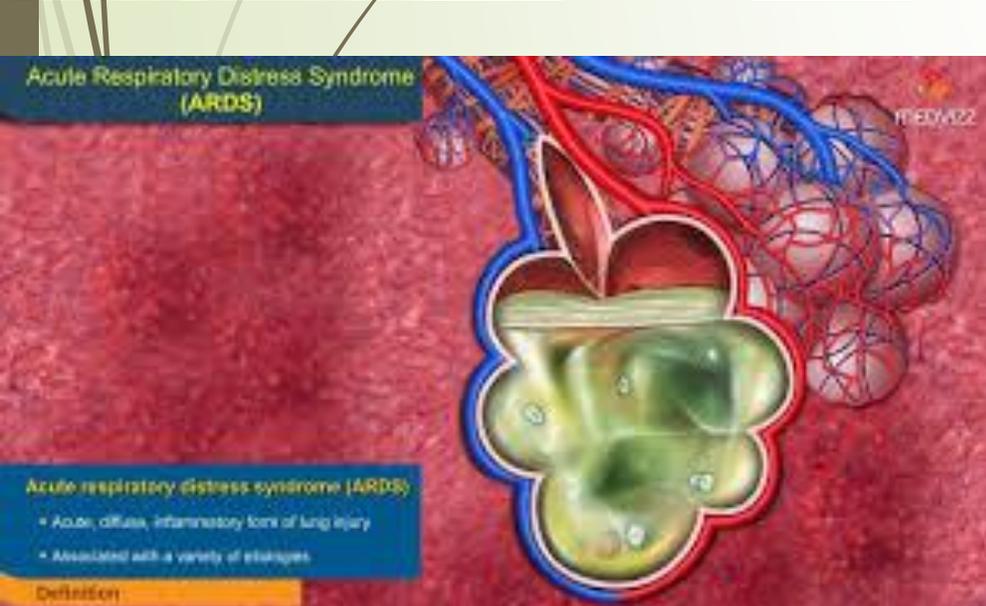
Lung complications such as:

- Pneumonia,
- Acute Lung Injury
- Most severe cases, acute respiratory distress syndrome (ARDS)
- Sepsis, can also cause lasting harm to the lungs



Pneumonia associated With COVID 19

- The airsacs become filled with fluid and inflamed,
- Bilateral process
- Late leading to breathing difficulties
- Respiratory Failure Leading to Ventilatory Support



Primary features of COVID 19 Lung Disease

- ▶ Atypical pneumonia or organizing pneumonia
- ▶ Distribution is typically bilateral, peripheral, and basal
- ▶ Bilateral findings in about 85% of patients
- ▶ 33 - 86% predominantly peripheral and
- ▶ 70 - 80% predominantly posterior





IMAGING OF THE LUNGS



Chest Xray

- **Portable** sufficient in most cases
- **Avoid routine daily CXR** (unlikely to change management, evaluate case-by-case)
- May be initially normal in up to ~30% of hospitalized COVID patients, particularly in early disease



CT Chest

- **Avoid CT of chest unless otherwise indicated:** e.g. for abscess or empyema, or other causes of hypoxemia like pulmonary embolism.
- Often will not change management
- Associated with potentially unnecessary risk (risk to staff of transmission in transit, risk to patient for desaturation in transit)
- Approximately 50% of CT scans are normal up to 2 days after symptom onset



CT Imaging of Lung

- Ground-glass opacification with or without consolidative abnormalities, consistent with viral pneumonia, minimal or no pleural effusions)
- Findings are often initially peripheral and may include a “reverse halo sign”.
- Lung ultrasound include thickening of the pleural line and B lines supporting alveolar consolidation
- Pleural effusions are unusual



