

Acute Respiratory Distress

Respiratory Distress:

Amos Charles, MD
Clinical Associate Professor of Medicine
Warren Alpert School of Medicine of the Brown University
Providence Rhode Island.

Waleed Ibrahim-Ali
Assistant Professor of Clinical Medicine
University of Illinois College of Medicine at Peoria

Specific Learning Objectives:

Knowledge:

Subinterns should be able to:

- 1) Recognize the need for an immediate response
- 2) Recognize the causes of acute respiratory distress
- 3) Recognize the symptoms and signs of acute respiratory distress
- 4) Assess the severity of patient condition on clinical presentation
- 5) Know the indications for emergent treatment
- 6) Know the indications for noninvasive mechanical ventilation
- 7) Know the indications for invasive mechanical ventilation
- 8) Initialize treatment to stabilize the patient
- 9) Recognize limitation (know when to request for immediate help from seniors/attendings/fellows/residents)
- 10) Indications for transfer to ICU
- 11) Recognize the diagnosis of acute pulmonary embolism
- 12) Recognize the diagnosis and management of massive pulmonary embolism
- 13) Recognize the diagnosis and management of acute pulmonary edema

Skills:

Subinterns should demonstrate the ability to:

- 1) Rapidly assess the patient's condition
- 2) Develop a management and treatment plan
 - a) create a differential diagnosis
 - b) provide appropriate emergent and supportive care
 - c) able to communicate patient's status with others

Attitudes and professional behavior:

Subinterns should demonstrate:

- 1) Compassion when reporting acute changes in patient's status to family members
- 2) Respect for patient wishes with regard to noninvasive and invasive mechanical ventilation
- 3) Understanding of advanced directives and code status
- 4) Understanding of the limitations of treatment in situations of terminal illnesses

Case I:

You are called to evaluate Mr. X, a 55 y/o male, admitted to the hospital two days ago with the diagnosis of acute pancreatitis. The nurse asks that you come immediately to the step-down unit because Mr. X is acutely dyspneic and noted to be cyanotic having bluish discoloration of his lips, fingers and toes.

Question 1

Do you need additional information from the nurse?

- *Ask about the patient's mental status (awake/alert/unresponsive)?*
- *Is the patient currently on oxygen?*
- *Is there is pulse oximetry?*
- *What is the patient's blood pressure & heart rate?*
- *Does the patient have intravenous access?*
- *How soon would you be expected to be at this patient bedside?*
- *Do you feel you need additional information over the phone to help you or should you go see this patient immediately?*

Question 2

What immediate orders would you give the nurse?

- *Administer supplemental O2 immediately?*
- *Would you call a code immediately or do you feel you need to see the patient first?*
- *Would you ask the nurse to put a call for the respiratory therapist?*
- *Would you order fluid administration if BP is low?*
- *Would you order a blood gas?*
- *Would you order a chest XR immediately?*
- *Would you order an EKG immediately?*

Question 3

What is your thought process at this time in terms of a differential diagnosis and immediate evaluation? (e.g. elevator thoughts)

1) *Formulate a differential diagnosis*

Acute pneumothorax

Acute pulmonary embolism

Acute bronchospasm

Acute airway obstruction (aspiration of food or other foreign body or mass)

Acute myocardial infarction

Tachy/bradyarrhythmia

Acute pulmonary edema

Acute respiratory distress syndrome

2) *Assess severity of condition & need for immediate Rx/transfer*

3) *Assess your ability to deal with situation or need to call for help*

4) *Review advanced directives (DNR/DNI/CMO code status)*

Question 4

What specific information would you like to obtain from the physical examination?

1) *Patient's appearance*

- a) *Acutely dyspneic, diaphoretic, cyanotic, wheezing, stridor, coughing, use of accessory muscle of respiration, restless, agitated.*
- 2) *Patient's mental status:*
 - a) *Awake, alert, oriented*
 - b) *Confused/disoriented*
 - c) *Lethargic/Obtunded/unresponsive*
- 3) *Patient's vitals: BP, HR, RR, pulsus paradoxus*
- 4) *Heart & lung examinations?*
- 5) *(Heart & lung sounds, chest expansion/symmetry/asymmetry/presence & location of S3 gallop, loud P2, paradoxical splitting of S2)*
- 6) *Skin examination: central and peripheral cyanosis*
- 7) *Chest palpation: Crepitus (subcutaneous emphysema)*

Physical examination:

On examination, Mr. X is awake, alert but acutely dyspneic with rapid shallow breathing (RR 30-40) and is using his accessory muscles of respiration. His breathing is noisy with audible high-pitched wheezing. He is responsive but unable to express himself in full sentences (pauses after each word to catch his breath). He is sitting upright in bed, restless and agitated. His lips are cyanotic with dry mucous membrane.

