Case 202: Shortness of Breath

- **Chief complaint**
  - 67-year-old male presents with sudden onset shortness of breath

- **Vital signs**
  - **HR: 123 BP: 230/115 RR: 36 Sat: 82% on RA** T: 37°C Wt: 100 kg

- **Patient appearance**
  - Patient appears diaphoretic, sitting upright with hands on knees

- **Primary survey**
  - Airway: only able to speak in short phrases
  - Breathing: severe respiratory distress, shallow and limited breath sounds
  - Circulation: cool, diaphoretic skin
  - Disability: PEERL, oriented, GCS 15
  - Exposure: the patient is currently fully dressed -> get into a gown

- **Action**
  - Place patient on the monitor
  - Advanced airway equipment and crash cart to the bedside, consider placing pads on patient
  - Oxygen via NRB, page respiratory therapy for BiPAP
  - Two large-bore peripheral IV lines (draw rainbow top)
  - POC glucose (178, if asked for)
  - Order stat ECG (tech paged)
  - Order stat portable CXR (tech paged)
  - POCUS (RN looking for machine)

- **Instructor Prompt:** learners should discuss differential diagnosis for acute respiratory distress, including review of how vitals and bedside testing (ECG, CXR, POCUS) can shape initial management

- **History**
  - Source: Patient and wife
  - HPI: a 67-year-old male presents with acute onset of shortness of breath that has worsened over the past few hours. His wife reports that he ran out of his meds a few days ago. He went to sleep in the recliner this evening because he “wasn’t comfortable” in the bed. He woke up after a few hours complaining of shortness of breath and a cough

productive of frothy sputum. If asked, his wife will report that his shoes aren't fitting because his legs are more swollen than usual. He denies any chest pain. ROS is otherwise negative.
    - PMHx: hypertension, diabetes, high cholesterol, CHF (doesn't know EF)
    - PSHx: none
    - Allergies: none
    - Meds: furosemide, metformin, statin, amlodipine (doses unknown)
    - Social: denies alcohol, smoking or drugs
    - FHx: non-contributory
    - Code Status: full code

- **Physical Exam**
    - **General:** ill-appearing, severe respiratory distress, speaking in short phrases only
    - HEENT: normal
    - **Neck:** JVD to mandible
    - Chest: nontender
    - **Heart:** tachycardic rate and regular rhythm
    - **Lungs:** diffuse crackles, minimal air movement, sig increased WOB
    - Abdomen: normal
    - **Extremities:** 1 + pitting edema BLE (chronic), 1+ distal pulses, otherwise normal
    - Back: normal
    - Neuro: normal
    - **Skin:** (must ask specifics) cool extremities, otherwise normal
    - Lymph: normal

- **Results**
    - Stat POCUS: Thoracic for B-lines and Echo for EF assessment
        - **Video 202.2 A-** thoracic US showing significant B-lines bilaterally
        - **Video 202.2 B**- echo with parasternal long axis and parasternal short axis views showing severely reduced EF and LV dilation
    - Stat ECG (verbal report- sinus tachycardia, LVH)
    - **Stat portable CXR** (Figure 202.1- bilateral pulmonary edema, vascular congestion and pleural effusions)

- **Action**
    - Order Labs
        - CBC, BMP, troponin, BNP, lactate
        - Consider LFT, coagulation studies, blood type and screen, urinalysis
    - Order Meds
        - Nitroglycerin- 0.4 mg SL q5 min x 3 doses (can also consider nitropaste) while setting up a nitroglycerin gtt
            - Begin IV nitroglycerin gtt at 50-200 mcg/min and rapidly titrate while at bedside

        - Consider furosemide IV 0.5-1 mg/kg IVP
    - Initiate BIPAP (iPAP 10-15 cm/ePAP 5 cm, FiO2 100%, titrate as needed)

- **Response/Results**
    - Patient reevaluation and repeat vitals:
        - If given high dose nitroglycerin (> 50 mcg/min IV or ≥ 1.2 mg sublingual):
            - Improving shortness of breath
            - **HR: 110 BP: 170/70 RR: 26** Sat: 97% on **100% FiO2**
        - If given low dose or no nitroglycerin:
            - Worsening shortness of breath requiring intubation
            - **HR: 130 BP: 220/105 RR: 46 Sat: 90% on 100% FiO2**
    - Case 202 Lab Results (sig for WBC 11.3, CO2 20, AG 15, BUN 30, Cr 1.8, Gluc 180)
    - Additional Lab Results: **lactate 2.6, troponin 0.10**, **BNP 5500**

- **Action**
    - Discuss case with Cardiology
    - Update patient and wife of presumed diagnosis and plan
    - Consider Foley catheter placement for close I/O monitoring
    - Admit patient to ICU/CICU

