Caught by POCUS: Post-TAVR Pericardial Effusion

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ABSTRACT

Point-of-care ultrasound (POCUS) is becoming increasingly popular in the field of anesthesiology and is being incorporated into anesthesia resident education. Ultrasound provides a portable, quick, and inexpensive diagnostic tool to help guide clinicians in their decision making and management of medically complex patients. One important utilization of POCUS is helping to guide management of undifferentiated hypotension. We present a case of a patient who underwent a Transcatheter Aortic Valve Replacement (TAVR) procedure who then suffered from hypotension in the post-anesthesia care unit (PACU). POCUS was used to help identify the cause of the patient's hypotension and led to the diagnosis of a pericardial effusion.

INTRODUCTION

The pericardium is the outermost layer of the heart, providing lubrication and support for the myocardium.[1] Fluid accumulation in this space is known as a pericardial effusion.[2] As fluid accumulates, patients progress from asymptomatic to the most severe forms, which obstruct venous return to the heart, causing a decrease in cardiac output. The latter is known as cardiac tamponade and is a medical emergency requiring prompt recognition and treatment.[3]

Transcatheter Aortic Valve Replacement (TAVR) procedures have become more common over the past decade with rapidly advancing technology.[4] One complication associated with this procedure is a pericardial effusion.[5] In this case report, we describe a clinical scenario of a patient who underwent a TAVR and developed hypotension at the end of the case. A POCUS exam in the PACU helped diagnose a new pericardial effusion causing hypotension and helped to direct appropriate medical therapy for this patient.

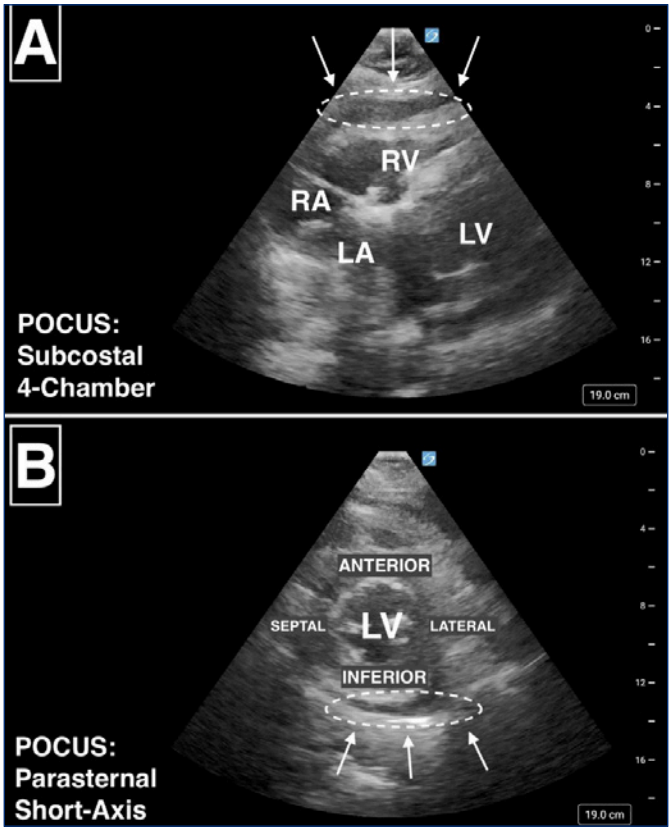
CASE PRESENTATION

Our patient was a 89-year-old female with a past medical history that included hypothyroidism, atrial fibrillation, a permanent pacemaker (PPM) due to sick sinus syndrome, and a bicuspid aortic valve with severe aortic stenosis (AS). A transthoracic echocardiogram (TTE) demonstrated an aortic valve area (AVA) of 0.6 cm^2 with mildly reduced left ventricular function (LVEF 51%) and no other remarkable findings. After consultation with the structural heart clinic, the patient was scheduled for an elective TAVR.

On the day of the procedure, the patient received moderate sedation with midazolam, fentanyl, and dexmedetomidine. An arterial line was placed for hemodynamic monitoring and supplemental oxygen was provided via facemask. After a seemingly uneventful valve deployment, an intraoperative TTE was done which was unremarkable in its findings. Post procedure, the patient's blood pressure began

Figure 1. Cardiac POCUS Imaging

[**A**] Subcostal 4-Chamber view: arrows and circle show the pericardial effusion adjacent to the right atrium and ventricle. [**B**] Parasternal Short-Axis view: arrows and circles show the pericardial effusion below the inferior wall of the left ventricle.



