





UNIVERSITY *of* WASHINGTON

# Internal Medicine Residency Program

*What do you do when you're  
called to see someone who's:*

**S.O.B.**

Kenneth P. Steinberg, M.D.  
Professor of Medicine  
University of Washington



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# Internal Medicine Residency Program

*What do you do when you're  
called to see someone with:*

## DYSPNEA

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# Learning Goals

- Mechanisms
- Bedside evaluation
- Emergency care



# DYSPPNEA: A definition

- An abnormal or uncomfortable sensation of breathing.
- A subjective experience of breathing discomfort that is comprised of qualitatively distinct sensations that vary in intensity



# Patients with Dyspnea

- Type 1 diabetic with nausea & vomiting
- Alcoholic male with acute GI bleed
- Chronic liver failure with ascites
- College student with severe diarrhea
- Elderly woman with CHF
- Medical student with pneumonia
- Hospitalized man with a PE
- Young woman with a pneumothorax
- Senator with COPD

*Why do they all have the same symptom?*



# Pathophysiology

- The respiratory system is designed to maintain homeostasis with respect to gas exchange and acid-base status.
- Derangements in this balance or in the work required to maintain homeostasis can result in dyspnea.



# Pathophysiology of Dyspnea

- Increased work of breathing
  - Demand placed on respiratory muscles
- Chemoreceptors
  - Hypercapnia
  - Hypoxemia
  - Acidosis
- Mechanoreceptors
  - Upper airway
  - Lung
  - Chest wall
- Central (psychogenic, meds)

*Many conditions have more than one mechanism contributing to dyspnea*



# Pathophysiology Simplified

- Respiratory muscle work
- Gas exchange and metabolic demand
  - Oxygenation of the blood
  - Oxygen delivery to the tissues
  - Acid production
  - CO<sub>2</sub> clearance
- Airflow and lung stretch

# Important Components of the “Respiratory System”

- Brain
- Spinal Cord
- Nerves
- Muscles
- Chest Wall
- Diaphragm
- Pleura
- Airways
- Alveoli
- Heart
- Blood Vessels
- Blood

*...even the mighty Mitochondria!*





# Case #1

- You are the Night Medicine intern. The RN calls you at 2:30 AM to report that Ms. Petunia Acco, a 68 yo woman admitted 5 days ago for CAP and a mild COPD flare, has worsening dyspnea. The nurse asks you what you would like to do.
- You check your sign-out.

# Case #1



Patient	Problem List/PMH	Meds	Signout
Acco, Petunia 68 yo F Med Flr rm 1 Code: full NKDA  HD 5 – CAP, mild COPD flare	Mitral stenosis CAD h/o NSTEMI CHF Hyperlipidemia COPD h/o DVT Osteoarthritis	IV antibiotics Prednisone Albuterol/ipratr opium ASA Simvastatin Lisinopril Metoprolol Furosemide KCI	WBC improving BCxs negative SCx non- specific  R subclavian line placed today  NTD



# Case #1

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# Case #1 - DDx

- Pulmonary edema, CHF, ?ischemia vs. volume overload
- COPD exacerbation
- Progressive pneumonia, ALI/ARDS
- Pneumothorax
- Pulmonary embolus



# What would you do next?

- Order furosemide 40 mg IV x 1
- Order CT angiogram
- Go see her
- Stop her IV fluids
- Activate the cath lab

# When Called about Dyspnea: Key First Steps



- On the phone:
  - Vital signs
  - Oxygen saturation
  - Mental status / distress
  - Background - Why are they in the hospital?
- What do you want prior to your arrival:
  - Oxygen, monitor, IV
  - Albuterol
  - ABG, ECG, CXR, etc?
- *You must see the patient !*



# Case #1 - Exam

- In moderate respiratory distress
- T 37.4, HR 108, BP 128/67, RR 24, SpO<sub>2</sub> 91% on 4 lpm NC
- No JVD
- Lungs with right basal crackles, occasional soft wheeze with good airflow
- Bilateral but asymmetric pretibial pitting edema, 1+ on the right, trace on the left
- *What would you order next?*



Please *don't* order the CXR as:

- F/U
- F/U SOB



## Case # 1 - Data

- CXR - RLL focal opacity unchanged from admission, no evidence of worsening CHF or PTX
- ABG - 7.48/34/62 on 4 lpm NC (baseline on 2 lpm NC was 7.39/43/78)
- ECG: no ST-T wave changes, no ischemic changes, no changes from baseline
- *What next??*



# *Three* “PILLARS” for Patients with Dyspnea



## Safety Net

- Oxygen
- IV access
- Monitors

## Vital Signs

- Pulse
- BP
- RR
- Temp
- SpO<sub>2</sub>
- Mental status

## Primary Survey

- A
- B
- C
- D
- E

# Dyspnea: A – B – C – D – E



- Airway
  - Partial Obstruction
- Breathing
  - Asthma, Atelectasis, COPD, Pleural Effusion, Pneumonia, Pneumothorax, Other Infiltrative Processes
- Circulation
  - Anemia, Arrhythmia, CHF, Ischemia, Pericardial Effusion, Shock, PE
- “Deficits”
  - Neuro & Musculoskeletal Abnormalities (e.g., Myasthenia gravis, Scoliosis)
- “Extras”
  - Abdominal disorders, Acidosis, Anxiety/Hyperventilation, Electrolyte Abnormalities (K<sup>+</sup>, Phosphate)



## Case #1 – What would you do?

- Order a BNP
- Order a D-dimer
- Order a CT pulmonary angiogram
- Order a V/Q scan
- Order an echocardiogram



# Signs and Symptoms of VTE

- Calf pain
- Homan's sign
- Leg swelling
- Erythema
- Dyspnea
- Chest pain
- Hemoptysis
- Syncope
- Hypoxemia

**NEITHER SENSITIVE NOR SPECIFIC!**



# Wells Clinical Prediction Model

ITEM	POINTS
Clinical signs and sx of DVT	3
Alternative dx less likely than PE	3
HR > 100	1.5
Immobilization or surgery in past 4 weeks	1.5
Previous PE/DVT	1.5
Hemoptysis	1
Malignancy (on treatment, treated in last 6 months, or receiving palliative care)	1

**7.5 + High**

Probability: Low < 2 points, Mod 2-6 points, High >6 points



# Revised Geneva Score

<u>Variable</u>	<u>Points</u>
● Risk factor	
● Age > 65y	1
● Prev. VTE	3
● Recent surgery of Fx	2
● Active malignancy	2
● Symptoms	
● Unilateral leg pain	3
● Hemoptysis	2
● Clinical signs	
● HR 75 - 94 bpm	3
● HR ≥ 95	5
● LE edema and/or pain on palpation of LE	4

## Score

Low risk = 0 - 3

Intermed. = 4 -10

High risk = ≥ 11

**Case # 1 = 13**

# Inpatients

## A caveat to using D-dimer assays?



- 233 consecutive inpatients suspected of VTE who had D-dimer
  - Radiologic diagnosis and 3-month follow-up was gold standard

	Elisa	Microlatex
Sensitivity (%)	89	86
Specificity (%)	20	20
Negative predictive value (%)	93	91
Positive predictive value (%)	13	13



