A Shortcut to Death: Aorto–Left Atrial Fistula in the Setting of MRSA Infective Endocarditis

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INTRODUCTION

The development of an aorto-atrial fistula (AAF) is a rare but problematic complication of endocarditis. We present an exceptional case of a 60-year-old man with infectious endocarditis (IE) leading to aorto–left atrial fistula.

CASE PRESENTATION

Our patient was a 60-year-old gentleman with comorbidities including stroke, chronic obstructive pulmonary disease, intravenous drug use, and hepatitis C who presented to the emergency department after being found down and disheveled by his roommate. He initially presented to a nearby hospital, where he was found to have splenic and left renal infarcts on imaging; he was then transferred to our hospital for further management. On initial presentation, he was febrile to 102.6°F and was started empirically on cefepime and metronidazole. Blood cultures were positive for methicillin-resistant Staphylococcus aureus, and he was transitioned to daptomycin and cefaroline. Workup also revealed a urinary tract infection and a urine drug screen positive for cocaine and opioids. Initial transthoracic echocardiography (TTE) demonstrated no evidence of vegetations, but the parasternal short-axis view was difficult to visualize. Transesophageal echocardiography (TEE) revealed a bicuspid aortic valve (BAV) with severe thickening of the aortic root with multiple echo-lucencies extending to the base of the anterior mitral leaflet, findings suggestive of an aortic root abscess (see Video 3). Furthermore, TEE demonstrated an aorto–left atrial fistula with continuous shunt on color flow imaging (see Figures 1 and 2, Video 4). Cardiothoracic surgery was consulted, but the patient was deemed at too high a risk for surgery. Given his worsening hemodynamic state, he was started on a norepinephrine drip to maintain adequate perfusion. Nevertheless, his overall clinical state continued to deteriorate. Despite treatment with daptomycin and cefaroline, he had refractory bacteremia with methicillin-resistant S aureus continuing to grow on multiple blood cultures. Furthermore, he had worsening renal failure with subsequent extreme electrolyte derangements and a lactic acid level of 4.7, requiring continuous renal replacement therapy. The next day, however, his wife requested for continuous renal replacement therapy to be discontinued with no further escalation of care, opting for comfort measures only. His respiratory status continued to decline, and the patient passed away later that evening. His splenic and left renal lesions are now thought to have been septic emboli. He developed acute decompensated heart failure, most likely due to a left-left shunt and regurgitation caused by the aorto–left atrial fistula. Chest computed tomography demonstrated no evidence of emboli.

DISCUSSION

An AAF is a rare but potentially life-threatening condition in which an anomalous connection forms between the aortic structures and cardiac atria. The etiology can widely differ, including congenital causes, secondary to conditions such as IE or valve replacement, or iatrogenic. In the case of IE, when the infection spreads beyond vascular structures, it can lead to periannular complications, such as AAFs. In the literature, the prevalence of AAF in the setting of IE is 1% to 2%. The pathogenesis of AAFs related to infection is caused by extension and infiltration of abscesses related to the endocarditis. As the infection spreads to surrounding tissue, it inflames and weakens the myocardium, slowly eroding a path in the form of a fistula into a nearby space, such as the atrium. Our literature suggests that 51.7% of AAF formations open into the right atrium. Interestingly, the junctional zone between the mitral and aortic valve annulus, known as the mitral-aortic intervalvular fibrosa, is, unfortunately, ideal for abscess formation given its relative hypovascularity. This is thought to be a result of the decreased ability to mount an immune response. Multiple reviews have demonstrated a roughly similar distribution of causative organisms with Staphylococcus species being found in 58% of cases, followed by Streptococcus species in 28%, Enterococcus species in 7%, and 7% of cases being polymicrobial. Prognosis, however, did not seem to differ on the basis of the organism involved.

Echocardiography is a core component in the diagnosis and management of valvular pathologies. Although TTE is a great tool for the initial assessment of suspected structural pathologies, TEE is superior in providing a detailed assessment of structure and function. Anguera et al. demonstrated that the detection rates of AAF using TTE and TEE are 53% and 97%, respectively. Additionally, TEE is superior to TTE in assessing valve function and morphology as well as delineating intracardiac pathology, such as complications of endocarditis, namely, root abscess and fistulas. Furthermore, because most aorto–left atrial fistulas usually occur from the posterior aspect of the aorta, the anatomy is naturally better assessed using TEE. Naturally, this leads to a better signal-to-noise ratio on TEE, resulting in higher quality images and less attenuation. TEE is the superior imaging technique and has better resolution in the evaluation of cardiac pathology because of the proximity of the probe to the diseased segment of the aorta.

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Given its course through a dense and anatomically delicate area, the development of an AAF is often associated with life-threatening complications. The literature reports very high rates of these complications, with >60% of patients developing significant heart failure and >40% ending in death.\(^1\) Unfortunately, surgical mortality itself is also very high at about 40%.\(^4\) Factors associated with adverse outcomes, in the literature, include septic shock, hemodynamic instability, and congestive heart failure. All of these factors were present in our patient. With severe thickening of the aortic leaflets and a flail noncoronary cusp leading to severe aortic regurgitation, our patient struggled to maintain adequate perfusion. Despite pressor support and proper antibiotic therapy, his clinical course continued to decline. Systolic failure and underperfusion ultimately led to renal failure, requiring the use of continuous renal replacement therapy. Although not manifested in our patient, AAF can also be associated with an array of conduction abnormalities, from bundle branch blocks to first-, second-, and third-degree heart blocks in up to 10% of cases.\(^7\) Unsurprisingly, AAF is a rare but very problematic complication of IE with high mortality despite adequate treatment.\(^7\) For this reason, high suspicion, timely diagnosis, and early treatment with antibiotics and/or surgery are of utmost importance.\(^7\)

Surgery remains the preferred choice for management of aorto-atrial fistulae.\(^7\) Ergin et al.\(^9\) stressed the importance of removing all infected elements, followed by reconstruction of the aortic annulus for safe anchoring of a valve conduit. Fierro et al.\(^1\) summarized currently available conduit options for reconstruction to include conventional aortic valve replacement (using a mechanical or stented biological valve), aortic valve replacement with translocation, aortic root replacement using a homograft, pulmonary autograft (Ross procedure), a stentless biological valve, or a composite graft. With this approach,
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