

Ultrasound Findings in Two Patients with Hemodynamically Unstable Pulmonary Embolism

LUKE SULLIVAN, BA, MD; SHANNA STRAUSS, MD, MS; WILLIAM BINDER, MD

CASE PRESENTATIONS

Patient #1 is a 76-year-old woman with a past medical history of chronic obstructive pulmonary disease (COPD) on 2 liters of oxygen at home, who presented to the emergency department (ED) in respiratory distress. She reported one week of increased dyspnea on exertion, orthopnea, abdominal distention, leg swelling and increased home oxygen requirement. Her past medical history also included atrial fibrillation (AFib), congestive heart failure (CHF), remote breast cancer, and a previous pulmonary embolism (PE), for which she was on warfarin. Physical exam revealed a systolic blood pressure ranging from 70–90 mm Hg, and an irregular pulse in the 130–150 range. Her lungs were clear. An EKG demonstrated AFib with rapid ventricular rate (RVR). Point-of-Care ultrasound (POCUS) revealed right ventricular (RV) enlargement (**Figure 1**). Additionally, no B-lines were identified. During placement of a central line, a very plump, right, internal jugular vein containing swirling clot was visualized on POCUS (**Figure 2**). A CT pulmonary angiogram (CT PE) demonstrated a saddle PE extending into all lobar and multiple segmental branches bilaterally (**Figure 3 and Video 1**). The patient was given tissue plasminogen activator (TPA) and transferred to the intensive care unit, where she required thrombectomy for removal of her PE.

Patient #2 is a 96-year-old woman with a history of hypertension and dementia who presented to the ED via EMS after having an unwitnessed fall at her nursing home. EMS found the patient to be unresponsive and apneic, but with a pulse. Upon arrival to the ED, however, she was noted to have pulseless electrical activity (PEA) and cardiopulmonary resuscitation (CPR) was initiated. The patient received epinephrine, calcium gluconate, and bicarbonate per ACLS guidelines, but she never had a shockable rhythm. During the resuscitation, POCUS revealed a blood clot in the right atrium and a dilated RV suggestive of pulmonary embolism (**Figures 4A,B**).

CPR and epinephrine were continued, and the patient was given 50 mg of TPA. Return of spontaneous circulation (ROSC) was achieved and the patient was started on an epinephrine infusion and received an additional 50 mg

Figure 1. Example of enlargement of the right ventricle.