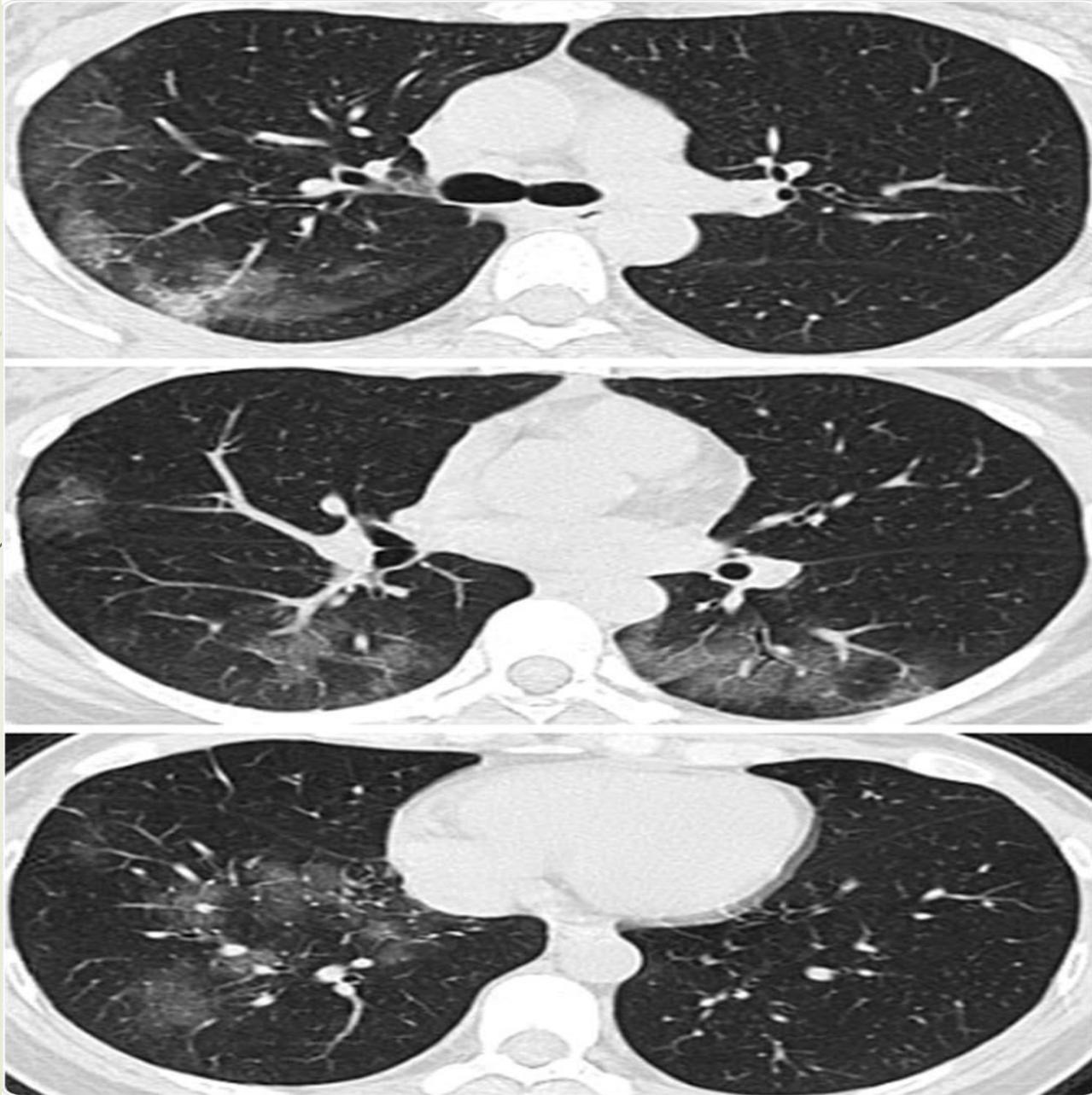
Parenchymal Imaging Findings

- Variable and depend on time course ([Wang, RSNA, 2020](#)):
- **Days 0-5:** 65% pure ground glass opacities (**GGO**), 24% GGOs with intralobular lines
- **Days 6-11:** 40% pure GGOs, 22% pure GGO with intralobular lines, 28% GGO with irregular lines and interfaces
- **Days 12 - 17:** more **consolidations** (38% show “mixed” pattern of consolidation, GGOs, and reticular opacities with architectural distortion).