# D-dimers: Take Home Points

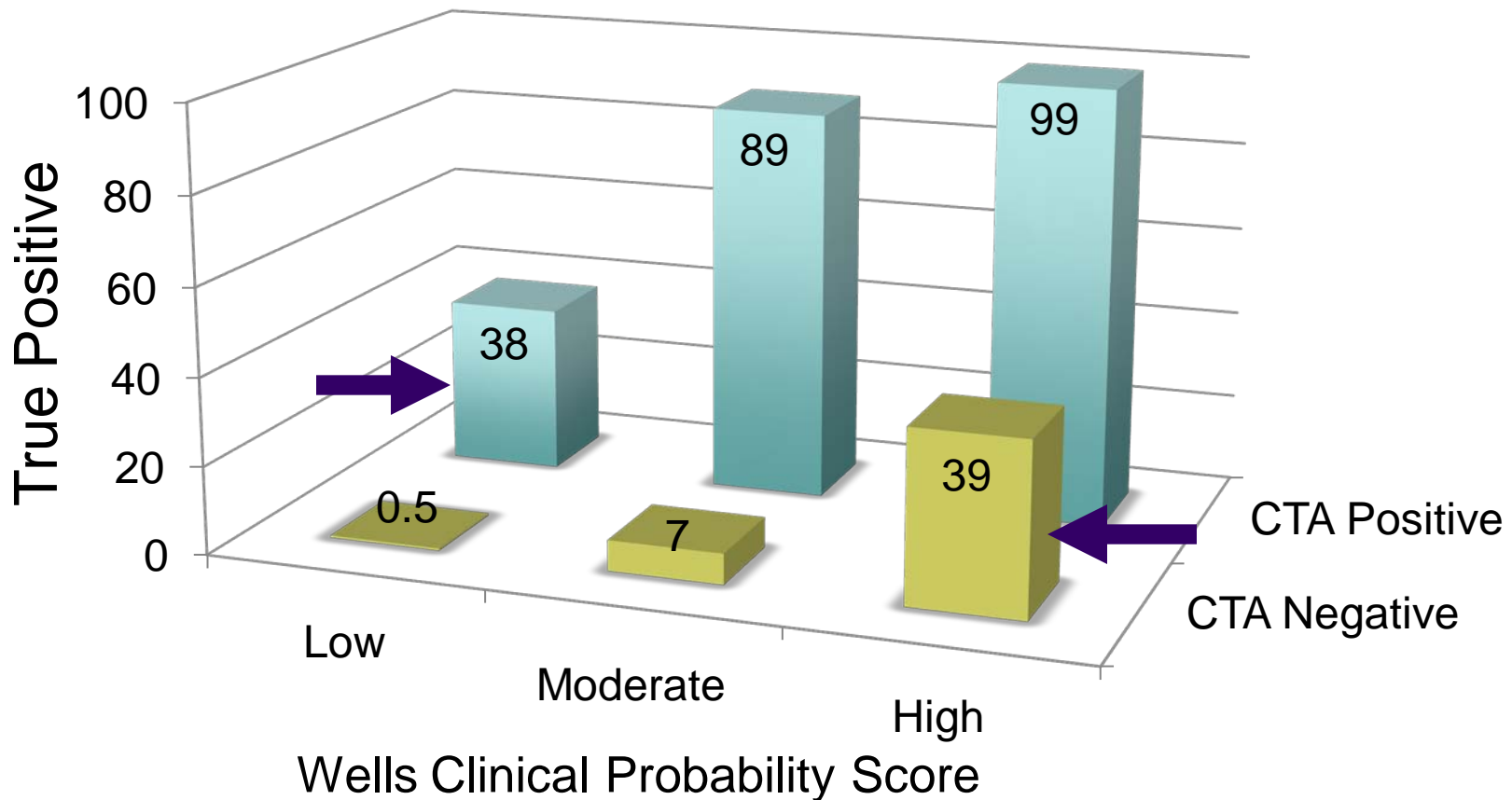
- Properly used when clinical suspicion is low
  - If negative, no further tests necessary
- If further tests are planned anyway, no need for D-dimer
- Positive result is not helpful
- Chance of negative result decreases with age and comorbid disease
- May be unreliable in inpatients

# PIOPED II



## Why Clinical Scoring is Necessary

Prevalence of PE by Clinical Probability and CTPA Findings



Se:4  
Im:112

[A]

Study Date:2008-07-02  
Study Time:3:08:48 PM  
MRN:





# VTE: “Diagnostic Strategy”

- Determine Pre-Test Probability
  - Well’s score
  - Revised Geneva score
- Basic Studies: ECG, CXR, ? ABG
- D-Dimer: probably not helpful for inpatients
- Follow a diagnostic algorithm
- V/Q Scan vs. LE Duplex vs. CTPA
- Always ask: should therapy be started?



## Case #2

- You are the Night Medicine intern. The RN calls you at 3:30 AM to report that Mr. William Pallor, a 65 yo man admitted early today for an anemia of unclear etiology and COPD has worsening dyspnea. The nurse asks you what you would like to do.
- You check your sign-out.