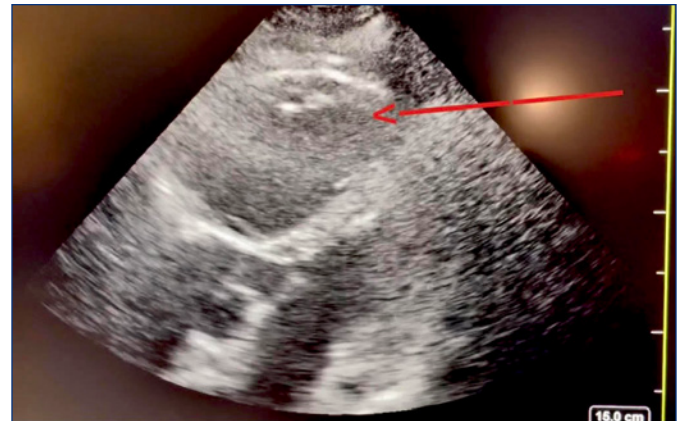
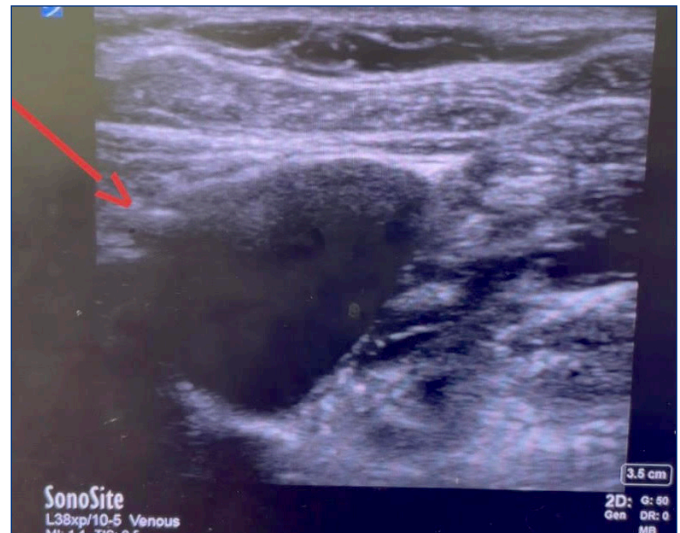
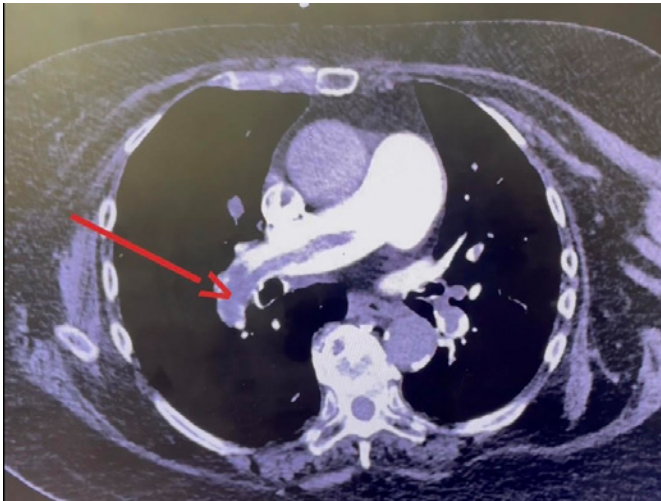


Figure 2. Internal jugular vein containing swirling clot.

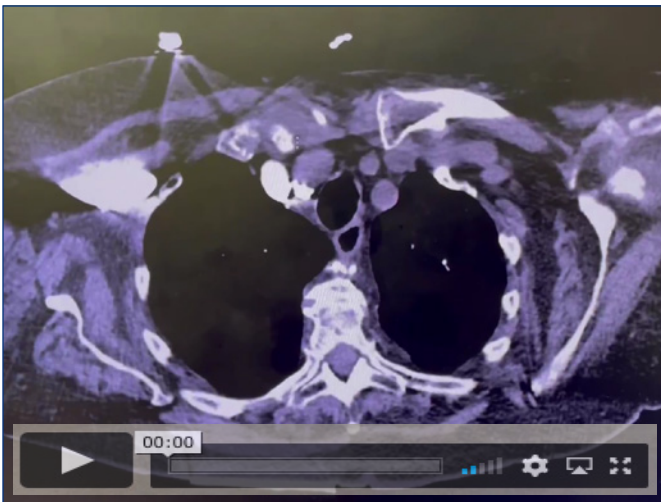


of TPA. After stabilization, a CT PE was obtained and revealed extensive bilateral PE. The patient was admitted to the intensive care unit for continuation of care. Because of her age, comorbidities, and unknown down time, by family decision, the patient was transitioned to comfort measures only and terminally extubated.

Figure 3 and Video 1. CT PE showing large saddle pulmonary embolus extending into all lobar and multiple segmental branches bilaterally. Additionally, there is associated reflux of contrast into the IVC and hepatic veins, enlargement of the right atrium and right ventricle with RV/LV ratio measuring greater than 1 and bowing of the interventricular septum.



