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Case Report

Re-do Replacement Surgery for Degenerated Stentless Bioprostheses : The Open "Valve-in-Valve" Technique

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ABSTRACT

Re-do operations for stentless bioprostheses are considered high-risk procedures, because severe adhesions are often found around the prosthesis. We present a technique for re-do replacement of a degenerated stentless bioprosthetic aortic valve within the prosthesis (open "valve-in-valve" procedure). This technique provides the possibility of a valve re-do replacement without disturbing the severely adherent stentless bioprosthesis or the aortic root or both. We believe that this technique is a simple and safe way to perform re-do replacement of a degenerated stentless bioprosthetic valve without dissecting the severe adhesion. (Jikeikai Med J 2011 ; 58 : 117-20)

Key words : reoperation (aortic valve), aortic valve (replacement), heart valve (bioprosthesis)

INTRODUCTION

The stentless bioprosthetic valve has been used extensively in the aortic position because of its good hemodynamic properties and durability[1,2]. However, more than 15 years later, the expectation of durability has only been partially fulfilled. Re-do operations because of structural valve deterioration have recently been reported. Re-do replacement of stentless aortic valves implanted with the subcoronary, root inclusion, and full-root techniques are considered high-risk procedures, because these prostheses often show severe adhesion around the aortic root[3].

We treated 2 patients with failed stentless bioprostheses (Freestyle tissue valve ; Medtronic Inc., Minneapolis, MN, USA). One bioprosthesis had been implanted with the subcoronary technique (patient 1, a 74-year-old man), whereas the other was a full-root implantation with a stentless valve and composite Dacron vascular prosthesis (patient 2, a 72-year-old woman). Here, we describe the re-do replacement of a degenerated surgical stentless bioprostheses within the valve without explantation of the implanted valves. This technique is simple and reproducible and allows replacement without the need for excision of a severely adherent stentless valve or aortic root reconstruction.

TECHNIQUE

The patients underwent re-do surgery via median sternotomy using standard cardiopulmonary bypass and mild systemic hypothermia. A femoral artery was cannulated for arterial return. A femoral vein and the superior vena cava were cannulated for venous drainage. Myocardial protection was achieved by selective antegrade/retrograde infusion of a cold blood cardioplegic solution. A left ventricular drain was inserted through the right upper pul-

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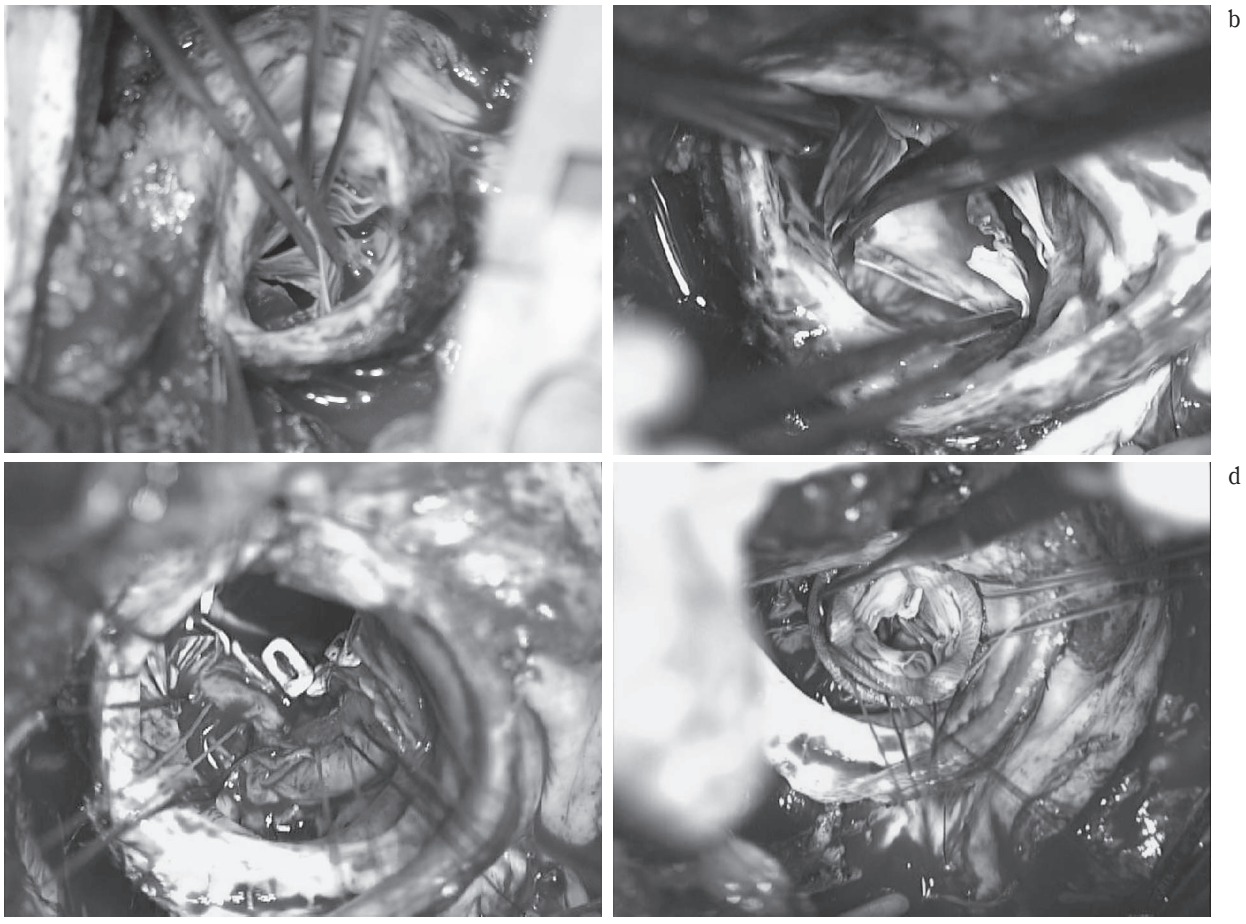

