


A case of freestyle valve reoperation 23 years after the first operation

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Abstract

We present a case of redo stentless valve operation in a 73-year-old man who underwent aortic valve replacement via the subcoronary approach with a freestyle aortic bioprosthesis 23 years ago at our institution. He was referred for surgery because an echocardiogram showed severe aortic regurgitation due to structural valve deterioration, and aortic valve replacement was planned. Severe circumferential calcification and adhesion were noted during the surgery between the freestyle and native roots. Redo-aortic valve replacement was successful despite the technical difficulty. In stentless valve reoperations following aortic valve replacement via the subcoronary method, the planning of valve-in-valve transcatheter aortic valve implantation and sutureless valve implantation may be a practical and safe strategy.

Keywords

Stentless bioprosthesis, stentless valve, structural valve deterioration, reoperation, redo aortic valve replacement

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Introduction

The Medtronic Freestyle stentless bioprosthetic valve offers excellent hemodynamic performance and long-term durability. Some studies have reported that a redo stentless valve operation is technically demanding due to severe calcification and adhesion between the stentless valve and native aortic root. However, there have been a few reports on the strategies and outcomes of stentless valve reoperations. We report a case of redo stentless valve operation 23 years after aortic valve replacement (AVR) via the subcoronary approach.

Case presentation

A 73-year-old man was diagnosed with aortic regurgitation due to the bicuspid valve 23 years ago. He underwent AVR via the subcoronary approach with a freestyle aortic bioprosthesis at our institution. He was being followed up somewhere else and was referred to our institution for exertional dyspnea. An echocardiogram showed normal left ventricular function with an ejection fraction of 58%, a left ventricular diastolic/systolic diameter of 43/29 mm, no pericardial effusion, no aortic stenosis, moderately severe aortic regurgitation due to structural valve deterioration, and moderate tricuspid regurgitation. Computed tomography revealed severe calcification of the aortic root (Figure 1(a)).

AVR and tricuspid annuloplasty were planned because the patient had low surgical risk scores (EuroSCORE II 5.5%) and no frailty. Through median sternotomy, the adhesion was carefully released, and the femoral vein and ascending aorta were cannulated. Then, the cardiopulmonary bypass was initiated. The superior vena cava cannula was added, and the total flow was obtained. Severe adhesions around the native aortic root were noted. After the aortotomy, a leaflet tear was found on the non-coronary cusp (Figure 1(b)). There were severe, circumferential calcifications and adhesions between the freestyle porcine root and native aortic root. The boundary between the porcine and native aortic root was not detected, and both appeared fused. A suture could not be placed on the annulus. Upon inspecting the stentless valve, decalcification was performed using the cavitron ultrasonic surgical aspirator to preserve the native aortic root. We explanted all parts of the freestyle valve except for the first-line cuff. AVR was performed with a

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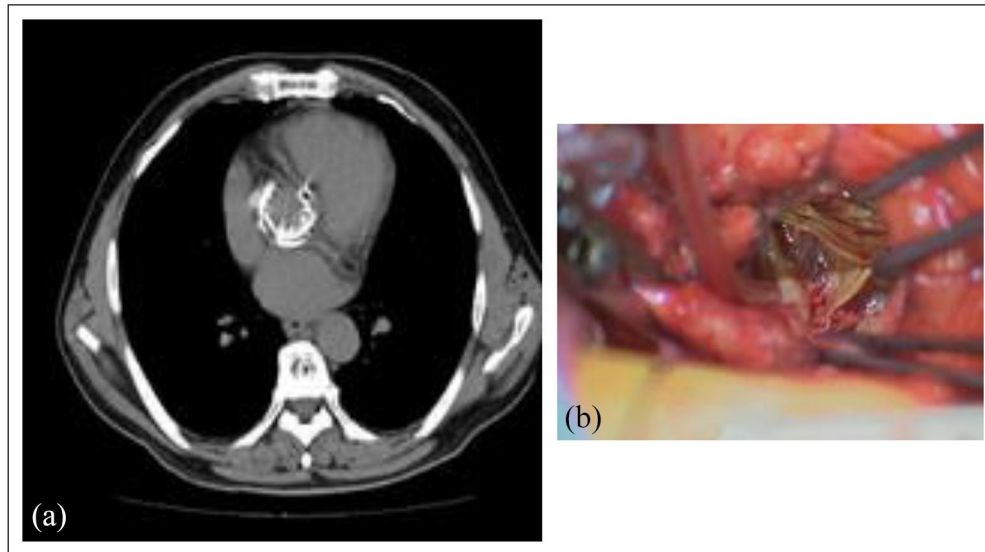


Figure 1. (a) A preoperative computed axial tomography showed severe calcification of the porcine and the native aortic root and (b) operative findings showed a leaflet tear and calcification of the non-coronary cusp.

