

CASE REPORT

Imaging

Isolated left ventricular cardiac tamponade diagnosed on point-of-care ultrasound in the emergency department: A case report and brief literature review

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Abstract

In this case report, we describe isolated left ventricular cardiac tamponade, a rare complication of cardiac surgery, diagnosed on point-of-care ultrasound (POCUS) in the emergency department (ED). To our knowledge, this is the first report of such a diagnosis made on ED bedside ultrasound. Our patient was a young adult female with a history of recent mitral valve replacement who presented to the ED with dyspnea and was found to have a large loculated pericardial effusion causing left ventricular diastolic collapse. Rapid diagnosis via POCUS in the ED allowed for expedited definitive treatment by cardiothoracic surgery in the operative room and emphasizes the importance of a standard 5-view cardiac POCUS examination when post-cardiac surgery patients present to the ED.

KEYWORDS

cardiac tamponade, echocardiography, point-of-care, ultrasound

1 | INTRODUCTION

Point-of-care ultrasound (POCUS) is diagnostic ultrasonography performed at the bedside for rapid identification of various pathologic conditions.¹ POCUS is especially useful in the emergency department (ED) due to the speed of pathology identification compared to comprehensive radiology studies. It is established that emergency medicine physicians are competent in the use of POCUS goal-directed echocardiography (GDE),² which typically includes a limited number of the standard echocardiographic views, namely parasternal long-axis, parasternal short-axis, apical 4-chamber, subxiphoid, and inferior vena cava views, with the goal of rapidly assessing cardiac anatomy and function, especially in critically ill patients. GDE is increasingly incorporated into emergency medicine residency education, but studies have also indicated proficiency can be obtained through a dedicated GDE

curriculum.²⁻⁴ It has been well described that emergency medicine physicians can accurately diagnose acute cardiac pathology using GDE, including cardiac tamponade,² which is a state of hemodynamic instability caused by compression of heart chambers, typically the right atrium or right ventricle, by a pericardial effusion.⁵ In this case report, we describe what is, to our knowledge, the first report of ED POCUS rapidly identifying postoperative left ventricular tamponade, a rare but still potentially life-threatening clinical pathology.

2 | CASE SUMMARY

The patient was a 36-year-old adult female with a history of mitral stenosis and regurgitation, who had undergone open mitral valve replacement 3 weeks prior, presenting to the ED with a chief concern of shortness of breath. The patient reported she was compliant with her home anticoagulation and had been recovering well from

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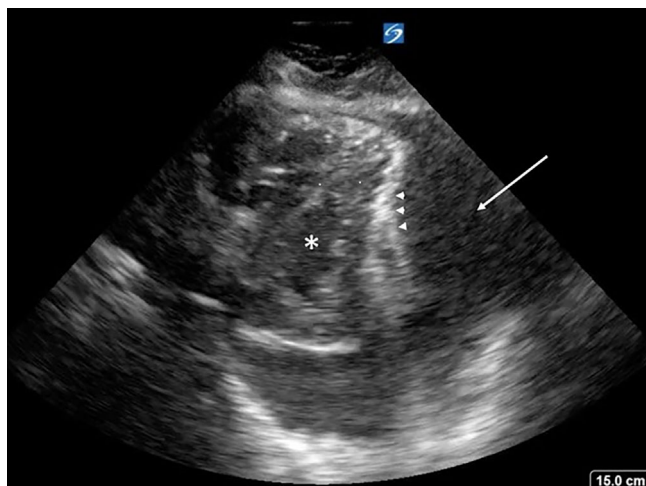


FIGURE 1 Subxiphoid short axis view centered on left ventricular cavity (asterisk) with focal left-sided pericardial effusion (arrow) causing diastolic left ventricular free wall collapse (arrowheads).

her surgery until the day before her presentation when she experienced the onset of dull chest discomfort, fatigue, and exertional dyspnea.

Vital signs on arrival to the ED were within normal limits: temperature 36.7°C, blood pressure 111/70, heart rate 99, respiratory rate 18, and oxygen saturation 100% on room air. A physical examination revealed an ill appearance, intermittent tachycardia, and an early systolic click consistent with her mechanical valve, but showed no evidence of jugular venous distension, peripheral edema, rales, or other signs of respiratory distress. Differential diagnoses initially considered included acute coronary syndrome, arrhythmia, valvular abnormality including malfunction of implanted valve, congestive heart failure, postoperative complication including pericardial effusion or cardiac tamponade, and infection. Electrocardiogram (ECG) revealed evidence of sinus tachycardia with a normal axis, normal intervals, and no ST changes. Labs obtained were significant for leukocytosis with a white blood cell count of 12.7 and stable postoperative anemia with hemoglobin of 9.5. Electrolytes and creatinine were within normal limits. International normalized ratio was 2.7, appropriately elevated for the patient's goal of 2.5–3.5. Troponin was also elevated at 0.09, and B-type natriuretic peptide was 1278. Chest radiograph revealed right basilar atelectasis but no vascular congestion or infiltrates concerning pneumonia.