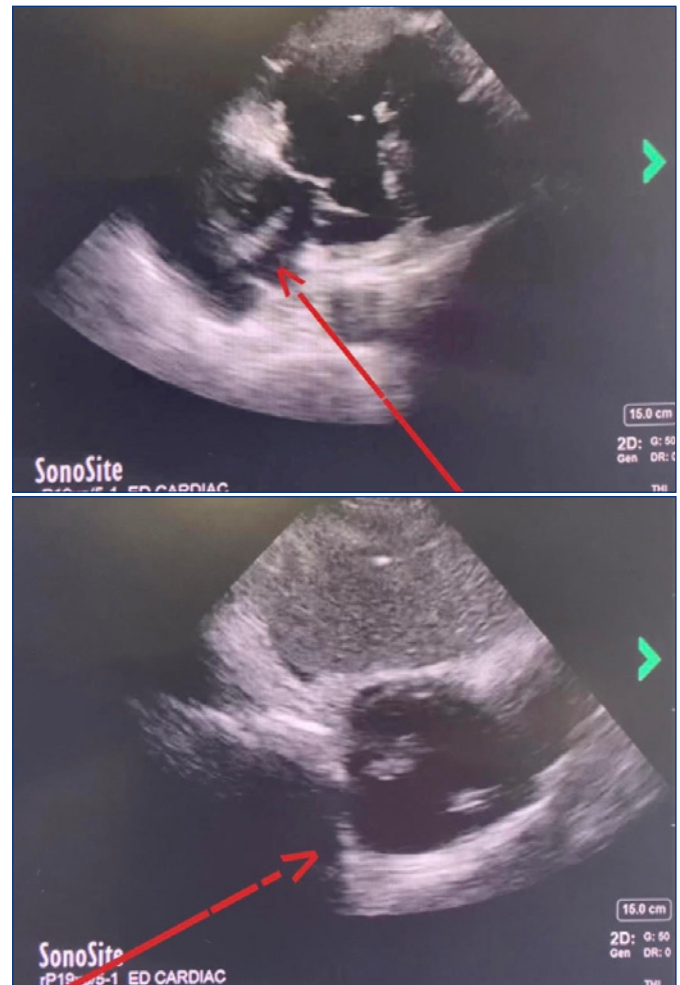
Click to play video. [<https://vimeo.com/841898475>]



DISCUSSION

The two patients described above illustrate opportunities for POCUS imaging to be used in the time-sensitive diagnosis and treatment of PE. In many patients with PE and normal vital signs, a focused cardiac ultrasound will be normal. However, our two patients were unstable and had visualized clot. In the unstable patient with a PE, echocardiogram findings are rarely unremarkable.¹ It is more common to see POCUS findings suggestive of right heart strain. These findings include RV enlargement (RV:LV ratio >0.6 in the apical 4 chamber view (A4C)), septal flattening in the parasternal short view (PSS), poor tricuspid annular plane systolic excursion (TAPSE) or McConnell's sign.

Figure 4. Evidence of clot in the right atrium [A] and dilation of the right ventricle [B].



Providers may also recognize a plump, fixed, inferior vena cava and expanded right or left internal jugular vein. While RV strain is not specific to PE and may be noted in other causes of obstructive or cardiogenic shock, it was highly suggestive in both of our patients. Performing POCUS in the unstable patient with undifferentiated dyspnea allowed us to evaluate our patient's ejection fraction, as well as to look for B lines, which are used to diagnose congestive heart failure (CHF). Additionally, the absence of lung sliding ruled out a pneumothorax and allowed us to hone our differential diagnosis.^{2,3,4} While both of our patients were able to obtain CT scans, in patients who are too unstable for CT or who are deteriorating, POCUS may expedite initiation of appropriate treatment.^{5,6,7}

References

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Authors

Luke Sullivan, BA, MD, Alpert Medical School of Brown University, Providence, RI.

Shanna Strauss, MD, MS, PGY-2, Brown Emergency Medicine, Providence, RI.

William Binder, MD, Associate Professor of Emergency Medicine, Alpert Medical School of Brown University, Providence, RI.

Correspondence

Luke_sullivan@brown.edu