

Ultrasound in Emergency Medicine



LOW-PRESSURE PERICARDIAL TAMPONADE: CASE REPORT AND REVIEW OF THE LITERATURE

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Abstract—Background: Focused cardiac ultrasound (FoCUS) is accurate for determining the presence of a pericardial effusion. Using FoCUS to evaluate for pericardial tamponade, however, is more involved. Many experts teach that tamponade is unlikely if the inferior vena cava (IVC) shows respiratory variation and is not distended. **Case Report:** A 53-year-old woman presented to the emergency department (ED) with severe orthostatic hypotension, exertional dyspnea, and hypoxia. The evaluation did not reveal an acute cardiopulmonary etiology, but FoCUS demonstrated a pericardial effusion, with several signs consistent with tamponade. The IVC, however, was not distended. She was believed to be hypovolemic, but fluid therapy provided minimal benefit. The patient's condition improved only after aspiration of the effusion. The patient's presentation was likely a "low-pressure" pericardial tamponade. Patients with this subset of tamponade often do not have significant venous congestion, but urgent pericardial aspiration is still indicated. **Why Should an Emergency Physician Be Aware of This?:** Pericardial tamponade may not manifest with IVC plethora on ultrasound. Patients with low-pressure tamponade do not present with the most florid signs of tamponade, but they nonetheless fulfill diagnostic criteria for tamponade. If a non-plethoric IVC is used to rule out tamponade, the clinician risks delaying comprehensive echocardiography

or other tests. Furthermore, the potential for deterioration to frank shock could be discounted, with inappropriate disposition and monitoring. © 2016 Elsevier Inc. All rights reserved.

Keywords—pericardial; effusion; tamponade; echocardiography; IVC

INTRODUCTION

Focused cardiac ultrasound (FoCUS) is employed to answer specific clinical questions during the clinician's evaluation of the patient. In particular, pericardial effusions can be identified with a high degree of accuracy with a FoCUS examination (1). If an effusion is found, the clinician must then assess whether cardiac tamponade is present. Many FoCUS experts recommend assessing the inferior vena cava (IVC) when evaluating for tamponade, because a dilated IVC without respiratory variation has been reported to be an extremely sensitive sign (2,3).

We report a case of a dyspneic and hypotensive patient who was found to have a new pericardial effusion, along with several echocardiographic signs of tamponade, but also a near-flat IVC. Although the patient lacked findings of overt venous hypertension, she had significant clinical improvement only after aspiration of the effusion. This presentation suggests the diagnosis of a "low-pressure" tamponade, a variant of pericardial tamponade.

Streaming video: Brief real-time video clips that accompany this article are available in streaming video at www.journals.elsevierhealth.com/periodicals/jem. Click on Video Clips 1, 2, and 3.

CASE REPORT

A 53-year-old woman presented to the emergency department (ED) with severe orthostatic hypotension and exertional dyspnea. She had a history notable for end-stage renal disease and was on peritoneal dialysis. She also had severe pulmonary hypertension (pulmonary artery pressure 70/33 mm Hg on right heart catheterization 1 year earlier) due to interstitial lung disease (with a restrictive pattern on pulmonary function testing) and left-ventricular diastolic dysfunction, and was oxygen-dependent. Medications included hydralazine, losartan, amlodipine, nebivolol, and furosemide.

She had been hospitalized for community-acquired pneumonia 2 weeks earlier. Upon discharge, her blood pressure had been 121/74 mm Hg after being restarted on her prior outpatient antihypertensives. After discharge, she had noted increasing dyspnea and orthostatic dizziness. She also had some amount of nausea and vomiting. One day before ED admission she was found to have a systolic blood pressure (SBP) of 70 mm Hg during a scheduled outpatient visit, but she declined transfer to the ED at that time. The hypotension was seen the next day as well (70/48 mm Hg) during a visit to a physician, and this time she agreed to transfer to the ED.