Vitals: BP 90/50 HR 110 RR 30-40 T afebrile. Pulse oximetry: 75% on 100% NRM

Neck: Internal jugular veins distended with pulsus paradoxus

Heart: distant S1/S2, tachycardic with regular rate

Lungs: distant breath sound with diffuse wheezing

Abd: soft, nondistended,

Ext: No clubbing, or edema

Neuro: No focal motor deficits

Question 5

What would do you do next?

- *Should patient be intubated immediately (invasive/noninvasive)*
- *Should patient be transferred immediately to ICU?*
- *What medications should be given immediately?*
- *Diagnostic work up:(CXR/EKG/ABG, cardiac enzymes/lytes, CT angi, Echo)*
- *Rx: (BiPAP/endotracheal intubation, chest tube, oxygen, heparin, lasix, bronchodilator, topical, SL, IV, PO nitrate)*
- *X-ray and laboratory findings*
- *CXR: is there hyperinflation/tension pneumothorax/diffuse bilateral infiltrates/ cardiomegaly/ normal?*

Questions 6

What can be gained from reviewing the patient's medical records?

- *Past medical history*
- *Past surgical history*
- *Recent/previous hospitalizations*
- *Current medications*
- *Prior history of similar episodes of same symptoms*

Mr.X has a history of severe COPD and is currently on home oxygen at 2liters. His other past medical history includes hypertension and osteoarthritis. He is currently on a Fentanyl PCA for acute pancreatitis. He has had multiple exacerbations of COPD and the last admission was four months prior to this admission. Patient is a full code

His labs reveal:

ABG: ph 7.15/ pCO2 85/ pO2 45, WBC 13.5/ HgB 15/ Hct 45/ Plat 300K

Na 140, K 3.1, CL 100, CO2 42, BUN 35, Creatinine 1.5, Glucose 245;

EKG: sinus tachycardia with P-pulmonale, RAE, nonspecific ST-T abnormalities;

Chest X-Ray shows hyperinflated lungs with no evidence of pneumothorax or infiltrate.

Question 7

What is your most likely diagnosis?

Based on the summary of the patient's symptoms, pertinent physical examination findings, Chest X-Ray and laboratory findings. Most likely diagnosis: COPD exacerbation

Question 8

What are your options at this point & how would you proceed?

Treatment: Aggressive bronchodilator, steroid, supplemental O2, IV steroid & BiPAP

Pt should be watched closely for response to BiPAP. If no response, endotracheal intubation should be initiated

Question 9

Should you rediscuss code status with the patient or his/her healthcare proxy at this point?

Patient may be too sick at this point to rediscuss his code status. He and his proxy should however be told about the need for prolonged mechanical and possible need for tracheostomy.

Case II

This is your second call night as an intern. You are sitting in the physicians' lounge hoping it would be a quiet night. Your pager goes off; it is your senior resident. She wants you to go and evaluate a patient in the General Medical Floor with shortness of breath. She provides you the details she received during check out. Patient is a 65 year old woman with multiple co-morbid conditions who was admitted with pneumonia 4 days ago. She was started on IV Antibiotics and was recovering well. The team did not anticipate any problems. The senior resident was paged by the nurse stating that the patient has been complaining of increasing shortness of breath and has been working hard to breathe.

You arrive at the bedside...

Question 1

What critical information would you like to obtain at this point in time?

- *Assess hemodynamic stability. It is important to assess the vital signs and also assess patient's oxygen saturation, check for fevers, hypotension, tachycardia*
- *Find out from the nurse the onset and duration of the patient symptoms as well as patient's activity that is associated with shortness of breath (at rest or with activity)*
- *Identify if the patient has IV access and the code status of the patient*
- *Do a quick chart review to assess the following:*
 - *Patient's admitting diagnosis*
 - *Associated co morbid conditions*
 - *Patient's I/Os*
 - *Current Medications*
 - *New medications*
 - *Most recent labs/X-rays*

Question 2

What historical questions would you ask the patient and what physical exam findings will you focus on as you examine the patient?