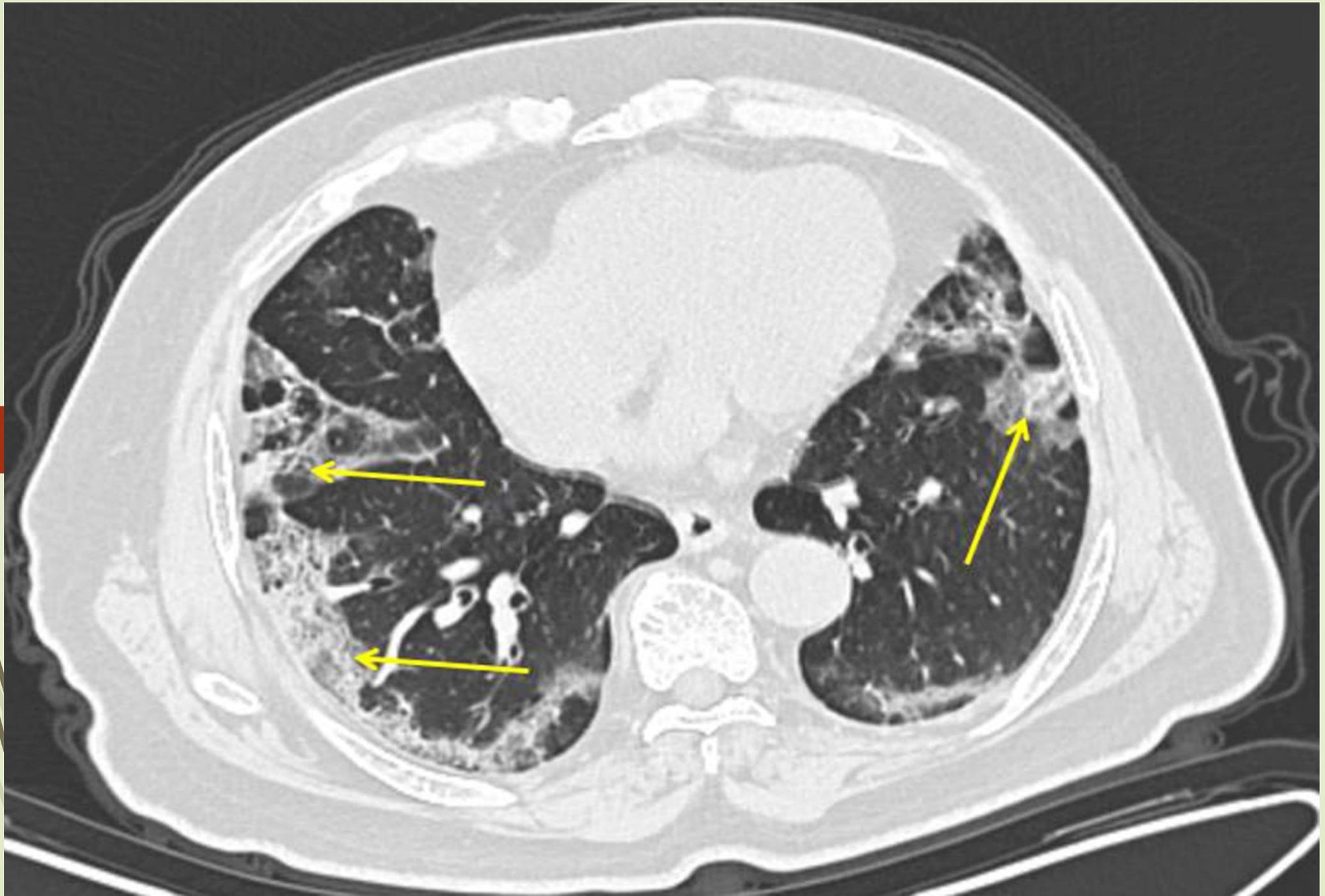
Parenchymal Imaging Findings

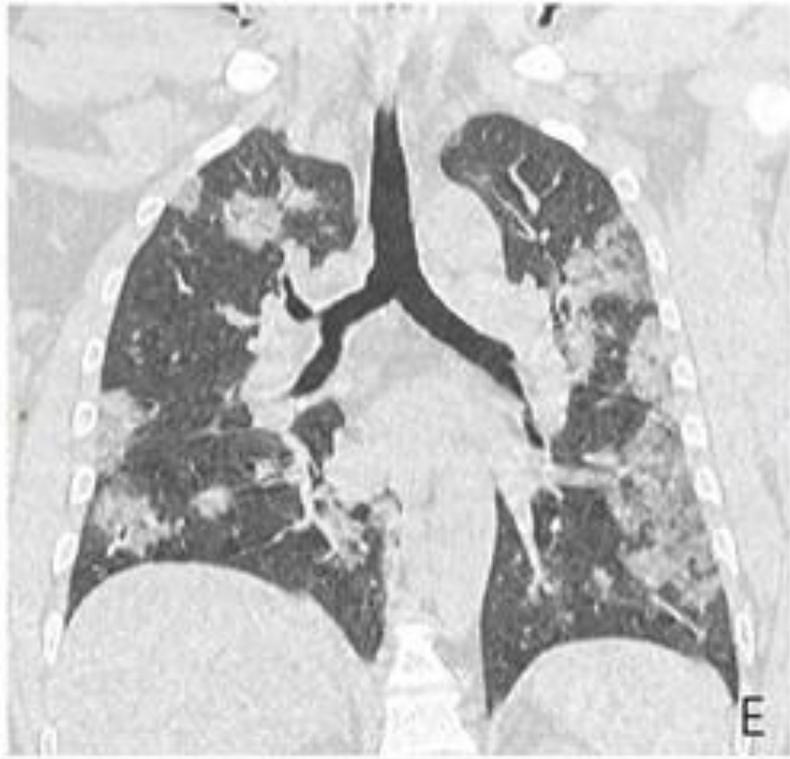
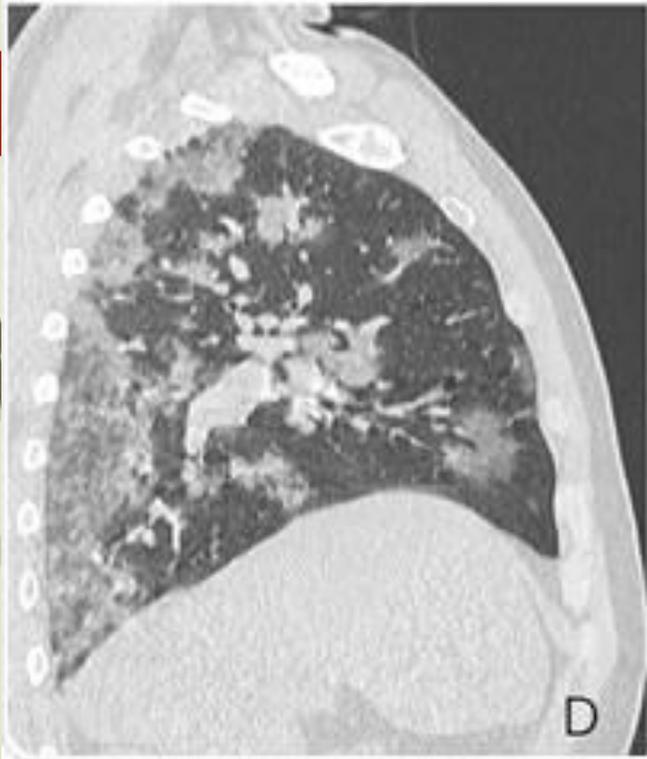
- Late findings may include fibrotic changes
- Small bilateral effusions can be seen in <10% of patients; large effusions are not.
- Large effusions, cavitations, discrete nodules, lymphadenopathy suggestive of another process (e.g. superimposed bacterial infection)



Lung Consolidation







Pathology of Lung on Autopsy

- Most autopsy reports describe hyaline membrane changes and microvessel thrombosis suggestive of **early ARDS** (ie, exudative and proliferative phases of diffuse alveolar damage [DAD])
- Other findings include bacterial pneumonia (isolated or superimposed on DAD) and viral pneumonitis
- Less common findings include acute fibrinous organizing pneumonia , amyloid deposition (heart and lung), and rarely alveolar hemorrhage and vasculitis
- Evidence of pulmonary thrombosis and thromboembolism has been reported





Progression of Lung Disease

- As pneumonia progresses, more of the air sacs become filled with fluid leaking from the tiny blood vessels in the lungs.
- Eventually, shortness of breath sets in, and can lead to acute respiratory distress syndrome (ARDS)
- Patients may require ventilator support
- People who survive ARDS and recover from COVID-19 may have lasting pulmonary scarring



Is Lung Damage Reversible?

