American Journal of Case Reports

ISSN 1941-5923
© Am J Case Rep, 2016; 17: 699-702
DOI: 10.12659/AJCR.899374

Received: 2016.05.02
Accepted: 2016.06.14
Published: 2016.10.03

Valve-in-Valve Replacement Using a Sutureless Aortic Valve

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

ABCDEFG 1,2 Pascal M. Dohmen
BDE 3 Lukas Lehmkuhl
DEF 1 Michael A. Borger
DE 1 Martin Misfeld
DE 1 Friedrich W. Mohr

1 Department of Cardiac Surgery, Heart Centre Leipzig, University of Leipzig, Leipzig, Germany
2 Department of Cardiothoracic Surgery Faculty of Health Sciences University of The Free State, Bloemfontein, South Africa
3 Department of Radiology, Heart Centre Leipzig, University of Leipzig, Leipzig, Germany

Corresponding Author: Pascal M. Dohmen, e-mail: pascal.dohmen@yahoo.de
Conflict of interest: None declared

Patient: Female, 61
Final Diagnosis: Tissue degeneration
Symptoms: Dyspnea
Medication: —
Clinical Procedure: Redo valve replacement
Specialty: Surgery

Objective: Rare disease
Background: We present a unique case of a 61-year-old female patient with homograft deterioration after redo surgery for prosthetic valve endocarditis with root abscess.
Case Report: The first operation was performed for type A dissection with root, arch, and elephant trunk replacement of the thoracic aorta. The present re-redo surgery was performed as valve-in-valve with a sutureless aortic bioprosthesis. The postoperative course was uneventful and the patient was discharged on day 6.
Conclusions: The current case report demonstrates that sutureless bioprostheses are an attractive option for surgical valve-in-valve procedures, which can reduce morbidity and mortality.

MeSH Keywords: Aortic Valve • Aortic Valve Stenosis • Cardiac Surgical Procedures

Full-text PDF: http://www.amjcaserep.com/abstract/index/idArt/899374

Background

Re-aortic root replacement carries a significant risk of mortality and morbidity; therefore, alternative options must be considered [1]. Transcatheter aortic valve implantation (TAVI) has become implemented in daily practice to treat aortic valve disease and is associated with significant advantages in inoperable patients [2]. For high-risk patients, TAVI *vs.* surgical aortic valve replacement (SAVR) is controversial due to potential complications such as pacemaker implantation [3], paravalvular leak [4], and hospital mortality [5]. Sutureless aortic valves are an additional proposed option in such high-risk patients [6–8]. The current case study presents a re-redo valve-in-valve procedure with a sutureless bioprosthesis to treat a failing homograft.

Case Report

A 61-year-old obese (body mass index of 37.5 kg/cm^2) female patient with dyspnea, NYHA Class II, was admitted to our hospital. The medical history of this patient showed surgery for type A dissection in 2008, which was successfully treated with a 23-mm biological root replacement, extended by a 24-mm Dacron prosthesis for arch repair and elephant trunk. In the following year the patient developed active infective endocarditis of her bioprostheses, with severe abscess, which was treated with a 21-mm aortic homograft in re-root technique. On the most recent admission, transthoracic echocardiography showed a severely calcified homograft with an aortic orifice area of 0.4 cm^2, a peak pressure gradient of 79 mmHg, and a severely hypertrophic left ventricle. The left ventricular ejection fraction was mildly reduced at 47%. Angiography excluded relevant coronary artery disease. Computed tomography showed a severely calcified aortic homograft, so-called porcelain ascending aorta (Figure 1), with a rest dissection membrane extending from the descending aorta into the iliac vessels. A median re-re-sternotomy was carefully performed since peripheral cannulation was not possible due to previous surgery and rest dissection membrane. The operative situs revealed intensive adhesions and preparation performed under cardiopulmonary bypass was performed on the beating heart. The aortic homograft was exposed through a high transverse aortotomy, performed at the level of the Dacron prosthesis. After excision of the aortic homograft leaflets, a sutureless Perceval size S (Sorin Biomedica Cardio Srl, Sallugia, Italy) bioprostheses was positioned into the homograft annulus by using 3 guiding suture-lines. After successful ballooning and using warm saline solution to unfold the nitinol stent, the guiding sutures were removed. Aortic cross-clamping time was 52 min and cardiopulmonary bypass time was 108 min. Intraoperative transesophageal echocardiography demonstrated no paravalvular leakage, with a peak and mean pressure gradient of 11 and