# Case #2



Patient	Problem List/PMH	Meds	Signout
<p>Pallor, William</p> <p>65 yo M</p> <p>Med Flr rm 2</p> <p>Code: full</p> <p>NKDA</p> <p>HD 1 – anemia of unclear etiology, mild COPD flare</p>	<p>Anemia, HCT 22%</p> <p>COPD, GOLD stage 3</p>	<p>Prednisone</p> <p>Albuterol/ipratropium</p> <p>s/q heparin</p>	<p>Anemia work-up ongoing. Does not appear to be GI source.</p> <p>NTD</p>



# What would you do next?

- Order furosemide 40 mg IV x 1
- Order 2 u PRBC stat
- Order a direct/indirect Coomb's test
- Activate the cath lab
- Go see him



## CASE #2

- EXAM: ill older, overweight male, AOX3.
- VS: P 110, BP 160/105, RR 22, T 38.1 C, SpO2 89% on RA
- Respiratory distress, diaphoretic, wheezes and rhonchi with scattered crackles and prolonged expiratory phase. No JVD, distant heart sounds, no peripheral edema.
- How would you care for him now?



# What would you *not* order now?

- Bedside spirometry
- ABG
- Repeat HCT
- CXR
- Oxygen
- ABG 7.32/45/58/22
- HCT 21%
- CXR – changes c/w COPD but no new opacities or edema



# COPD: Acute Therapy

- Oxygen
- Albuterol / Atrovent
- Corticosteroids: start at 60-125 mg IV methylprednisolone
- Limited-Spectrum Antibiotics
- ? Diuretics – *dry lungs are happy lungs!*
- Non-Invasive Ventilation
  - NPPV, BiPAP®
- Intubation & mechanical ventilation



## Other Considerations: COPD

- Bedside spirometry usually not helpful
- ABG usually needed
- CXR & ECG usually needed
- Consider: MI, PE, pneumonia, CHF, pneumothorax,



# Oxygen Saturation Goals

- Most patients
  - SpO<sub>2</sub> ≥ 92%
- Neurological, myocardial injury, pregnancy
  - SpO<sub>2</sub> ≥ 94%
- COPD patients
  - at risk for CO<sub>2</sub> retention
  - What's their baseline?
  - SpO<sub>2</sub> ≥ 88%, ≤ 94%
  - But *under*-oxygenation is worse!



# Learning Goals

- Mechanisms
- Bedside evaluation
- Emergency care

# *Three* “PILLARS” for Patients with Dyspnea



## Safety Net

- Oxygen
- IV access
- Monitors

## Vital Signs

- Pulse
- BP
- RR
- Temp
- SpO<sub>2</sub>
- Mental status

## Primary Survey

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# Non-Cardiopulmonary Causes

## Don't forget 'em!



- Metabolic acidosis
- Anemia
  - Absolute
  - Relative (e.g., methemoglobinemia)
- Sepsis
- Ascites
- Neuromuscular disease
- Anxiety

*Thank You!*





## Case #4

- 48 yo man with a PMH of C3 HIV
- Admitted for severe PCP, was intubated for 12 days, extubated 4 hours ago
- You are called for worsening dyspnea
- DDx?



## Case #4 - DDx

- Pneumothorax
- Recurrent PCP
- Volume overload
- Pulmonary embolus
- Aspiration of gastric contents
- Mucus plug
- Respiratory muscle fatigue



## Case #4 - Exam

- Somnolent but awake, in moderate respiratory distress
- T 36.8, HR 110, BP 155/97, RR 38, SpO2 87% on 50% Venti-mask
- No JVD
- Lungs with bibasilar rhonchi and crackles, no wheezing
- Bilateral trace pretibial pitting edema