- Yes, but not overnight.
- Initial injury is followed by scarring
- It can take three months to a year or more for a person's lung function to return to pre-COVID-19 levels



Three Factors That Affect Coronavirus Lung Damage

- ▶ Three factors that affect the lung damage and how likely the person is to recover and regain lung function:
- ▶ 1. **Disease severity.** mild case, or a severe one.
- ▶ 2. **Treatment:** what kind of care they get, and how quickly
- ▶ 3. **Health conditions:** such as chronic obstructive pulmonary disease (COPD) or heart disease

Note: Older people are also more vulnerable for a severe case (lung tissues may be less elastic, and weakened immunity)



Is Lung Damage Reversible (continued)

- ▶ Patient may be left with permanent lung damage.
- ▶ Growing numbers of people who still have breathlessness and coughing months after illness
- ▶ Chest scans show evidence of irreversible lung scarring.
- ▶ Estimates are as high as one in five who needed intensive care treatment.
- ▶ We have to be prepared in the future to manage these patients

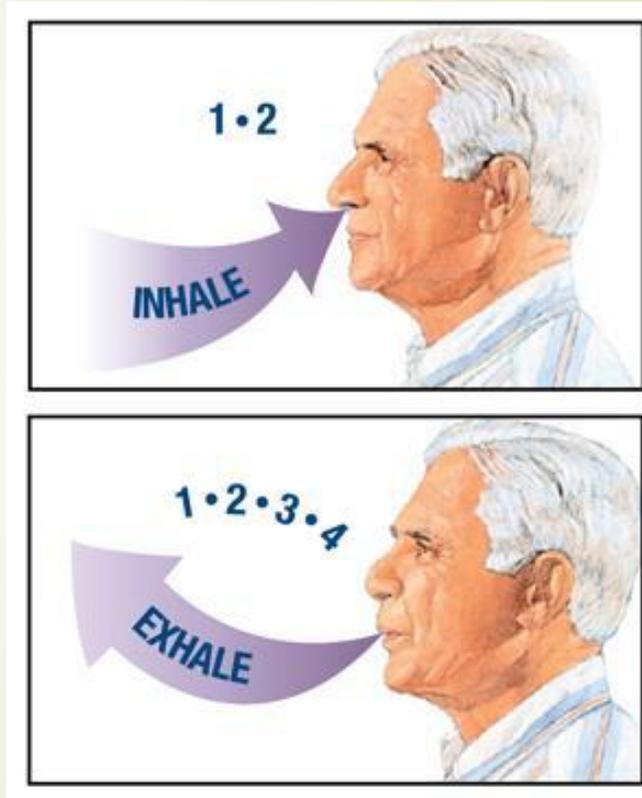


Pathophysiology of Scarring

- Most people have only mild symptoms
- Some have serious lung inflammation and an excess of immune signaling chemicals, leading to a complication called a cytokine storm.
- The inflammation can cause damage and scarring
- If someone is left with scarring, also known as fibrosis, there is no way to reverse it
- We can try to improve their aerobic fitness to compensate for their lower lung function and teach patient to cope with breathlessness

Ways To Improve Patient's Breathlessness

- Lung Volume Expansion
- Proactive Proning & breathing exercises
- Incentive Spirometry if patient is able to perform





Other Causes of Long Term Lung Problems

- Severe covid-19 makes blood more prone to clotting
- Some develop Pulmonary Embolism
- To compensate, new blood vessels grow, but these can be disorganized, leading to high blood pressure in their lungs. (**Pulmonary Hypertension**)

So What Can I Do To Help Ensure My Patient Doesn't End up with Chronic Lung Disease/Scarring?





REMEMBER THIS SLIDE:

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Evaluation of Patient's With COVID 19



Follow-up Visits For PUI or Confirmed COVID 19 Patients

- Follow-up typically via Telephone Call
- Routine follow up for low risk patients: Day 5 of symptoms
- Routine follow up for high risk patients : Day 4, 7, and 10 of symptoms
- Follow-up after discharge from emergency department or inpatient stay: 2 days
- **Note:** More frequent follow up may be needed for patients with **particularly high risk**, concerning symptoms, or concerns about reliability. Always instruct patients to call if worsening or new symptoms.