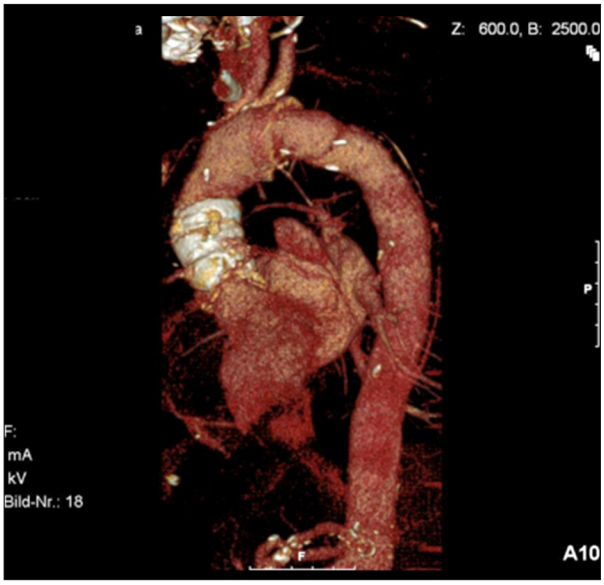

Figure 1. Multi-slice computed tomography of a 61-year-old female patient with a heavily calcified aortic homograft.

5 mmHg, respectively. The patient recovered quickly and was discharged home on postoperative day 6. Today, the patient is doing well and echocardiographic follow-up of the sutureless valve at 1 year is unchanged. The left ventricular ejection fraction has further normalized to 72%.

Discussion

The mortality rates of redo procedures after aortic root replacement due to active infective bioprosthetic endocarditis or after type A dissection are reported to be 7.7–17.9% [9,10]. This mortality risk is high during the early postoperative phase [11]. However, insufficient data exists after re-redo operations of both etiologies to estimate the current patient's risk. Transcatheter treatment of tissue valve deterioration, as well as of chronic and acute vascular diseases, are increasingly common [12]. There is growing interest in performing valve-in-valve TAVI procedure in failing bioprostheses, including homografts. Recent studies show the superiority of TAVI compared with medical therapy in inoperable patients, with improved survival rates and reduction of medical costs [13]. However, there is a gray zone for intermediate-risk (STS risk 4–8%) and high-risk (>8%) patients. Scharmer [5] showed that the in-hospital mortality is always lower in SAVR compared with TAVI, but for patients with a logistic EuroSCORE >20% it is similar, at 11.7% and 11.4%, respectively. TAVI appears to be favorable in very old patients. Finch et al. [1] reported on failing stentless aortic valve implantation following subcoronary or root replacement. They found a trend favoring valve-in-valve *vs.* root replacement with regards to decreased morbidity (26% *vs.* 48%, P=0.007),

as well as a trend for reduced mortality in TAVI patients (3% *vs.* 11%, p=0.12). The mean and peak velocity, however, were significantly higher in TAVI patients (2.0±0.5 *vs.* 1.2±0.4 m/s and 2.9±0.6 *vs.* 1.7±0.4 m/s, respectively, both p<0.0001). If transfemoral TAVI is not possible, as in this patient, an alternative could be the transapical approach. Bapat et al. [14], however, discussed the "Russian nested doll" problem with high post-procedural mean gradients of at least 20 mm Hg in small-diameter bioprostheses. A similar caution was provided by Gurvitch et al. [15] because significant residual gradients may remain with the currently available TAVI prostheses in ≤21-mm bioprostheses, especially in younger patients, and no long-term follow-up data are currently available.