## Case # 4 - Data

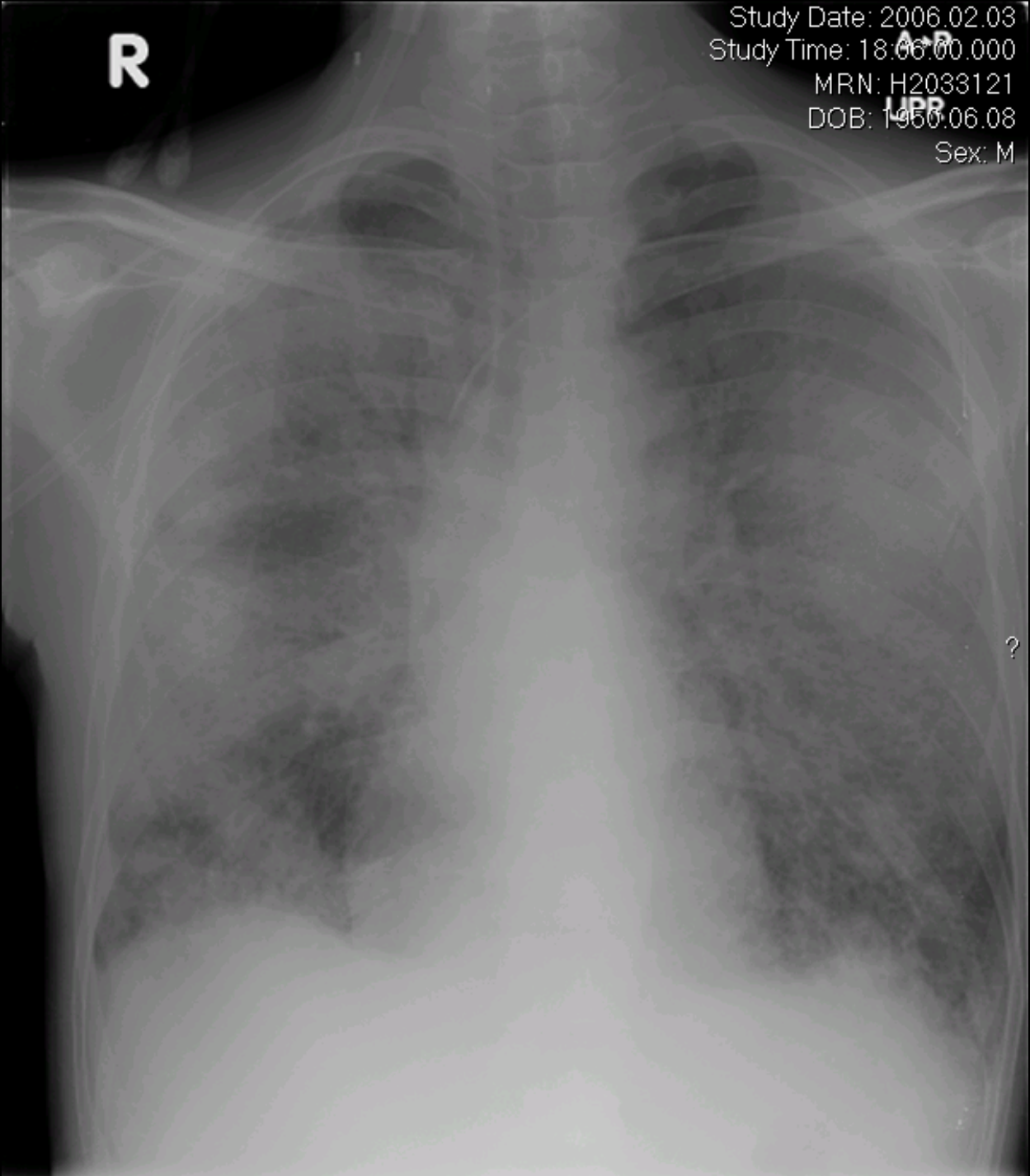
- CXR - bilateral patchy opacities
- ABG - 7.26/64/56 on 50% Venti-mask
- ECG: ST, no ischemic changes, no changes from baseline
- *What next??*
- *Can we use NPPV?*

MRN: 1950

Study Date: 2006.02.03  
Study Time: 18:06:00.000  
MRN: H2033121  
DOB: 1950.06.08  
Sex: M

R

A+P  
LPP



# Post-Extubation Respiratory Failure



- Upper airway obstruction
  - Subglottic and/or laryngeal edema
- Pulmonary edema secondary to increased venous return
- Respiratory muscle fatigue
  - Excess work of breathing
- Aspiration or mucus plugging

**Almost always requires reintubation!**