High Risk Patient Criteria

- Age 65 and older
- Residing in a nursing home, a long-term care facility, a group home, a correctional facility, a dormitory, homeless or with housing insecurity
- Underlying medical conditions:
 - Chronic lung disease or moderate to severe asthma-
 - Significant heart disease-Immunocompromised
 - Morbid obesity (BMI 40 and greater)-Diabetes
 - Chronic kidney disease / ESRD / Coming from a dialysis center
 - Chronic liver disease
 - Psychiatric or substance use disorder





Patient Assessment During Follow-up



Assessment for Dyspnea and Hypoxemia

- ▶ If home pulse oximetry is available, have the patient measure their oxygen saturation.
- ▶ Patients with relative hypoxemia (oxygen saturation < 94%) should be evaluated in-person.
- ▶ Assess whether dyspnea interferes with activities of daily living
- ▶ Assess for tachypnea, tachycardia, cyanosis and use of accessory muscles by asking appropriate questions .



Assessment for Dyspnea and Hypoxemia (continued)

- ▶ Establish trajectory of dyspnea
- ▶ Studies of hospitalized patients indicate that dyspnea, when it occurs, develops 5-8 days into symptomatic illness, with ARDS at 8-12 days.
- ▶ Patient with progressive dyspnea, particularly early in the course of symptoms, requires very close follow up.



Assessment of Mental Status and Function

- Inquire about decline or change in alertness, memory, behavior and attention. Abnormalities in mental status should prompt in-person evaluation.
- Consider doing an abbreviated “Mini Mental Status Exam”
- Patients with recent falls, syncope, near syncope or near falls should be evaluated in-person



Inquire about Chest Pain/Chest Tightness

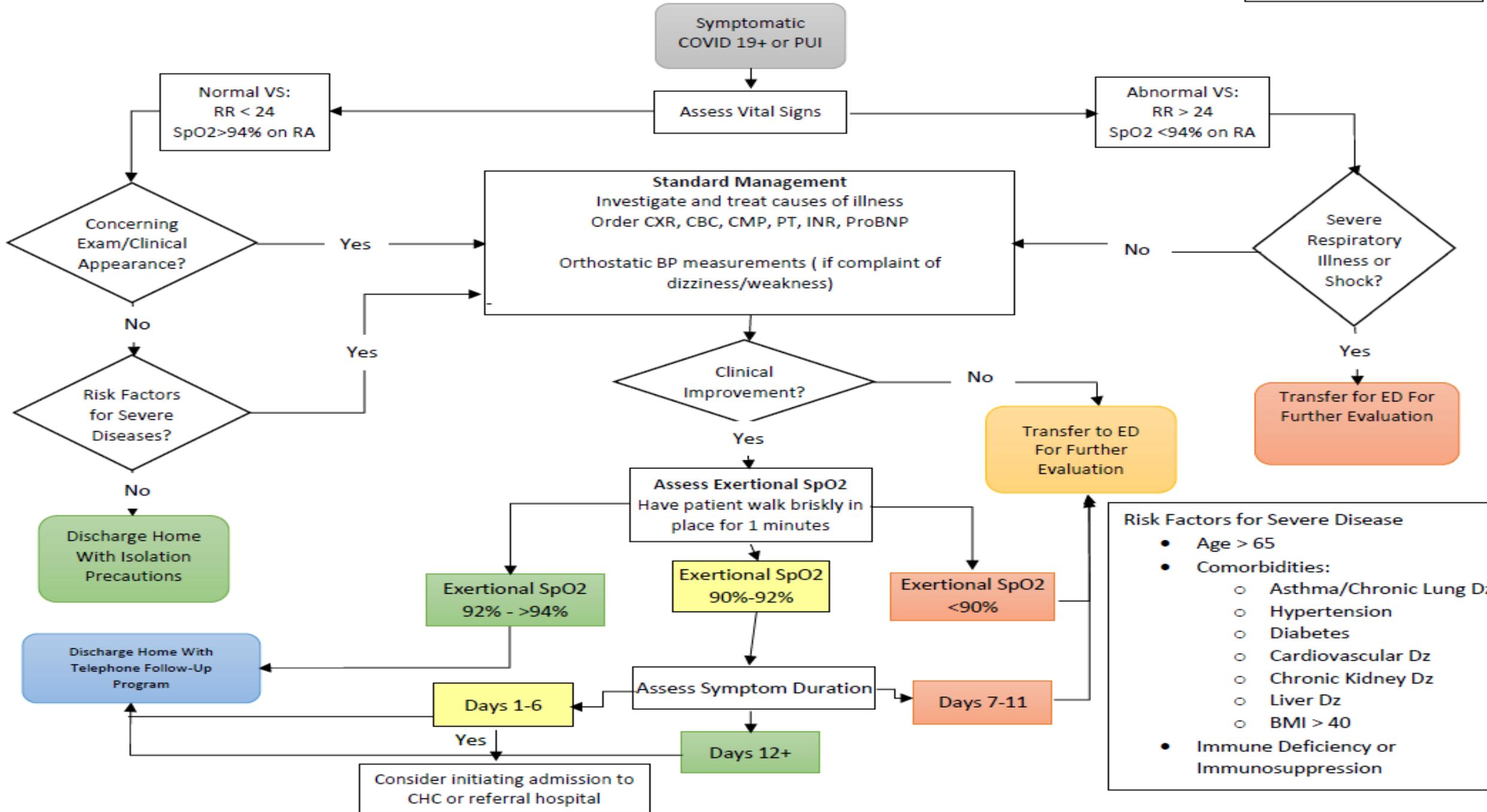
- ▶ Any complaints of chest pain or tightness should prompt in-person evaluation in ED.
- ▶ The high rates of cardiac and thromboembolic complications necessitate rule outs for ACS and PE