- *Historical questions:*
- *Any chest pain, palpitation?*
- *Pain/swelling in the legs?*
- *Fevers, chills, cough, sputum production?*
- *Physical exam*
- *Vital signs, also check for pulsus paradoxus if you suspect cardiac tamponade or severe asthma*
- *Neck – distended veins*
- *Cardiac exam to look for new murmurs, S3 gallop*
- *Lungs: crackles or changes consistent with pneumonia, signs of pneumothorax (crepitus on chest palpation)*

- *Skin: rashes or mottling of the skin*
- *Extremities: edema, redness, tenderness to palpation of calf*

Nurse states that patient was doing fine till dinner 2 hours ago. After dinner she has been complaining of increasing shortness of breath. They checked a pulse ox that was 85%, put the patient on oxygen and called the resident. Patient has a history of mild COPD, coronary artery disease, diabetes and history of systolic congestive heart failure that has been under good control during this hospital stay. She is in a positive fluid balance of 500cc over the last three days. Her medications include Ceftriaxone, azithromycin, carvedilol, lisinopril, furosemide, nitrates, insulin, advair and albuterol inhalers.

Patient denies chest pain, just cannot find a comfortable position and cannot lie down in bed. General examination, patient is in moderate distress, diaphoretic, using accessory muscle of breathing. Vital signs reveal a HR 120/min, BP 110/55, T. 100 degree Fahrenheit, RR 37/min and oxygen saturation of 83% RA on 2 liters. Neck exam shows has no distended neck veins. Cardiac exam reveals tachycardia, normal S1 and S2, Lung exam reveals bilateral wheezes, there is no tracheal deviation. Skin exam did not reveal any rashes. There was minimal bilateral pitting edema and calf tenderness

Question 3

What is your differential diagnosis? What is the next step in patient management?

- *Differential diagnosis:*
- *Acute Pulmonary embolism*
- *Acute pulmonary edema*
- *Exacerbation of COPD*
- *Acute respiratory distress syndrome*
- *Acute myocardial ischemia*
- *Pneumothorax*
- *Worsening of pneumonia*
- *Sepsis syndrome*
-
- *Next steps:*
- *Increase oxygen to improve oxygen saturation*
- *Check a stat arterial blood gas. The arterial blood gas should be used to determine the presence of respiratory failure. There are 2 types of respiratory failure: Hypoxemic and Hypercapnic; Hypoxemic : PaO2 of less than 60 and Hypercapnic: PaCO2 greater than 50*
- *Order a stat EKG, cardiac enzymes*
- *Order a breathing treatment*
- *Check stat Chest X-ray*
- *Call your senior resident for help*

You place the patient on non rebreather face mask. Oxygen saturation improves to 95%. EKG and ABG are pending. Patient is still tachycardic and tachypnic. The senior resident is on her way. You do additional chart review that reveals that the patient has an abnormal lung nodule on a recent CXR that needs follow up CT scan. Her DVT prophylaxis was ambulation only, but the nurse tell you the patient has not been ambulating.

Stat EKG reveals sinus tachycardia without any acute ischemic changes. Arterial blood gas reveals a pH 7.5, pCO₂ 35, pO₂ 45. Patient is given bronchodilator therapy and high flow oxygen but continues to be tachypneic and tachycardic. The senior resident arrives on the scene and you update him on the patient's progress.

Question 4

Your senior resident asks, "What is your diagnosis based on your physical exam and laboratory data?"

This is a 65 year old female with multiple co morbid condition, admitted for treatment of pneumonia, and who has been on bed rest and developed acute shortness of breath while in the hospital, most likely has an acute Pulmonary Embolism: Pt was not on DVT prophylaxis, she has been immobile, and she has suspicious lesion for lung CA on CXR that increases her risk. She has the typical symptoms of sudden onset of tachycardia, tachypnea, and hypoxemia, has bilateral calf tenderness and swelling.

ARDS: Possible, but need to await the chest X-Ray

Mucous plugging: This is a possibility, however patient has not been coughing much and has not choked on food and has been awake the whole time.

COPD exacerbation: less likely. The patient was doing fine over past few days, no increase of sputum production, no fever or SOB, did not require any O₂ during her stay till a few hours prior.

Pneumonia: less likely. Pt was improving on Antibiotics, she had acute onset of shortness of breath and respiratory distress. Patient fever is down and her white blood cell count has been improving.

CHF Exacerbation/arrhythmias/MI: not likely. No signs of CHF or arrhythmias on my physical exam or on the monitor. EKG shows no acute changes, CIEs are pending.

Pneumothorax: Not likely. No signs on my physical exam, but needs to be ruled out. Chest X-Ray is pending.

Question 5

Do you need additional diagnostic tests at this point?