GDE was performed by a 3rd year ED resident and ultrasound-fellowship trained ED attending physician using the standard 5-view technique, as workup otherwise had been nonspecific. This revealed a hyperdynamic left ventricle (LV) with loculated pericardial effusion isolated to the left heart. LV collapse was noted during diastole, which was concerning for early tamponade (Figures 1 and 2; Videos S1 and S2). There was no evidence of right atrium (RA), right ventricle (RV), or left atrium (LA) collapse. Cardiothoracic surgery (CTS) was consulted and decided on immediate operative intervention. Perioperative transesophageal echocardiogram confirmed a large focal area of pericardial effusion causing significant compression of the apex and lateral wall of

the LV. Approximately 500 cc of old blood was evacuated from the pericardial space during the operation and a pericardial drain was placed. Postoperative echocardiography showed improvement in the effusion without evidence of continued LV diastolic collapse. The patient recovered well after surgery with drain output slowly decreasing over several days, ultimately removed on postoperative day 4. She was discharged home on postoperative day 10 with no further recurrence of effusion.

3 | DISCUSSION

Cardiac tamponade is a state of hemodynamic instability as a result of rapid or excessive fluid accumulation within the pericardial space, to the point of affecting heart chamber function.⁵ Typically, cardiac tamponade affects the right heart chambers, as they have thinner, more compliant walls and are in a lower-pressure system. Therefore, an increase in intrapericardial pressures can more easily overcome the right heart pressures.⁶ Signs and symptoms of cardiac tamponade include dyspnea, tachycardia, elevated jugular venous pulsation (JVP), and pulsus paradoxus. Echocardiography is frequently used to evaluate this pathology. Typical findings include right atrial systolic collapse, right ventricular diastolic collapse, plethoric inferior vena cava, and exaggeration of respirophasic changes across the tricuspid and mitral valves (as a surrogate for pulsus paradoxus).⁵

In rare cases, tamponade of the left atrium and/or left ventricle can occur. Risk factors include patients with circumferential effusions with concomitant underlying severe pulmonary hypertension as well as patients with loculated effusions surrounding the LA or LV, typically seen after cardiac surgery.⁷ In patients with pulmonary hypertension, when right heart pressures are severely elevated, the intrapericardial pressure exerted by the circumferential effusion can overcome the diastolic pressure in the LV, causing LA or LV diastolic collapse

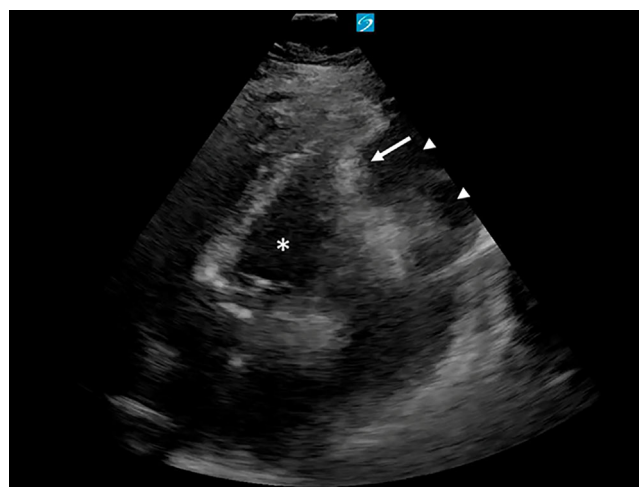


FIGURE 2 Apical 4-chamber view centered on left ventricular cavity (asterisk) with focal left-sided pericardial effusion (arrowheads) causing diastolic left ventricular free wall collapse (arrow).

even in the absence of RA or RV collapse.⁷⁻⁹ In patients with loculated effusions or other localized compressive effects such as with esophageal stents or massive pleural effusions, as seen in other case reports,^{10,11} the intrapericardial pressure exerted by the effusion only affects the adjacent chambers, which can potentially cause isolated left heart tamponade.

In patients after cardiac surgery, pericardial effusions are common, with many of these effusions being loculated. Pepi et al¹² report the incidence of effusion as 64% after any cardiac surgery, with 57.8% of those effusions being loculated. A total of 1.9% of these effusions caused tamponade physiology. Isolated left ventricular tamponade is exceedingly rare. It was first described as a late postoperative complication in cardiac surgery after an uncomplicated valve replacement, similar to our case described above.¹³ Since then, additional CTS literature has attempted to further describe and characterize atypical presentations of pericardial effusions and tamponade in postoperative patients, finding tamponade after cardiac surgery is more likely due to a smaller, loculated effusion that presents with different symptoms, limiting the utility of conventional clinical and echocardiographic signs as described above.^{14,15} These patients do not always present with elevated JVP, pulsus paradoxus, or hemodynamic instability even if subclinical effects are present. In patients with loculated effusions, LV diastolic collapse has been found to be a reliable sign of regional LV tamponade and is associated with hemodynamic consequences such as decreased cardiac output.¹⁷ D'Cruz et al¹⁴ reviewed echocardiograms of 11 postsurgical patients who were displaying clinical signs of cardiac tamponade and found 7 of these to have posterior loculated effusions, with 2 showing abnormal wall motion of the LV, the particularly abrupt anterior motion of the LV wall during diastole, causing the decreased diastolic volume of LV. This diastolic collapse usually occurs before the development of hypotension or pulsus paradoxus in patients with loculated effusions,^{17,18} therefore suggesting the diagnosis of tamponade cannot be excluded in postoperative patients without echocardiographic evaluation.¹⁶

This case adds to a body of literature outlining the importance of echocardiographic evaluation of the postoperative cardiac patient. Specifically, we emphasize the importance of obtaining a cardiac POCUS examination when postoperative cardiac patients present to the ED to screen for focal pericardial effusions causing atypical tamponade. Although our patient was not overtly hemodynamically unstable at the time of initial presentation, she was symptomatic from her effusion and demonstrated signs of cardiac tamponade. Her presentation could easily have been misattributed to another process, which may have led to a catastrophic outcome if not for accurate, timely POCUS in the ED.

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