In Person Evaluation For Hypoxia

- It is important that patients are ambulated for signs of relative hypoxia with exertion.
- An initial finger pulse oximeter may show oxygen saturation to be in acceptable range, but with ambulation patient's oxygen levels may drop significantly

Disposition Assessment Algorithm



- Risk Factors for Severe Disease**
- Age > 65
 - Comorbidities:
 - Asthma/Chronic Lung Dz
 - Hypertension
 - Diabetes
 - Cardiovascular Dz
 - Chronic Kidney Dz
 - Liver Dz
 - BMI > 40
 - Immune Deficiency or Immunosuppression

How To Use Your Finger Pulse Oximeter



Check your oxygen level a minimum of three times daily. It is easier to remember to check it upon awaking, mid-day, and before bedtime. Normal baseline oxygen levels range from 95 to 100%. Yours is _____. If your oxygen level drops 4 or more points below this number, please contact the clinic at _____ for evaluation and instructions on the next steps or call your call your nearest Emergency Room. If you feel short of breath or have difficulty breathing, call 911 immediately and proceed to your nearest Emergency Room.

FACTS

- A Pulse oximeter is a simple and painless way to measure the amount of oxygen your blood is carrying.
- By using a small device like a *pulse oximeter*, your blood oxygen levels can be checked.
- %SpO2** is the value of your **oxygen saturation level**. For most patients it should be between 95 – 100%. Some patient who have chronic lung and heart disease may have values less than this, but it should always be above 90. If your value is less than 90 or is more than 5 points different than your baseline you should contact your healthcare provider.
- PR** is the value of your **Pulse Rate** or heart rate. This value differs among patients and normally ranges between 60-100. Some patients may have lower pulse rates (athletes and patient on certain blood pressure medications), but any values less than 50 or more than 150 can be concerning and you should contact you healthcare provider for evaluation. Any values significantly different from your baseline values should raise concern and you should contact a healthcare provider.

PROCEDURE

- While in a sitting position, turn on the device. Wait for the display to light up. It will go through calibrations and checks for a few seconds.
- Make sure your hand is at the level of your heart.
- Insert your finger into your device. Most people start with the middle finger, but any finger can be used.
- If you are unable to get a value after adjusting your finger and it has been more than 30 seconds, try another finger.
- To manually check your pulse, place your index and middle fingers on the thumb side of your wrist until you feel a pulse. Count the number of beats in 15 seconds. Multiply this number by 4 to get your beats per minute. *Do not use* your thumb to check your pulse.



- To check the accuracy of the oximeter, manually check your pulse and compare it to your oximeter pulse reading (**PR**). If there is a 5-beat difference, your oximeter likely is not



THANK YOU

QUESTIONS?