Most important test would be an immediate Chest CT angio or a V/Q scan with a repeat CXR. No CXR is needed if a CT scan is done.

Question 6

If you feel you need additional tests which one(s) will you order & how useful are those tests for your decision to initiate therapy?

If CT angio & V/Q scan are nondiagnostic or negative, leg Doppler should be done to r/o DVT since the pretest clinical probability for PE was high in this case.

Question 7

At which point would you initiate specific therapy?

Therapy with fractionated or unfractionated heparin for PE should be initiated immediately if there is going to be any delay in obtaining the CT or the V/Q scan.

Chest X-ray reveals a right lower lobe infiltrate that is unchanged from previous X-Rays. No other changes noted on the chest X-Ray. Her cardiac isoenzymes were negative. Her electrolytes and renal function was normal. Her BNP was minimally elevated at 150. Chest CT angio revealed pulmonary embolus in the right pulmonary artery

Question 8

Does this patient have Massive Pulmonary Embolism?

No. The patient has normal BP with no clinical signs or symptoms of R heart failure. The clinical picture therefore does not qualify for the designation of massive Pulmonary Embolism.

Patient was transferred to the ICU and started on enoxaparin and warfarin and transferred to the floor 4 days later in a stable condition

Question 9

How would you manage this case if the patient has evidence of Right heart failure with hypotension?

Thrombolytic therapy would have been indicated. Aggressive volume repletion in those patients can lead to adverse outcome.

Question 10

What would be your diagnosis and management if the patient above had different findings listed below?

- i) The CXR showed diffuse bilateral pulmonary infiltrates. Hypoxemia DID NOT improve with supplemental oxygen.**
 - *ARDS (non-cardiogenic pulmonary edema) most likely diagnosis*
 - *CHF and Volume overload should be considered in the differential diagnosis*
 - *Treatment needs to be directed at the underlying etiology*
 - *Pressors may be needed in patients with ARDS with symptomatic hypotension*
 - *Diuretic remains the mainstay of therapy in patients with heart failure with normal BP. If arrhythmia or cardiogenic shock therapy should be directed at the underlying cause.*

ii) Decrease air entry on lung exam, Prolonged expiration with expiratory wheezes, ABG: ph 7.2, pCO₂ 90, pO₂ 60.

- *Hypercapnic respiratory failure probably secondary to COPD exacerbation.*
 - *Continue antibiotics*
 - *Start therapy with beta 2 agonist and ipratropium*
 - *Start patient on IV corticosteroids*
 - *Consider Non-invasive vs. invasive ventilation*

iii) Elevated JVD, bilateral crackles on lung examination, Presence of S3 gallop on cardiac exam, BNP of 2300 (very high) CXR revealing cardiomegaly and new bilateral pulmonary infiltrates.

- *CHF exacerbation (Cardiogenic pulmonary edema).*
 - *Correct hypervolemia with diuretics.*
 - *Look for cause of CHF exacerbation (MI, Arrhythmias, Valvular heart disease etc).*
 - *Review current medical treatment for CHF (ACEI, BB, aldactone, digoxin)*
 - *Review her recent echocardiogram finding, consider ordering one if she has not had an echocardiogram done to assess for systolic versus diastolic dysfunction.*
 - *Patient may need invasive versus non invasive ventilation. Further treatment depending on the cause.*

References

- Leaver SK, Evans TW. Acute respiratory distress syndrome. *BMJ*. 2007 Aug 25;335(7616):389-94.
- Tapson VF. Acute pulmonary embolism. *N Engl J Med*. 2008 Mar 6;358(10):1037-52.
- Peñuelas O, Frutos-Vivar F, Esteban A. Noninvasive positive-pressure ventilation in acute respiratory failure. *CMAJ*. 2007 Nov 6;177(10):1211-8.
- Brochard L: Noninvasive ventilation for acute respiratory failure. *JAMA* 2002; 288: 932
- Disorders of ventilation. *Harrison's principles of Internal Medicine*
- Quon BS, Gan WQ, Sin DD. Contemporary management of acute exacerbations of COPD: a systematic review and metaanalysis. *Chest*. 2008 Mar;133(3):756-66.
- Raju P & al: The pathogenesis of respiratory failure: an overview. *Respir Clin N Am* 2000; 6: 195
- Kucher, N, Goldhaber, SZ. Management of Massive Pulmonary Embolism. *Circulation* 2005; 112:e28
- Daniel, KR, Courtney, DM, Kline, JA. Assessment of cardiac stress from massive pulmonary embolism with 12-lead EKG. *Chest* 2001; 120:474