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CASE REPORT

Potential Rheumatological Heart Disease Causing Triple Valve Replacement: A Case Report

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Abstract

Introduction: Mechanical valves were identified in the aortic, mitral, and tricuspid valves of an 88-year-old donor. The presence of these valves along with the donor's past medical history and body habitus indicate a triple valve replacement surgery was performed.

Case Presentation: Here we describe our 88-year-old donor's body habitus during routine anatomical dissection and findings that suggested a history of valvular disease and dysfunction.

Discussion: Evidence of a rare triple valve surgery is discussed along with how this type of case report acts as a useful exercise contributing towards medical student education.

Conclusion: Our donor's anatomical dissections strongly suggested that she underwent a simultaneous triple valve replacement due rapidly progressing rheumatic heart disease. This unique case serves as a valuable educational exercise for medical students, highlighting the clinical relevance of anatomy in diagnosing complex pathological conditions.

Key Words: *Rheumatic heart disease; Triple valve replacement; Cadaver dissection; Case report; Donor*

Introduction

The purpose of this case report is to explore a peculiar finding within the heart of a donor in our anatomy lab as an exercise for medical student education. Upon dissection of the heart, she appeared to have a mechanical triple valve replacement (TVR) of the aortic, mitral, and tricuspid valves. The most common cause of simultaneous multi-valve failure is rheumatic heart disease (RHD) followed by degenerative valvular heart disease [1]. In our donor's case, her remaining pulmonary valve was normal, leading to our determination that she suffered from RHD. As a result of this disease progressing rapidly, we believe our donor underwent a TVR rather than separate valve replacements.

Case Presentation

Our donor is an 88-year-old female whose cause of death is listed as congestive heart failure.

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She is approximately 163 cm in height and moderately heavy upon visual assessment. Her thoracic region displayed a long, vertical scar down the median plane, commonly indicative of cardiac surgery. During dissection of the pectoral region and anterior thoracic wall, staples were discovered bisecting the entire length of her sternum at the midline. Removal of the anterior thoracic cage was difficult due to considerable fibrotic scarring between the pericardial sac and the endothoracic fascia posterior to the sternum. The enlargement of the heart was visually evident as the donor's cardiothoracic ratio was 0.67, placing her clearly in the cardiomegaly range [2]. The left and right atrium, as well as the right ventricle, were enlarged. The left ventricle was narrowed with considerable hypertrophy of the ventricular walls (Figure 1).

Figure 1) *Anterior view of the donor's heart. Note the narrowed left ventricle and enlarged right atrium, right ventricle, and left atrium.*

Once the pericardial sac was removed from our donor's heart, we were able to see evidence of surgery on the heart itself. Surgical stitches were discovered at the base of the aorta and our initial assumption was that she had undergone a coronary artery bypass graft (CABG), but there was no evidence of coronary bypasses as the heart was cleaned. Upon opening the left and right atrium, we found that both the bicuspid and tricuspid valves had been replaced with mechanical valves. Both valves were circular with a 2.5 cm diameter and would have operated via hemodynamic flow (Figure 2). Within the left and right ventricle, the valve cusps, chordae tendineae, and papillary muscles were removed. In the left ventricle, we found that the aortic semilunar valve had also been replaced with a circular mechanical valve, approximately 2 cm in diameter (Figure 3). The pulmonary semilunar valve was the only valve that retained its original components.

Figure 2) ***Left.*** *Mechanical valve replacement of the bicuspid valve.* ***Right.*** *Mechanical valve replacement of the tricuspid valve.*