- **Diagnosis**
    - Primary Diagnosis: Flash pulmonary edema
    - Secondary Diagnoses: Hypertensive emergency, acute decompensated heart failure

- **Critical actions**
    - Stat ECG
    - Stat CXR +/- POCUS
    - High-dose nitroglycerin
    - BiPAP, intubate if respiratory decline
    - Admit to ICU/CICU

- **Instructor Guide**
    - This is a case of acute pulmonary edema secondary to severe hypertension in a patient with congestive heart failure (CHF). The patient presents with severe respiratory distress from CHF that must be managed aggressively. The patient should be given nitrates and placed on BiPAP or CPAP. If inadequate doses of nitroglycerin are used, the patient will require intubation. Once the patient is stabilized, the learner should focus on determining the underlying cause of the patient's symptoms (in this case, being out of his meds is the likely etiology). The patient should be dispositioned to the ICU or CICU.

- **Case Teaching Points**
    - The differential for acute SOB should include asthma, bronchospasm, pneumonia, viral syndrome, bronchitis, COPD, pleural effusion, cardiac tamponade, pneumothorax, ACS,

pulmonary embolism, upper airway obstruction (anaphylaxis or aspiration), valvulopathies, non-cardiogenic pulmonary edema and cardiogenic pulmonary edema.

- **What is Sympathetic Crashing Acute Pulmonary Edema (SCAPE)?**
    - Acute onset heart failure associated with severe hypertension
        - Also called flash pulmonary edema
    - A rapid increase in LV end diastolic filling pressures → interstitial and alveolar edema → hypoxia → catecholamine surge → increased SVR and further LV dysfunction → worsening pulmonary edema

- **What are the signs and symptoms seen with SCAPE?**
    - Rapid progression of dyspnea, cough productive of pink and/or frothy sputum
    - Tachycardia, hypertension, hypoxia, rales or wheezes, S3, JVD, peripheral edema

- **What is the management for SCAPE?**
    - Goal is to decrease LVEDV which improves SV and CO (Frank-Starling curve)
    - Treatment includes:
        - Decrease preload/afterload (nitroglycerin +/- diuretics)
        - BiPAP or CPAP
        - Inotropes for cardiogenic shock (norepinephrine, dobutamine, milrinone)

- **What medications should be used in treating SCAPE?**
    - While IV access is being obtained, start with 0.4 mg SL nitroglycerin tablets every 3-5 minutes (up to three doses)
        - 1 tablet of 0.4 mg SL nitroglycerin every 3-5 minutes = 80-133 mcg/min- keep this in mind when starting nitroglycerin gtt
    - Nitroglycerin infusion at 100-200 mcg/min (titrate by 20-40 mcg/min q3-5 min)
        - In higher does, nitroglycerin reduces both preload and afterload
        - Some advocate for starting rates at 400 mcg/min and titrating as needed
    - Further afterload reduction with ACE-Inhibitors
        - Consider captopril 12.5 mg SL or 0.635 mg enalapril IV
    - Morphine has historically been used to decrease dyspnea but has been associated with increased mortality and should generally be avoided in this population

- **What is the role of diuretics in treating SCAPE?**
    - Historically, diuresis with loop diuretics has been standard of care
    - Not all patients with SCAPE are volume overloaded so treatment with diuretics should be based on the patient's history and exam
    - Patients who are volume overloaded should be given loop diuretics, generally the IV equivalent of their home dose (or up to 2.5 the home daily PO dose if clinically indicated)

- **POCUS Pearls**
    - POCUS can be helpful in determining the cause of acute dyspnea- faster and more sensitive than CXR for pulmonary edema
    - Patients with pulmonary edema will typically have B-lines on ultrasound bilaterally
        - B-lines are vertical “comet tail” or “spotlight” reverberation artifacts that arise from the pleural line and extend the depth of the screen without fading
        - They move with ventilation and lung sliding
        - > 3 B-lines in > 2 lung fields is diagnostic of interstitial edema
    - In contrast, patients with COPD, asthma or normal lungs will have an A-line pattern of repeating horizontal reverberation artifacts
        - B-lines obscure A-lines
    - Not all B-lines occur secondary to edema as anything that causes thickening of the interlobular septae (i.e. increased lung density) causes B-lines
        - Examples include pulmonary fibrosis, ARDS, early pneumonia, pulmonary contusion
        - Combining thoracic ultrasound results with POCUS echo and clinical history is helpful for interpreting your scan