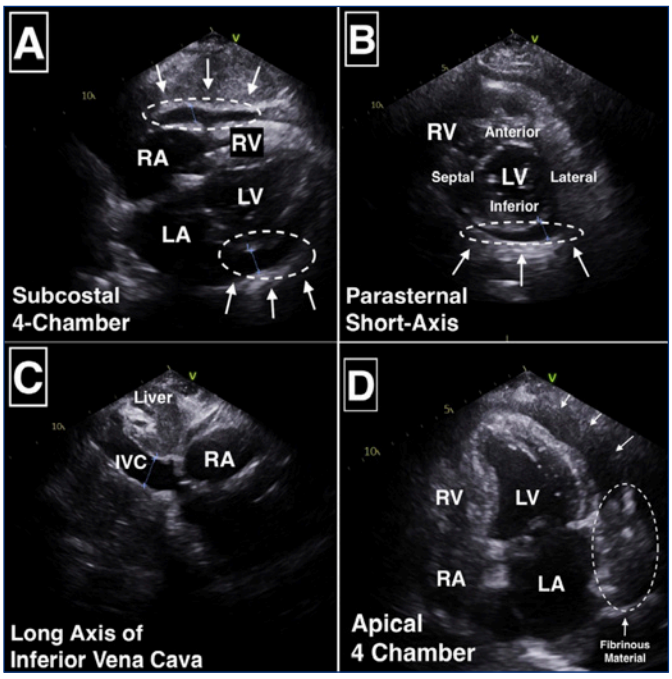
RA = right atrium, RV = right ventricle, LA = left atrium, LV = left ventricle

to slowly downtrend, requiring fluid boluses and a phenylephrine infusion to restore normotension. Due to her deteriorating clinical picture, a cardiac POCUS examination was performed to evaluate the cause of the patient's persistent hypotension. A pericardial effusion was noted (**Figure 1**) and the interventional cardiac procedural team was notified.

Considerations raised with the procedural team included the adequacy of heparin anticoagulation reversal, the urgency to drain the pericardial effusion, and further resuscitative efforts. Ultimately, the decision was made to continue observing the patient in the PACU for any further hemodynamic compromise and to monitor the pericardial effusion for any further expansion. Subsequently, a formal TTE in the CCU demonstrated a moderate circumferential pericardial effusion, a plethoric IVC without respiratory variation, no right atrial systolic collapse, some right ventricle diastolic compression, and some fibrinous material in the pericardium (**Figure 2**). Repeat echocardiograms later in the day showed a stable effusion without signs of worsening tamponade physiology. With further resuscitative efforts, the patient was eventually weaned off of phenylephrine. Follow-up TTE the next day showed a stable effusion and the patient was ultimately discharged home.

Figure 2. Formal Transthoracic Echocardiogram

[**A**] Subcostal 4-Chamber View and [**B**] Parasternal Short-Axis show the pericardial effusion outside of both ventricles (demonstrated by the arrows and circles). [**C**] Subcostal Long-Axis of the IVC shows a plethoric inferior vena cava dilated to 2.34cm. [**D**] Apical 4-Chamber shows fibrinous material in the pericardial space as demonstrated by the circle with the arrows pointing towards the pericardial effusion wrapping around the LV.



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DISCUSSION

One of the benefits of TAVR over open surgical valve replacement (SAVR) is the relative non-invasive nature of the procedure. In the past two decades, the typical anesthetic plan has shifted towards moderate sedation over GA for TAVR procedures.[5] There are two major benefits to this technique. The first is early recognition of neurologic dysfunction if the patient requires less time to regain consciousness after moderate sedation as compared to GA. The second is allowing the anesthesia provider to focus more on procedural causes of hypotension rather than anesthetic causes such as: valve malposition, paravalvular regurgitation, conduction abnormalities, coronary hypoperfusion, hypovolemia, and pericardial effusions.[6]

POCUS is a bedside tool that can be used to evaluate the heart and lungs to aid in diagnosis, medical intervention, and acute procedures.[6] The cardiac assessment is a particularly helpful tool in the evaluation of hypotension, specifically looking at cardiac function, volume status, valvulopathies, and a pericardial effusion causing tamponade physiology. Determining the specific cause of the patient's hypotension may lead to the correct treatment to fix the underlying problem. Ultimately, we discovered an effusion best visualized in the subcostal 4-chamber and parasternal short-axis views (**Figure 1**).

Echocardiography is a simple, accurate, and reliable tool to assess the size, location, and hemodynamic impact of an effusion.[7] These qualifications make it very valuable for diagnosis and classification of pericardial effusions.

CONCLUSION

While the clinical presentation of pericardial effusions may seem insidious and complex, physicians can make a rapid and accurate diagnosis of effusion and hemodynamic impact using a combination of clinical signs and symptoms augmented with the diagnostic advantage of a bedside POCUS evaluation, leading to the appropriate management of the patient.

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