Case Report

POCUS-Guided Diagnosis of Infective Endocarditis in Bicuspid Aortic Valves with Heart Failure and Valvuloaortopathy

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Abstract

Cardiac point-of-care ultrasound (POCUS) is a ground-breaking tool for the timely identification of previously undiagnosed cardiac abnormalities and their related complications. The bicuspid aortic valve (BAV) is the most common congenital heart anomaly, yet it often remains undiagnosed and asymptomatic. This case report highlights the role of cardiac POCUS in identifying the BAV and its related complications, such as aortic stenosis or regurgitation, aortopathy, and infective endocarditis.

Keywords: *bicuspid aortic valve, aortic aneurysm, infective endocarditis, point of care ultrasound, heart failure.*

INTRODUCTION

According to postmortem studies, the bicuspid aortic valve (BAV) is the most common congenital cardiac abnormality, affecting 0.5% to 1.4% of patients.[1,2] BAV is a highly heterogeneous and complex disease associated with valvuloaortopathy and cardiovascular complications.

The complications associated with BAV include aortic stenosis, aortic regurgitation, premature heart failure, and infective endocarditis. Aortic dilatation, or aortopathy, has been closely linked to potentially life-threatening events such as aortic aneurysm, aortic dissection, and rupture.[1-3]

Patients with BAV may not exhibit any symptoms and maintain normal valve function for years before diagnosis. Conversely, some patients may develop complications and eventually require aortic valve replacement. Early identification of BAV in the emergency department (ED) via cardiac point-of-care ultrasound (POCUS) can improve patient outcomes through timely intervention and management.

Herein, we present a case report demonstrating the utility of cardiac POCUS in the ED for identifying BAV and its associated complications.

CASE PRESENTATION

A 29-year-old man presented with shortness of breath, chest pain, and increasing lethargy for one week. He reported sleeping with three pillows for the past week and experiencing fever for three days prior to presentation. He had no medical or family history of cardiac diseases and did not consume alcohol or smoke.

On examination, vital signs revealed a blood pressure of 64/40 mmHg, a heart rate of 120 beats/min, a temperature of 38.5°C, and an oxygen saturation of 90% on 15 L/min via a non-rebreather mask. He was jaundiced, his extremities were cold, and his pulse volume was diminished. The cardiovascular assessment revealed dilated jugular venous pressure, S3 gallops, generalized lung crackles, and grade 5 holosystolic murmur loudest at the lower sternal edge. Both radio-radial and radio-femoral delays were absent. No stigmata of endocarditis could be appreciated.

The electrocardiogram revealed a marked hyperacute T-wave over the precordial leads, left anterior fascicular block, left ventricular hypertrophy, and poor R-wave progression. Cardiac POCUS revealed severely depressed left ventricular function with an ejection fraction of 20%. The cardiac chambers were dilated with global hypokinetic segments. Notably, a thickened bicuspid aortic valve prolapsed during

diastole and had a systolic dome shape during systole, which was visualized in the parasternal long axis view [Figure 1 and Figure 2].

Figure 1: Thickened BAV with a systolic dome-shaped in the PLAX view

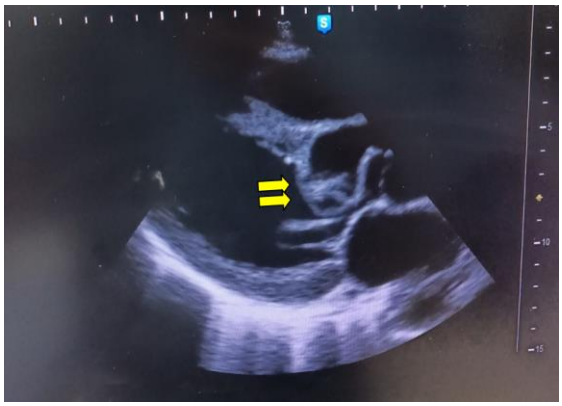

Figure 2: Diastolic prolapse of the bicuspid aortic valve in the PLAX view

In the parasternal short-axis view, the right coronary cusp and non-coronary cusp fused to produce a raphe, and the Mercedes-Benz sign was absent [Figure 3 and Figure 4]. The aortic root annulus and ascending aorta showed mild dilatation, measuring 3.0 cm and 4.1 cm, respectively [Figure 5].