In the current patient, as SAVR approach was performed by using a sutureless bioprosthesis to avoid a re-redo root replacement in a porcelain homograft with associated high risk of morbidity and mortality. The clinical course showed a fast recovery, with favorable valvular hemodynamics and rapid left ventricular recovery. A recent propensity-matched study by Santarpino et al. [6] compared the use of transcatheter valves with sutureless valves in high-risk patients, demonstrating a higher rate of paravalvular leakage in the TAVI group *vs.* the sutureless valves (13.5% *vs.* 0%, p=0.027). The overall cumulative survival in both groups was also significantly different, being 97.3% in the sutureless group *vs.* 86.5% in the TAVI group (p=0.015). Interestingly, this study showed a 25% mortality rate in patients with paravalvular leakage and no mortality in patients without paravalvular leakage. Initially, sutureless aortic valve were redesigned to facilitate the performance of minimal invasive aortic valve replacement in patients [16]. The benefits of using sutureless aortic valves have been shown in several multicenter studies [17,18]. Therefore, the indication of using sutureless aortic valves has been extended in more demanding procedures [19]. Our group demonstrated promising results in high-risk patients suffering from TAVI failure or active prosthetic valve endocarditis [20,21]. Other groups have used sutureless aortic valves in high-risk patients suffering from multiple-valve disease, with excellent results [22]. Takagi et al. [23], in a recent meta-analysis of comparative studies between sutureless valves and TAVI, demonstrated a statistically significant reduction in early mortality in favor of sutureless valves over TAVI (2.5% *vs.* 7.3%; OR, 0.33 95% CI, 0.16–0.69; p=0.003) and a significant reduction of paravalvular leakage (3.5% *vs.* 33.2%; OR, 0.09; 95% CI, 0.05–0.16; p<0.00001), which has a significant influence on late mortality, as previously described. Furthermore, the economic impact of TAVI on society should not be underestimated, which clearly favor sutureless aortic valves [24]. Randomized trials are desperately needed to evaluate the optimal indication for sutureless valves *vs.* TAVI in patients at high risk in multiple-valve disease and patients with bioprosthetic valve deterioration, especially with small diameter.

Conclusions

The current case report demonstrates that sutureless bioprostheses are a safe and efficient option for surgical valve-in-valve procedures, which can reduce morbidity and mortality.

References:

1. Finch J, Roussin I, Pepper J: Failing stentless aortic valves: Redo aortic root replacement or valve in a valve? Eur J Cardiothorac Surg, 2013; 43: 495–504
2. Dubois C, Coosemans M, Rega F et al: Prospective evaluation of clinical outcomes in all-comer high-risk patients with aortic valve stenosis undergoing medical treatment, transcatheter or surgical aortic valve implantation following heart team assessment. Interact Cardiovasc Thorac Surg, 2013; 17: 492–500
3. Bagur R, Rodes-Cabau J, Gurvitch R et al: Need for permanent pacemaker as a complication of transcatheter aortic valve implantation and surgical aortic valve replacement in elderly patients with severe aortic stenosis and similar baseline electrocardiographic findings. JACC Cardiovasc Interv, 2012; 5: 540–51
4. Kodali SK, Williams MR, Smith CR et al: Two-year outcomes after transcatheter or surgical aortic-valve replacement. N Engl J Med, 2012; 366: 1686–95
5. Scharmer U: Surgical replacement or transcatheter implantation? How decisions should be made in aortic stenosis. Dtsch Med Wochenschr, 2011; 136: 2106–8
6. Santarpino G, Pfeiffer S, Jessl J et al: Sutureless replacement versus transcatheter valve implantation in aortic valve stenosis: A propensity-matched analysis of 2 strategies in high-risk patients. J Thorac Cardiovasc Surg, 2014; 147: 561–67
7. D'Onofrio A, Messina A, Lorusso R et al: Sutureless aortic valve replacement as an alternative treatment for patients belonging to the "gray zone" between transcatheter aortic valve implantation and conventional surgery: A prpensit-matched, multicentre analysis. J Thorac Cardiovasc Surg, 2012; 144: 1010–18
8. D'Onofrio A, Salizzoni S, Rubino AS et al: The rise of new technologies for aortic valve stenosis: A comparison of sutureless and transcatheter aortic valve implantation. J Thorac Cardiovasc Surg, 2016; 152(1): 99–109.e2
9. Malvindi PG, van Putte BP, Sonker U et al: Reoperation after acute type A aortic dissection repair: A series of 104 patients. Ann Thorac Surg, 2013; 95: 922–28
10. Leontyev S, Borger MA, Davierwala P et al: Redo aortic valve surgery: Early and late outcomes. Ann Thorac Surg, 2011; 91: 1120–26
11. Doerr F, Hledwein MB, Bayer O et al: Inclusion of "ICU-DAY" in a logistic scoring system improves mortality prediction in cardiac surgery. Med Sci Monit Basic Res, 2015; 21: 145–52
12. Patelis N, Moris D, Karaolanis G, Georgopoulos S: Endovascular *vs.* open repair for ruptured abdominal aortic aneurysm. Med Sci Monit Basic Res, 2016; 22: 34–44
13. Reynolds MR, Magnuson EA, Wang K et al: Cost-effectiveness of transcatheter aortic valve replacement compared with standard care among inoperable patients with severe aortic stenosis: Results from the placement of aortic transcatheter valves (PARTNER) trial (Cohort B). Circulation, 2012; 125: 1102–9
14. Bapat V, Attia R, Redwood S et al: Use of transcatheter heart valves for a valve-in-valve implantation in patients with degenerated aortic bioprosthesis: Technical considerations and results. J Thorac Cardiovasc Surg, 2012; 144: 1372–80
15. Gurvitch R, Cheung A, Ye J et al: Transcatheter valve-in-valve implantation for failed surgical bioprosthetic valves. J Am Coll Cardiol, 2011; 58: 2196–209

16. Borger MA, Dohmen P, Misfeld M, Mohr FW: Current trends in aortic valve replacement: development of the rapid deployment EDWARDS INTUITY valve system. Expert Rev Med Devices, 2013; 10: 461–70
17. Haverich A, Wahlers TC, Borger MA et al: Three-year hemodynamic performance, left ventricular mass regression, and prosthetic-patient mismatch after rapid deployment aortic valve replacement in 287 patients. J Thorac Cardiovasc Surg, 2014; 148: 2854–60
18. Laborde F, Fischlein T, Hakim-Meibodi K et al" Clinical and haemodynamic outcomes in 658 patients receiving the Perceval sutureless aortic valve: early results from a prospective European multicentre study (the Cavalier Trial). Eur J Cardiothorac Surg, 2016; 49: 978–86
19. Di Eusanio M, Phan K: Sutureless aortic valve replacement. Ann Cardiothorac Surg, 2015; 4: 123–30
20. Dohmen PM, Konertz J, Ewais E et al: Are sutureless aortic valves suitable for very high-risk patients suffering from active infective aortic prosthetic valve endocarditis? SA Heart, 2015; 12: 201
21. Christ T, Dohmen PM, Laule M et al: Sutureless aortic valve replacement in a patient with transfemoaral aortic valve replacement and left ventricular hypertrophy. Thorac Cardiovasc Surg Rep, 2015 [epub ahead of a print]
22. Minh TH, Mazine A, Bouhout I et al: Expanding the indication for sutureless aortic valve replacement to patients with mitral disease. J Thorac Cardiovasc Surg, 2014; 148: 1354–95
23. Takagi H, Umemoto T, ALICE (All-Literature Investigation of Cardiovascular Evidence) Group: Sutureless aortic valve replacement may improve early mortality compared with transcatheter aortic valve implantation: A meta-analysis of comparative studies. J Cardiol, 2016; 67: 504–12
24. Santarpino G, Pfeiffer S, Jessl J et al: Clinical outcome and cost analysis of sutureless versus transcatheter aortic valve implantation with propensity score matching analysis. Am J Cardiol, 2015; 116: 1737–43