- **Attributions**
    - **Author:** Dr. Jeremy Berberian, Dr. Rory Merritt
    - Editor(s): Dr. Eugene Hu, Dr. Samantha Barrett
    - Ultrasound content by: Dr. Rachel Haney, Dr. Sierra Beck, Dr. Bradley Wallace
    - Editor-in-Chief: Dr. Dana Loke, Dr. Kristen Grabow Moore
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- Image References
  - CXR from Dr Tomas Jurevicius, Radiopaedia.org, rID: 48089
  - POCUS images courtesy of: Northwestern Emergency Medicine POCUS Image Bank and Emory Emergency Medicine POCUS Archive

Case 202 Lab Results

Basic Metabolic Panel:

Na	135 mEq/L
K	4.0 mEq/L
Cl	100 mEq/L
CO_2	20 mEq/L
BUN	30 mg/dL
Cr	1.8 mg/dL
Gluc	180 mg/dL

Liver Function Panel:

AST	32 U/L
ALT	14 U/L
Alk Phos	90 U/L
T bili	1.1 mg/dL
D bili	0.3 mg/dL
Lipase	40 U/L
Albumin	4.0 g/dL

Complete Blood Count:

WBC	11.3 x 10^3/uL
Hb	12.1 g/dL
Hct	36.3%
Plt	300 x 10^3/uL

Coagulation Panel:

PT	13.1 sec
INR	1.0
PTT	28 sec

Urinalysis:

SG	1.018
pH	6.8
Prot	Neg
Gluc	Neg
Ketones	Neg
Bili	Neg
Blood	Neg
LE	Neg
Nitrite	Neg
Color	Yellow

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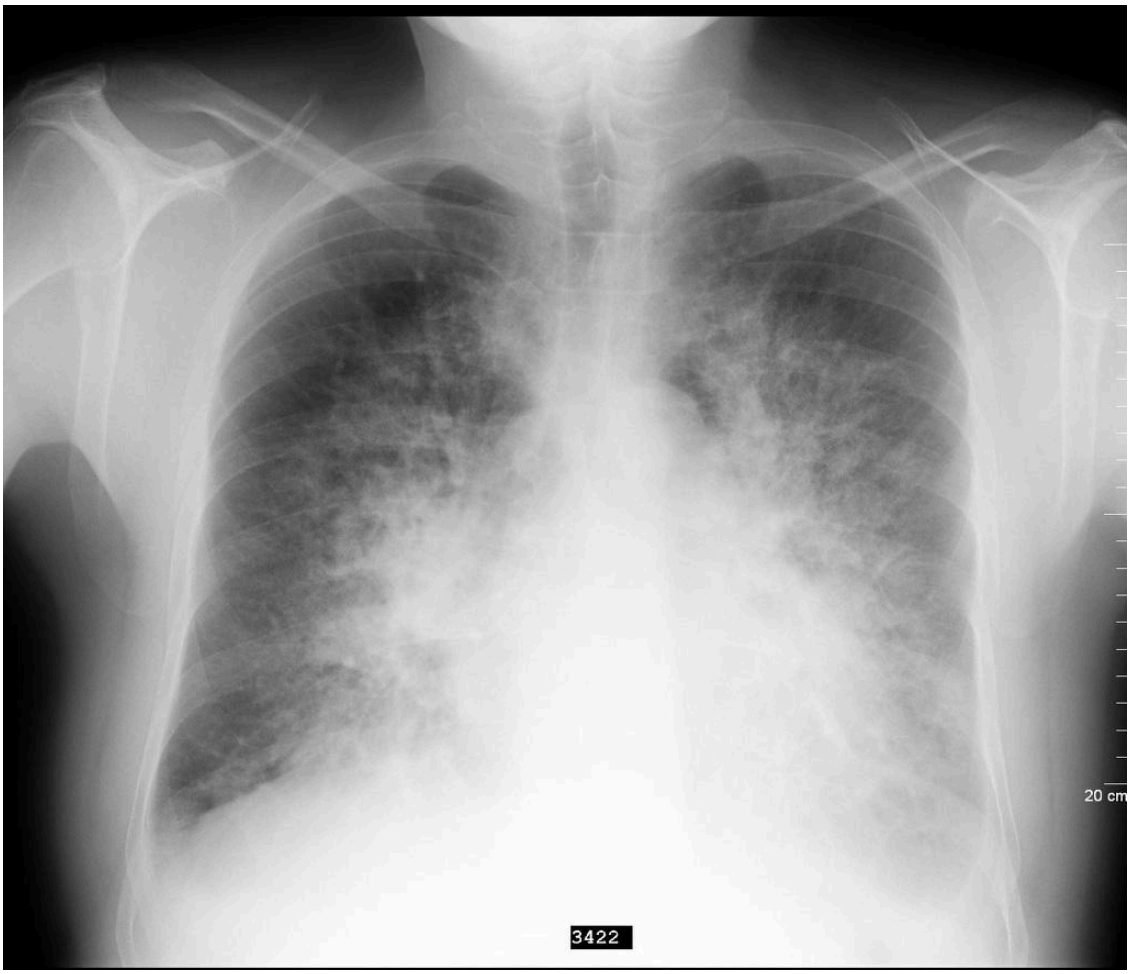
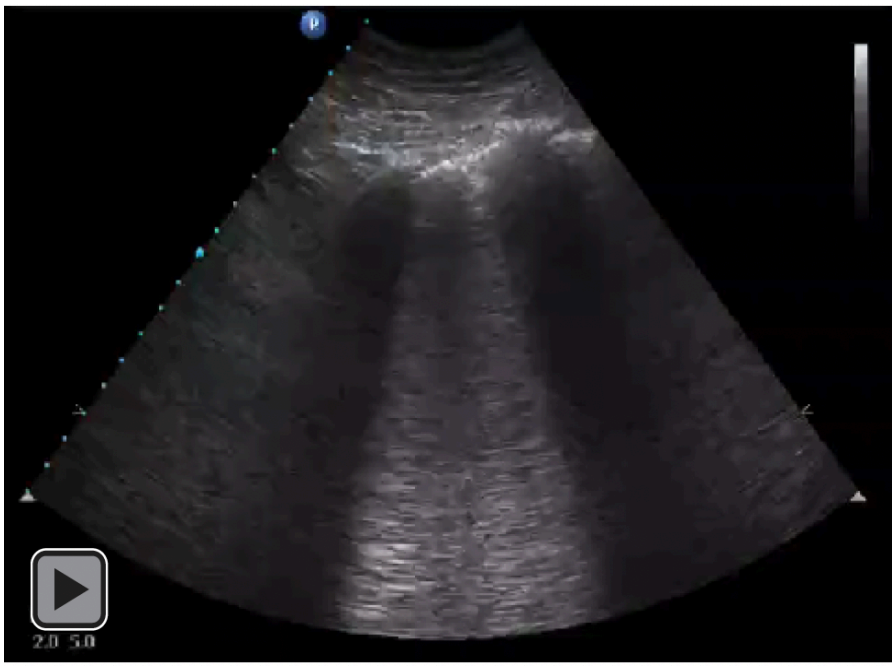
Figure 202.1- CXR



