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Emergent Operative Treatment of Aortic Dissection Years after Aortic Valve Balloon Dilatation, Ross Procedure, and Aortic Valve Replacement

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Aortic dissection; Ross procedure; Aortic valve replacement; Aortic valve reoperation; congenital heart disease

1. Abstract

This case report discusses a 38-year-old female with a history of congenital aortic stenosis who underwent the Ross procedure and subsequent aortic valve replacement (AVR) with a biological prosthesis. The patient presented with chest tightness and shortness of breath, revealing a 9 cm ascending aortic aneurysm 14 years post-Ross procedure. Operative intervention exposed a chronically dissected ascending aorta with severe degeneration of the implanted biological aortic valve. This commentary emphasizes the critical implications for management and surveillance in post-Ross procedure patients. Long-term complications, such as aortic root dilation and aortic regurgitation, necessitate careful monitoring. Our findings, occurring beyond the typical timeframe for complications, underscore the importance of continual surveillance in patients with autograft roots. We discuss the need for heightened awareness and consideration of ascending aorta replacement during aortic valvular operations, especially in those with predisposing factors. The case highlights the rarity of aortic dissection 14 years post-Ross procedure and the associated challenges in early detection. This commentary stresses the significance of strict follow-up protocols, advocating for ongoing monitoring of aortic dimensions and autograft tissue. The case serves as a reminder to the medical community to remain vigilant, considering the potential risks and complications even years after seemingly successful surgical interventions in congenital heart disease patients.

2. Background

Aortic valve pathology is one of the most common congenital heart pathologies, occurring in 5% of all children with heart disease. The choice of the best conduit for replacing the aortic valve that could sustain the hemodynamic challenges was and remains the subject of many researches. Since the time it was first described by Donald Ross in 1967, the Ross procedure was considered an excellent option for younger patients who needed to undergo aortic valve replacement (AVR). [1] Ten-year survival for the procedure has been reported as high as 96%, with up to 75% 10-year freedom from reoperation. The downsides and repercussions were well known even when it was first introduced and became more evident in the later years. The most important ones included aortic root and ascending aorta dilatation, and aortic regurgitation (AR). A study reported root dilation (>4 cm) in as many as 58% of patients and hemodynamically significant aortic regurgitation in 25% at 7 years [2].

3. Case Presentation

A 38-year-old female presented to the Emergency medicine department, complaining of mild chest tightness and shortness of breath. The patient had a history of congenital aortic stenosis. Due to the previously mentioned, she underwent aortic balloon dilatation at the age of 8. The Ross procedure for aortic insufficiency was performed 7 years later, and 7 years after that, aortic valve

replacement (AVR) with a biological prosthesis. (Figure 1) Other than the congenital heart disease (CHD) she had no other underlying comorbidities. The patient is a non-smoker and a non-drinker. She was pregnant and gave birth to one child. Her family history was insignificant regarding heart disease. Computed tomography (CT) scan at the time of the admission revealed a 9 cm ascending aortic aneurysm (AsAoA). (Figure 1, Figure 2) The echocardiogram showed a preserved ejection fraction of 55%–60% and dilatation of the ascending aorta up to 7, 6 cm. Aortic regurgitation was described as severe with AR PHT 183ms, combined with severe aortic stenosis (AS) and AVPGmean 57mmHg. Mitral and tricuspid regurgitation were trivial to a mild degree. The last ultrasound control was performed two years before admission, and the diameter of the ascending aorta was 43mm, meaning it grew more than 4 cm. Given the patient's symptomatic presentation and associated CT findings, she was admitted for emergent operative treatment.

In the operating room at the time of re-do sternotomy, examination revealed AsAoA, which filled most of the upper mediastinum and propagated to the underside of the sternum to which it was densely adherent. The heart was rotated and consequentially, the right heart cavities moved inferiorly and posteriorly. This caused the right atrium (RA) and right ventricle (RV) to settle behind the aneurysm. A significant amount of dense, adherent, inflammatory tissue was appreciated all around the heart cavities and the ascending aorta and aortic root. The aneurysm was extremely fragile, decaying when touched, and bleeding. Upon examining the aorta, the dissection flap was evident and it expanded into the root, and distally about 2 cm below the origin of the brachiocephalic trunk, where the healthy aortic tissue was discovered and would later be used as a site for cross-clamping. For this reason, cardiopulmonary bypass (CPB) was initiated using the right subclavian artery and right femoral vein for cannulation. Cardioplegia was administered directly into the coronary ostia. After cannulation and detailed examination, it was concluded that the AoA is chronically dissected, with a false lumen facing laterally and posteriorly. The previously implanted biological AV had signs of severe degeneration with commissures that were fused and the cups were rigid (Figure 3) Combined AS and AR were noted.