In the ED, she had blood pressure of 80/49 mm Hg, room-air oxygen saturation of 84%, heart rate of 79 beats/min, and was afebrile. The examination did not reveal jugular venous distention (JVD), and her lungs were clear.

An electrocardiogram (ECG) showed new T wave inversions in the inferior and anterior leads, but no electrical alternans or reduced QRS voltage. Computed tomography (CT) angiography of the chest was negative for pulmonary emboli. The ECG demonstrated right ventricular hypertrophy. Pro-B-type natriuretic peptide was markedly elevated at 13,200 pg/mL (< 900 pg/mL), but chest x-ray study did not demonstrate pulmonary edema. A troponin was trivially elevated at 0.045 ng/mL (99th percentile cutoff 0.034 ng/mL).

The emergency physician performed FoCUS. The overall systolic function was not grossly low, but a pericardial effusion was seen (Figure 1). Early diastolic collapse of the right ventricle (RV) was also found (Figure 2) (Video 1).

Late diastolic/early systolic collapse of the right atrium (RA) was seen in the apical 4-chamber view (Figure 3, Video 2).

The timing of the RV collapse is more clearly seen on an M-mode tracing of the parasternal long axis. The M-mode illustration was produced with online tool M.Mode.ify (Figure 4) (4).

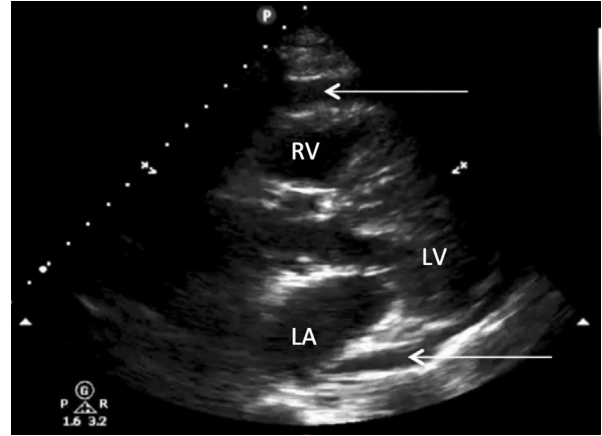


Figure 1. Parasternal long axis: thin arrow indicates anterior and posterior pericardial fluid. LA = left atrium; LV = left ventricle; RV = right ventricle.

Significant variation in the mitral valve (MV) inflow velocity was found with pulsed-wave Doppler. This measurement is obtained in the apical four-chamber view, with the Doppler sampling gate positioned just proximal to the MV tips (Figure 5).

A transverse subcostal view of the IVC, however, showed a non-dilated IVC that fully collapsed with inspiration. Unfortunately, a longitudinal view could not be obtained (Figure 6) (Video 3).

Treatment was initially directed toward suspected hypovolemia, and the supine blood pressure improved modestly after an i.v. bolus of 1 L normal saline, rising to a maximum systolic of 100 mm Hg. This improvement was transient, however. By the time she was admitted to a floor bed, her SBP had declined to < 90 mm Hg. She subsequently received an oral dose of midodrine and i.v. fluids were continued at 50 mL/h; no boluses were given after that administered in the ED. Her orthostatic intolerance did not improve significantly during the first day of admission, and worsening dyspnea prompted the team to transfer her to the cardiac intensive care unit. A comprehensive echocardiogram was unable to obtain Doppler evaluation of the mitral or tricuspid valves (TV) and could not visualize the IVC.

Based on the FoCUS performed in the ED, as well as the lack of clinical improvement, the medical team decided that the effusion should be aspirated. Because the etiology was unclear, and specimens of the pericardium could narrow the diagnosis, cardiothoracic surgery was consulted to perform a pericardial window. After breaking up loculations, about 400 mL hemorrhagic fluid was drained. Pathology did not demonstrate neoplasia, and cultures were negative.

Repeat echocardiography did not demonstrate any tamponade physiology. Both the cardiologist and the

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