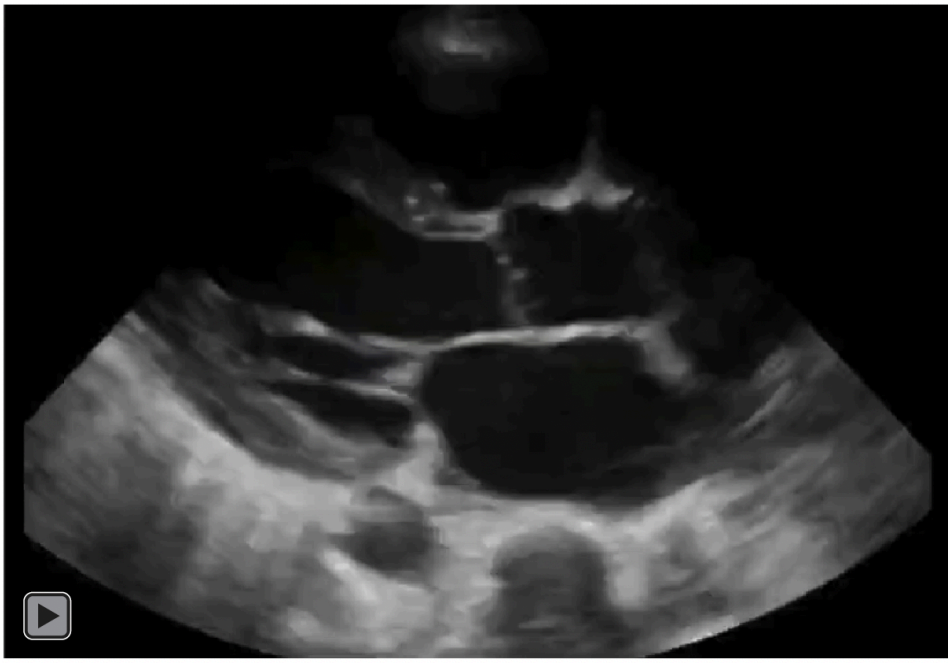
Back to case

Figure 202.2- POCUS

Return to case



A. Right and Left Hemithorax (video, video)



B. Limited Echo (video)