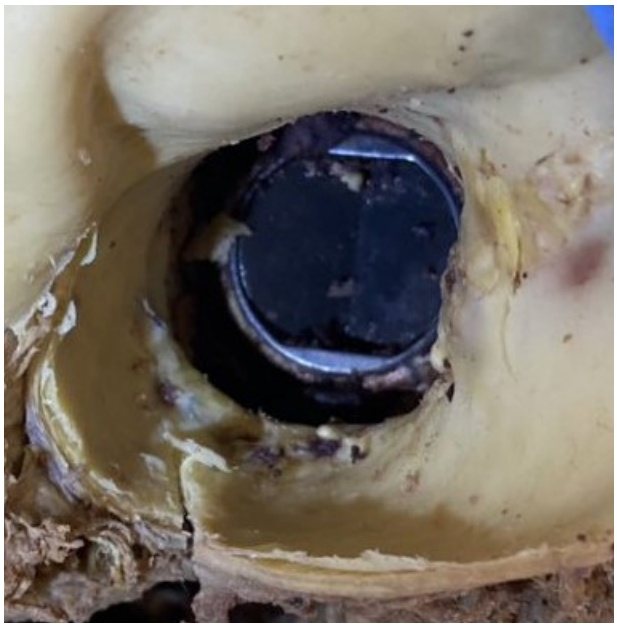

Figure 2) *Mechanical valve replacement of the aortic semilunar valve.*

The following measurements were taken from our donor. However, due to the formaldehyde preservative and timing of dissections, slight discrepancies from true dimensions may exist since the donor's time of death. Chest circumference was 86 cm, thoracic spine (i.e., T1-T12) was 26 cm, and horizontal chest-length was 27 cm. Approximate dimensions of the heart include: a circumference about the coronary artery of 33 cm, the base of the aorta to the apex was 11.5 cm, anterior right marginal to left marginal artery length was 18 cm via the coronary sulcus, from the right marginal artery the sulcus to the apex was 10 cm, from the left marginal artery the sulcus to the apex was 9 cm, the right atrium volume was 9 cm^3, and the left atrium volume was 12.5 cm^3.

Discussion

RHD is the consequence of a multisystem inflammatory condition known as rheumatic fever (RF). RF originates from an autoimmune reaction to a *Streptococcus pyogenes* infection. If left untreated, pancarditis ensues which eventually leads to valvular fibrosis, stenosis, or insufficiency [3]. The disease progression of RHD is usually expeditious in nature, hence prophylactic measures like early detection, proper hygiene, and penicillin antibiotics are encouraged. Despite global efforts to eradicate RHD, endemic areas (e.g., developing nations) endure this disease as a major health problem [4]. Essentially, this condition causes vast amounts of burden that necessitates open heart surgery, of which valve replacement is preferred over valve repair.

In the case of our donor, we identified that she had progressed from the acute RF phase to chronic RHD because she had three mechanical valve replacements and an absence of Aschoff bodies in her one remaining valve (i.e., pulmonic valve). Aschoff bodies or nodules normally appear in acute pre-rheumatic disease states and eventually leads to scarring of the atrioventricular (AV) and semilunar valves warranting their inevitable replacement [5]. RHD typically affects the mitral valve alone in 60% of cases, a combined mitral and aortic valve involvement in 20% of cases, and aortic plus both AV valves in merely 10% cases [5]. As a result of our donor's rare presentation, we predict that her RHD had diminished her heart valves integrity to such a severe extent that they required a TVR.

TVR procedures represent less than 1% of heart valve replacements that cardiac surgeons perform [6]. Therefore, our donor could have had a bi-valve replacement, which is the most common replacement procedure, followed by a single valve replacement. However, this is highly unlikely given the fact that patients with RHD only undergo replacement surgery once their disease status becomes severe [7]. Since the mitral valve and aortic valves are typically the first ones to be involved in RHD at a median age of 20, one could hypothesize that these valves were sent for repair followed by a later procedure for the tricuspid valve to be repaired. As RHD rapidly progresses and in the event of a rare presentation, such as our donor, this would imply an open-heart surgery being performed at some point to replace (not repair) the faulty valves [6]. Consequently, by the time our patient reached nearly 50 years old, her RHD must have warranted the replacement of all three valves. These valves would be replaced simultaneously in a single operation rather than separate operations because the time to recover from an individual open-heart surgery, given that the surgery goes well with few complications, is roughly 2-3 months [8].

Ultimately this case report serves to incorporate anatomy from a medical student's preclinical education into real patient contexts. A study conducted by Asante et al. found that case reports, such as this one, offers practical application of anatomical knowledge to further develop medical student's understanding and appreciation for clinical relevance of anatomy. This aids in developing their critical thinking skills as they apply anatomical knowledge to diagnose and comprehend pathological processes. In our case we analyzed the anatomical presentations of our donor's heart in order to retrospectively diagnose a pathological problem. Moreover, this interactive teaching method has a strong positive perception among medical students and is positively correlated with their interest and retention of anatomy [9].

Conclusion

Realistically, we believe there would have been little to no time for our donor to have been diagnosed with only 2 valves needing replacement followed by a later diagnosis mandating the third valve to be replaced. Hence, we conclude a simultaneous TVR must have been performed. Additionally, this case report serves as a useful educational exercise for medical students to ponder differentials while performing cadaveric dissections in their preclinical training.

Ethical approval

The donor was part of a medical anatomy laboratory course. Permissions for research were obtained from UT Southwestern Willed Body Program.

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