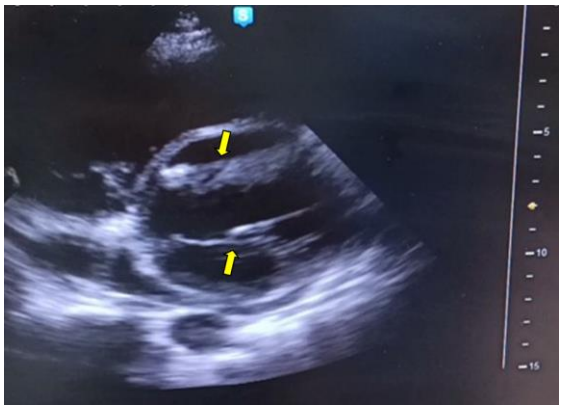

Figure 3: 'Fish-mouth' appearance of the bicuspid aortic valves when the AV valves are open in the PSAX view

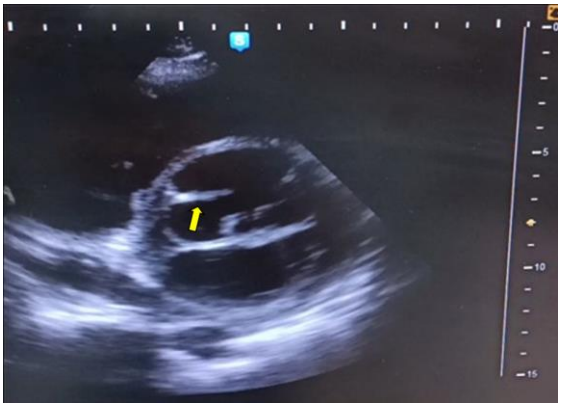

Figure 4: Fusion of the right coronary cusp and non-coronary cusp forming a partial raphe when the AV valves close in the PSAX view. The Mercedes-Benz sign is absent

Figure 5: Mild aortic root and ascending aorta dilatation.

Aortic stenosis, functional mitral regurgitation, and tricuspid regurgitation were also present on cardiac POCUS. His chest x-ray demonstrated cardiomegaly and fluid overload features. Computed tomography (CT) of the aorta revealed mild aortic root and ascending aorta dilatation (3.5 cm and 3.2 cm, respectively) without dissection or rupture.

Laboratory investigations revealed a white cell count of 17.6x103 U/L, a creatinine level of 198 mmol/L, a bilirubin level of 80.8 µmol/L, an AST level of 1635 U/L, an ALT level of 829 U/L, and a troponin I level of 187.6 ng/L. He was intubated, mechanically ventilated, and hemodynamically supported. Intravenous benzylpenicillin, gentamicin, and cloxacillin were administered for infective endocarditis. He was admitted to the intensive care unit for close monitoring. The serial blood cultures revealed no growth. Despite aggressive resuscitation efforts, he succumbed to sepsis with refractory hypotension and multiorgan dysfunction on day 5 of admission.

DISCUSSION

Cardiac POCUS is a vital tool in examining the BAV because it offers non-invasive imaging and can provide substantial anatomic and functional information in real-time. A normal aortic valve has three leaflet cusps: the non-coronary cusp, the left coronary cusp, and the right coronary cusp. The BAV is composed of two abnormal leaflets and may or may not have a raphe. The aortic valve can be visualized in the PLAX view as a dome shape during systole and prolapse during diastole. BAV visualizes as a 'fish-mouth' on AV valve opening in the PSAX view. The presence of the Mercedes-Benz sign alone is insufficient to rule out BAV because when the three leaflets' commissures line up together, they are misinterpreted due to the presence of a raphe.[4,5]

Studies have indicated that individuals with BAV are at increased risk of aortopathy and the development of aortic dissection.[3,6] Sievers et al. suggests that the presence of two raphes between the left and right cusps and the right and non-coronary cusps in type 2 morphology is correlated with the highest occurrence of aneurysms in the aortic root and ascending aorta.[7] In addition, endocarditis associated with BAV has a high morbidity and mortality rate, with a reported mortality risk of approximately 20%.[8] Compared with patients with endocarditis unrelated to BAV, those with BAV-related endocarditis are at increased risk of complications, including perivalvular and aortic root abscesses, which often necessitate aortic valve replacement.[8]

Nevertheless, the use of POCUS to evaluate BAV or other valve diseases has limitations. The quality of ultrasound image acquisition and interpretation depends greatly on the operator's expertise.[9] Furthermore, valvular pathology is often not included in standard training for POCUS operators. Therefore, when BAV is suspected, arranging a formal echocardiogram and suggesting a follow-up are recommended.

CONCLUSION

We emphasize the importance of cardiac POCUS in the ED for identifying the cause of premature heart failure in young patients. In our case, the patient was undiagnosed with BAV and experienced serious complications, including aortic stenosis, valvuloaortopathy, and endocarditis, leading to heart failure. Although the patient did not meet the major criteria for infective endocarditis, the presence of a predisposing heart condition, high-grade fever, and embolic phenomena suggest that IE should still be considered in this case.

CONFLICT OF INTEREST

We declare that there are no conflicts of interest associated with this study.

STATEMENT OF ETHICS APPROVAL/CONSENT

Informed consent was obtained from the patient's relative for the publication of this journal.

AUTHORS' CONTRIBUTIONS

Every author has made a significant contribution to the publication of this journal.

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