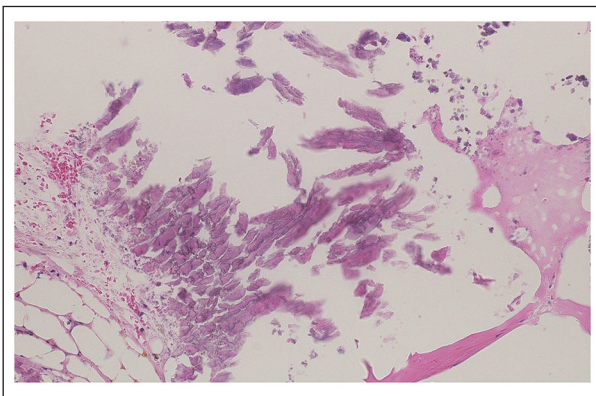


Figure 2. The pathological findings of leaflets showed degenerated tissues and a few aggregated histiocytes and deposition of calcification and cholesterol. Inflammatory and immune responses were implicated.

21-mm Edwards INSPIRIS Resilia valve in the supra-annular position. Tricuspid ring annuloplasty was performed with a 28-mm Carpentier Physio Tricuspid ring. The cardiopulmonary bypass time and aortic cross-clamp time were 375 and 217 min, respectively.

On postoperative day 1, the patient was extubated, and he resumed eating. A postoperative echocardiogram on postoperative day 7 revealed no aortic regurgitation. He was discharged on postoperative day 10. The pathological findings of leaflets included aggregated histiocytes and deposition of calcification and cholesterol (Figure 2). These findings suggested that inflammatory and immune responses were involved. The patient has been regularly visiting our clinic for 2 years following the operation.

Discussion

The excellent durability of the freestyle porcine bioprosthesis has been documented by several studies.¹

Nevertheless, stentless valves have currently limited popularity partly because the redo stentless valve operation is surgically challenging. Schneider et al.² observed that the prostheses implanted via the subcoronary approach grew into the native aortic root wall and annulus. Root replacement is a straightforward solution because complete resection of the prosthesis without damaging the native wall or annulus may not be feasible.² In this case, the first operation was performed with freestyle bioprosthesis despite its more demanding implantation technique because its long-term durability and excellent hemodynamic performance were expected. In addition, 23 years ago when freestyle valves began being used in our nation, its associated increased risk of stentless valve reoperation was not widely known.

There are some techniques to avoid standard AVR which requires annular sutures and root replacement. Hamasaki et al.³ have reported that redo AVR with Solo Smart bioprosthesis was performed successfully for a severely calcified sewing cuff along with the annulus tissue. In this case, Solo Smart bioprosthesis implantation into the wall of the sinus of Valsalva seemed impossible because of the severe calcification.³

Some have reported that the valve-in-valve procedures can be an effective way. Finch et al.⁴ studied the outcomes of aortic root replacement and valve-in-valve (ViV) after redo stentless operations. The 30-day mortality was reportedly higher in root replacement (11% vs 3%).⁴ They concluded that in cases wherein both root diameters are permissive and adequate debridement is feasible, ViV replacement is a

more conservative surgical strategy. Furthermore, others have reported that ViV transcatheter aortic valve implantation (TAVI) and sutureless valve implantation have been performed successfully and that these procedures can be valid alternatives to a failed stentless valve surgery.^{5,6} In this case, surgical AVR was planned; however, surgical AVR required so much technical difficulties and led to a longer operation time. ViV-TAVI or sutureless valve implantation should have been performed.

However, in stentless valve reoperation with the full-root method long after AVR, attention should be paid to the ViV procedure because the rupture of porcine roots has been reported. David et al.⁷ reported that mild dilation of porcine aortic roots after surgery is common, although aneurysm formation and rupture are rare during the first decade of follow-up. In such cases, aortic root replacement may be necessary if patients can endure the procedure.

We should have studied why those calcifications occurred mostly in the porcine aortic root other than in the cusps, but to our regret, the excised root was not pathologically studied. Della Barbera et al.⁸ studied 82 cases of structural valve deterioration of stentless valves. They reported that in stentless porcine, pinpoint calcification mostly occurred at the commissures, which are attached to the xenograft wall. Inflammation is often observed at the xenograft aortic wall partly because a freestyle valve has larger areas of porcine aortic tissue exposed to the host's tissue and circulation compared to other stentless valves, which may be related to glutaraldehyde fixation.^{8,9}

Conclusion

In this stentless valve reoperation, severe circumferential calcification and adhesion were observed between the freestyle porcine root and native aortic root. Both roots were fused by calcification. Severe calcifications and adhesions made suture placement challenging. ViV-TAVI or sutureless valve implantation may be a practical and safe strategy for stentless valve redo surgery.

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Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

This case was reported while adhering to the tenets of the World Medical Association Declaration of Helsinki. Submitted manuscripts conformed to the ICMJE Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals.

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Informed consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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