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JUST THE FACTS

Just the facts: point-of-care ultrasound for the diagnosis and management of acute heart failure

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Clinical scenario

A 75-year-old female with a past medical history of heart failure and chronic obstructive pulmonary disease presents with dyspnea that has been worsening over the past 5 h. Her vital signs include a normal temperature, heart rate of 103 beats per minute, and blood pressure of 210/106 mmHg. On examination, she has decreased breath sounds throughout with wheezes and scattered rales. You consider how best to narrow the differential diagnosis and select appropriate initial treatment for this patient.

Key clinical questions

How well does the history and physical examination help to identify or rule out heart failure in patients with acute shortness of breath?

Many of the commonly recommended historical and physical examination features have limited diagnostic accuracy for identifying or ruling out heart failure. One large systematic review found that dyspnea at rest, orthopnea, and paroxysmal nocturnal dyspnea were poorly predictive of heart failure [1]. While S3, jugular venous distension, and hepatojugular reflux have good specificity (87–97%), they lack sensitivity (12–37%) [1]. Other more commonly assessed physical examination findings, such as rales, wheezing, and leg edema, are more limited [1].

How can chest radiography assist with diagnosing acute decompensated heart failure?

Traditionally, chest radiography (CXR) has been the first-line imaging tool used to assess for pulmonary edema in suspected acute heart failure exacerbation. Chest radiography findings suggestive of heart failure include alveolar edema (most prominent in the perihilar area), Kerley B lines (horizontal lines in the lung periphery extending to the pleural surface), dilated upper lobe vessels, pleural effusion, and cardiomegaly. However, one systematic review and meta-analysis found that pulmonary edema on CXR was 56.9% sensitive but 89.2% specific for an acute heart failure exacerbation [1].

What is the role for lung point-of-care ultrasound in suspected heart failure?

Lung ultrasound has been increasingly utilized as an alternate or adjunctive modality to CXR, with the presence of ≥ 3 B lines (hyperechoic linear artifacts arising from the pleura and extending the length of the ultrasound screen) in ≥ 2 bilateral lung zones being suggestive of heart failure [2]. One systematic review and meta-analysis reported that lung ultrasound was 85.3% sensitive and 92.7% specific (Fig. 1A) [1]. Another systematic review directly comparing CXR

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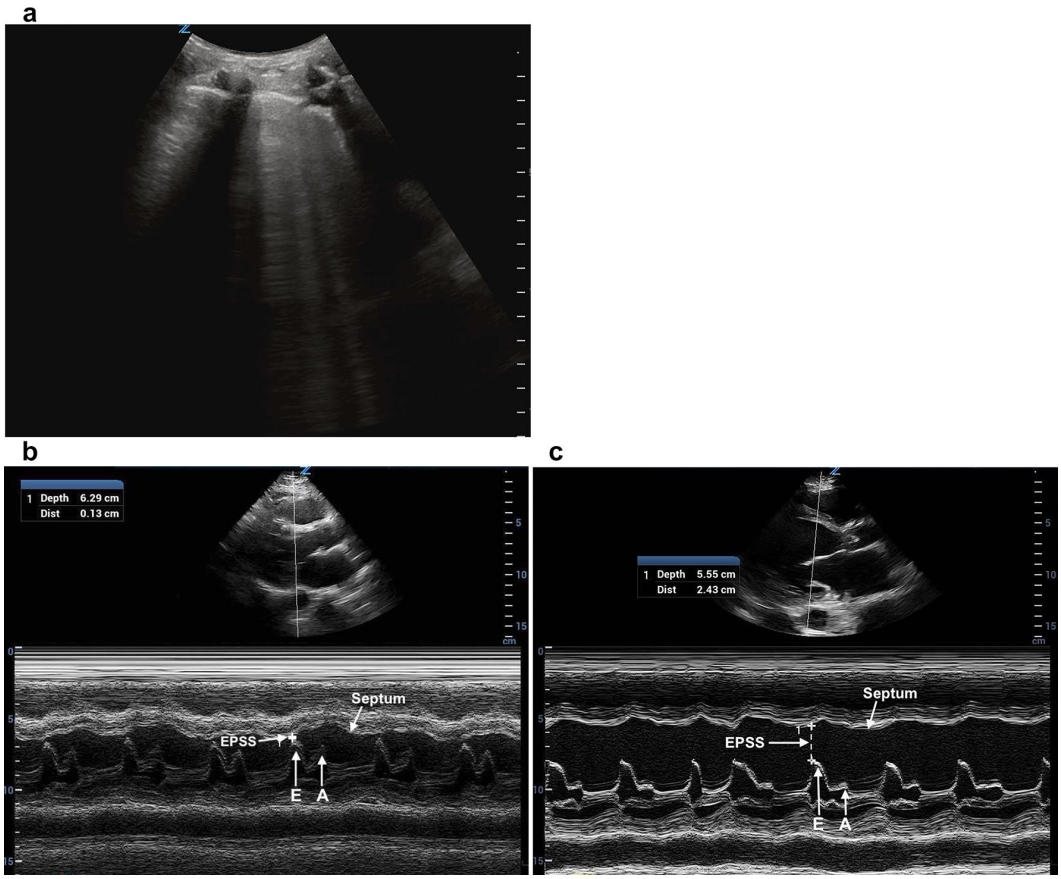

Fig. 1 **A** Lung ultrasound with B lines. **B** Normal systolic function with an EPSS < 7 mm. **C** Decreased systolic function with an EPSS > 10 mm. *E* E wave; *A* A wave; *EPSS* E-point septal separation

with lung ultrasound found that lung ultrasound was more sensitive (91.8% vs 76.5%) and specific (92.3% vs 87.0%) than CXR [3]. Importantly, B lines can also be seen in other pulmonary conditions, including pneumonia, pulmonary contusion, and interstitial lung disease, so it is important to consider the distribution of B lines and clinical scenario in the context of the lung ultrasound.

What is the role of cardiac point-of-care ultrasound in suspected heart failure?

Cardiac ultrasound can be used to identify systolic dysfunction visually through qualitative assessment of the parasternal short-axis view or by measuring the E-point septal separation (EPSS) in the parasternal long-axis view. Qualitative assessment is more accurate among experienced sonographers and is typically subcategorized as normal (≥ 50%), mild or moderate dysfunction (30–50%), and severe dysfunction (< 30%) [4]. An EPSS < 7 mm is suggestive of normal systolic function, while an EPSS > 10 mm is suggestive of a decreased ejection fraction (Fig. 1B and C) [5]. Cardiac ultrasound is also valuable for identifying alternate etiologies for the symptoms (e.g., right heart strain from a pulmonary embolism, pericardial effusion or tamponade, pleural effusions) [6, 7].

Case resolution

You perform a lung ultrasound and identify diffuse B lines suggesting pulmonary edema. Cardiac ultrasound demonstrates an enlarged left ventricle with decreased systolic function. You give nitroglycerin, an ACE inhibitor, furosemide, and initiate non-invasive ventilation. The patient's

symptoms improve, and she is transitioned off non-invasive ventilation and admitted to the general medical floor for further evaluation.

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Declarations

Conflict of interest None.

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