After the autograft and valve were excised and the coronary artery buttons mobilized, a Bentall STJ 23mm mechanical prosthesis and graft were sutured to the annulus. Coronary arteries were reimplanted into the graft. Control TEE was performed, and it showed normal flow over the AV, good RV, and LV dynamic. After the appropriate reperfusion time, the patient was warmed and weaned from bypass. Detailed hemostasis and sternal closure were done next. The patient was hemodynamically stable and EKG was within normal limits. With low to medium doses of 3 inotropes, continuously administered, with and minimal drainage, she was transferred to the intensive care unit (ICU). She spent 4 days in the ICU, was completely hemodynamically stable, neurologically intact, and mobilized. After an uneventful remaining course, she was discharged home on the 10th postoperative day. Control TTE 6 months after surgery showed preserved EF, no MR, TR, or AR with AVPGmax 19mmHg.

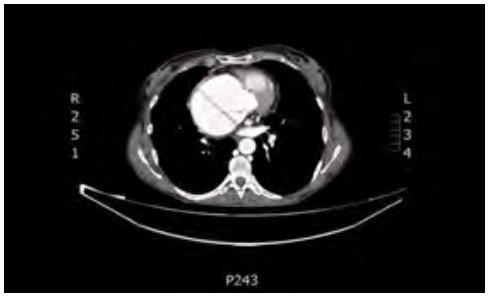

Figure 1: Obtained CT images of aortic dissection

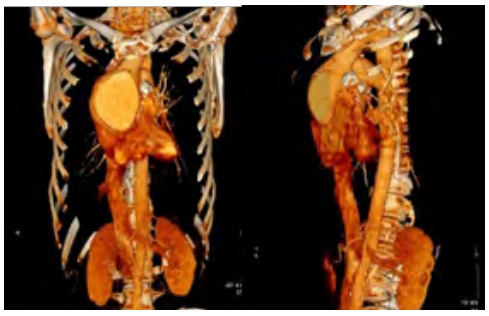

Figure 2: CT 3D reconstruction images of aortic dissection finding

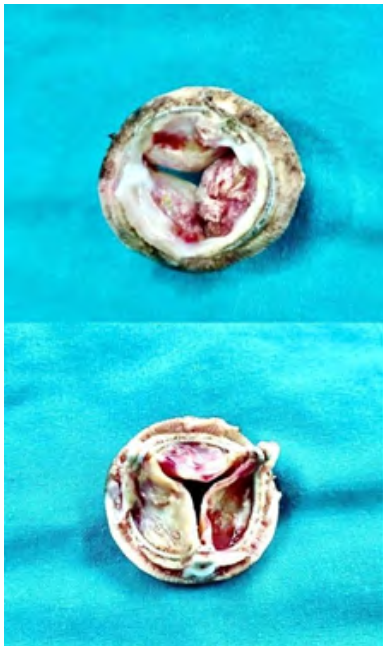

Figure 3: Image of excised aortic valve bioprosthesis

4. Comment

Dilatation of the aortic root and aortic valve insufficiency are relatively common consequences of the Ross procedure. This process is considered to begin early and progresses over the following years, but rarely reaches a significant point. [3] So far, when reviewing described cases of significant dilation of the autograft after the Ross procedure, and a lesser number of aortic dissection

cases, the median time frame in which they occurred was approximately 7 years postoperatively. [4] At 7 years, freedom from dilatation was 42+/-8%, freedom from regurgitation was 75+/-8%, and freedom from reoperation was 85+/-10% [2]. We have found one case that described the aortic dissection 16 years after the Ross procedure [5], as well as one 13 years after primary surgery, after pregnancy. [3] In this patient the severe dilatation and aortic dissection occurred 14 years after the Ross procedure, and 7 years after the first reoperation. As in most cases, TTE and CT didn't show signs of pericardial effusion. Research shows that 22-27% of patients who undergone previous AVR, with an ascending aorta diameter larger than 50 mm, eventually develop a Stanford type A dissection. We also considered this with regard to our patient because her first re-do surgery was the AVR [6-8]. Some data also suggest that pregnancy increases the risks of aortic complications such as rupture or dissection, particularly if the patient had previous aorta and aortic valve surgery [3]. Here, one could reason that the combination of all of the above-mentioned, predisposed the patient to the development of severe aortic dilation and consequentially aortic dissection. As in other studies, we believe that strong consideration should be given to the replacement of the abnormal ascending aorta at the time of any aortic valvular operation when the previous comorbidities and risk factors are included. High awareness of potential dissection is required in all patients with autograft roots, particularly those patients whose autograft root gradually dilates over the years. Strict surveillance follows up and monitoring of these rare patients should be continuously performed to follow the dimensions of the remaining aortic and autograft tissue.

5. Conflict of Interest Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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