Fig. 1. Figure showing the revision surgery in patient 1 (a 74-year-old man who underwent subcoronary implantation).
a : Transverse incision of the stentless graft above the commissures of the stentless valve. A tear was observed in the left coronary cusp.
b : Only the cusps were removed. Dissection of the surrounding fibrotic tissue was minimal, and the severe adhesion of the aortic root was left untouched.
c, d : After the cusps were removed, the new valve was sutured to the annulus of the stentless valve with interrupted pledgeted mattress sutures (2-0 braided polyester) using a supra-annular technique.

monary vein.

Revision replacement of the aortic valve was performed by means of transverse incision of the stentless graft above the commissures of the stentless valve prosthesis in patient 1, and by transverse incision of the composite Dacron graft in patient 2. Minimal dissection of the adhered tissue was performed, just around the ascending aorta (or Dacron graft or both) to allow aortic cross-clamping and transverse incision. The primary surgery in patient 1 had been performed with a subcoronary technique and a 25-mm Freestyle stentless valve, whereas patient 2 had been treated with the full-root technique and a 25-mm Freestyle stentless valve combined with a 24-mm Dacron graft. Both patients exhibited tears extending along the base of the valve cusp parallel to the sewing ring (the left coronary cusp in patient 1 and the noncoronary cusp in patient 2) (Fig. 1a). There was no calcification or endocarditis around the stentless valve. After the cusps of the stentless valves were removed (Fig. 1b), the aortic valve was replaced with a 19-mm Mosaic bioprosthetic heart valve (Medtronic Inc) in patient 1 (Fig. 1c, 1d) and a 19-mm St. Jude Medical Regent valve (St. Jude Medical Inc., St. Paul, MN, USA) in patient 2, following the routine procedure. Valves were sutured to the annulus of the stentless valves with interrupted pledgeted mattress sutures (2-0 braided polyester) by means of a supra-annular technique with the sutures passed through the annulus from the ventricular side (Fig. 1c).

The postoperative courses were uneventful, and both patients were discharged from the hospital in good condition. Their follow-up periods have been uneventful, with normal aortic valve function 4.5 years later (patient 1) and 2 years later (patient 2).

Discussion

We performed re-do replacement of stentless bioprostheses without explantation (open "valve-in-valve" technique). Our results confirmed that replacement within a stentless bioprosthesis is easier than complete replacement of the bioprosthesis. Therefore, this technique can be used for re-do surgery of degenerated stentless bioprostheses while avoiding the potential risks of complete excision of a severely adherent bioprosthesis as well as the total root reconstruction after full-root implantation.

The concept of re-do replacement of a bioprosthesis alone within an aortic composite graft after root replacement was first described by Shawkat et al.[4] and Urbanski et al.[5]. Although their concept of leaving the severely adherent aortic root undisturbed is similar to our concept, the concepts differ in whether the degenerated bioprosthesis is completely removed (they used a "stented" bioprosthesis, which was completely removed). In our procedure, we removed only the cusps of the degenerated "stentless" valve to minimize surgical invasion and avoid the risks involved in dissecting the adhesion. The "valve-on-valve" technique, in which a mechanical prosthesis is implanted on degenerated "stented" bioprosthetic annulus, was reported by Stassano in 1993[6]. They implanted the new valve on the "stented" bioprosthetic annulus, whereas we implanted the new valve within the aortic conduit of the "stentless" bioprosthesis after removing the valve leaflets.

Although our procedure avoids the risk of dissecting the severely fibrotic surrounding tissue, there are concerns about long-term results. The surgically implanted prostheses are small (19-mm bioprosthesis and 19-mm mechanical valve). The small valve size used for valve-in-valve implantation might result in effective orifice areas that are smaller than the acceptable limits, thereby creating a patient-prosthesis mismatch. The long-term durability of the remaining parts of the stentless bioprosthesis is also a concern.

Transcatheter aortic valve implantation (TAVI) for failed surgical bioprostheses (valve-in-valve TAVI) has recently been described as an option for patients for whom a second open-heart surgery is considered high risk[7,8]. The metal radiopaque stent framework serves as an ideal landing zone for the TAVI in "stented" bioprostheses; however, TAVI for the treatment of a dysfunctional "stentless" bioprosthesis is a challenging procedure, because of the lack of landing support (stent) for anchoring the transcatheter valve. Moreover, the absence of radiopaque markers complicates the positioning of the transcatheter valve[7]. Furthermore, excessive pannus can cause misdeployment, underexpansion can generate a suboptimal peak transvalvular gradient, and distortion can cause premature valve failure or compromised durability or both. Several other concerns concerning coronary obstruction should be highlighted[9]. Although the concept of "valve-in-valve" TAVI is an attractive option for patients with a failed stentless bioprosthesis, clinical experience is limited, and the device is not commercially available in Japan. At this time, an open "valve-in-valve" procedure might be practical. In conclusion, we believe that an open "valve-in-valve" procedure is a good therapeutic option, especially for high-risk patients with a degenerated aortic stentless bioprosthesis.

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