CASE REPORT

A second-time percutaneous aortic-valve implantation for bioprosthetic failure

Pablo Codner, Abid Assali, Hana Vaknin Assa & Ran Kornowski

Department of Cardiology, Institute of Interventional Cardiology, Rabin Medical Center, Petach Tikva and "Sackler" Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel

Correspondence
Ran Kornowski, Chairman of Cardiology, Rabin Medical Center, Petach Tikva 49100, Israel. Tel: 972-3-937-7107; Fax: 972-3-923-1016; E-mail: ran.kornowski@gmail.com

Funding Information
No sources of funding were declared for this study.

Received: 2 January 2015; Revised: 24 February 2015; Accepted: 6 July 2015

Clinical Case Reports 2015; 3(9): 753–756
doi: 10.1002/ccr3.339

Key Clinical Message
We report a case of an 84-year-old man with a history of surgical aortic-valve replacement for chronic aortic regurgitation (AR) who later developed severe prosthetic valve AR. Subsequent treatment with a Corevalve® was unsuccessful with severe AR seen at 3 years after the valve-in-valve procedure. The patient was then successfully treated with a second catheter-based Corevalve® implantation.

Keywords
Aortic stenosis, bioprosthesis failure, percutaneous aortic-valve implantation, structural heart disease.

Introduction
Transcatheter aortic valve-in-valve implantation (TAVI-VIV) has been shown to be feasible and safe [1]. This treatment has become a highly effective, alternative therapy for patients with structural bio-prosthetic valve deterioration. The median durability of surgical bio-prosthetic valves varies and range from 10 to 15 years [2, 3]. Patients with structural valve deterioration are often at high risk for an additional surgery due to advanced age and the presence of numerous co-morbidities. Nonetheless, the durability of the valve-in-valve procedure has not been characterized and only a few cases of valve failure have been described in the literature.

We present a case report of a patient whom was treated with a second valve-in-valve procedure following significant bioprosthetic valve deterioration and severe, symptomatic aortic regurgitation (AR).

Case History
An 84-year-old gentleman, with a previous history of ankylosing spondylitis, thrombocytopenia, permanent atrial fibrillation and systemic hypertension was admitted to our department in acute heart failure secondary to severe AR. In 1996, he was treated for both severe AR and mitral regurgitation (MR) with a Toronto SPV® 29 mm (St. Jude Medical Inc., St. Paul, MN, USA) biologic stentless valve and a 27-mm Medtronic-Duran® flexible mitral annuloplasty ring (Medtronic Inc., Minneapolis, MN, USA), respectively. In addition he received a single left internal mammary artery graft to the left anterior descending coronary artery and a permanent pacemaker due to high-grade atrioventricular block. Informed consent was provided by the patient before the preparation of this manuscript.

Investigation and Treatment
Following surgery our patient made an uneventful recovery maintaining an active lifestyle without significant symptoms (New York Heart Association functional capacity I). In April 2010, he developed progressive, exertional dyspnea, and subsequent echocardiography showed structural prosthetic valve deterioration with severe AR: effective regurgitant orifice 2.2 cm², peak and mean trans-aortic-valve gradients were 20 and 12 mmHg respectively with diastolic-flow reversal within the abdominal aorta (Fig. 1A).

Following discussion with the heart team he was referred for a TAVI-VIV procedure. In August 2010, a Medtronic-Corvalve® 29 mm (Medtronic Inc.) was suc-
cessfully implanted through a transfemoral route (Fig. 1B). The final positioning of the Corevalve® within the St. Jude Toronto SPV® bioprosthetic valve was relatively low, 10 mm below the lower edge of the stentless valve. Although valve migration cannot be ruled out due to the lack of angiographic landmarks: stentless bioprosthetic valve and absence of calcifications, using transesophageal echocardiography (TEE), significant para- or intravalvular regurgitation was ruled out. Postimplantation peak and mean transaortic-valve gradients were 13 and 8 mmHg, respectively. The patient made an excellent recovery with significant reduction in his symptom of effort-dyspnea.

In October 2012, the patient was hospitalized due to pyrexia associated with malaise. Two sets of blood cultures were positive for Streptococcus viridans. He underwent a TEE which showed two masses, 8 and 12 mm in diameter, attached to the right ventricular pacing lead. The aortic Corevalve® appeared normal without any features of prosthetic valve endocarditis. Peak and median transaortic-valve gradients were 12 and 8 mmHg respectively with mild paravalvular AR. A diagnosis of possible right-sided infective endocarditis was made and the patient received an 8 week course of intravenous antibiotics after which he was clinically well with negative blood cultures.

In April 2013, the patient was re-admitted to our institution with severe dyspnea at rest. Clinically he was afebrile though tachypneic (24 breaths per minute) with a wide pulse pressure of 130/42 mmHg. Pulmonary rates were audible as well as an early diastolic murmur consistent with significant AR. There were no stigmata of infective endocarditis and serial blood cultures were all negative. Both C-reactive protein and white blood cell count were normal. His chest X-ray confirmed pulmonary congestion. PET-CT examination was unremarkable.

A TEE was performed which showed severe intravalvular AR secondary to prosthetic aortic Corevalve® leaflet prolapse (vena contracta: 8 mm, pressure half-time: 190 msec, diastolic-flow reversal within the abdominal aorta, peak and mean aortic-valve gradients: 11 and 6 mmHg, respectively). Left ventricular function was shown to be at the lower limit of normal (Fig. 2A) with mild to moderate MR noted. There were no echocardiographic features of endocarditis. A gated cardiac-CT scan confirmed a normal position of the prosthetic valve within the aortic-root and left ventricular outflow tract (Fig. 2B).

In view of the significant deterioration of the prosthetic Corevalve® at 3 years after implantation, the patient was rediscussed by the Heart team. His EuroScore II, Logistic-EuroScore and STS scores were 34%, 63%, and 20%, respectively. He was subsequently referred for a second TAVI-VIV procedure again using a Medtronic-Corevalve® 29 mm device.

**Outcome and Follow up**

Hemodynamic tracing before the procedure confirmed severe AR as denoted by the homogenization of the systemic diastolic pressure with the left ventricular end diastolic pressure (LVEDP; Fig. 2C). The patient underwent the procedure via a transfemoral approach under general anesthesia with TEE guidance (Fig. 2D and E). According to VARC II criteria [4] the procedure was successful and without any complications (Video S1 and S2). After device deployment, TEE showed minimal transaortic peak and mean prosthetic valve gradients (18 and 8 mmHg, respectively) and an insignificant trace of paravalvular AR. Hemodynamic tracings after the procedure showed a clear separation of the systemic diastolic pressure and the LVEDP (Fig. 2F). The AR index increased from 2 before
to 34 after the procedure [5]. The patient made an uneventful recovery with discharge home on day 4. He was asymptomatic with regard to dyspnea both acutely and after clinical review at 6 months.

Discussion

This is one of the first case studies to report on the use of a second TAVI-VIV procedure for the treatment of severe AR within a Corevalve® bioprosthesis. Deterioration of a Corevalve® device is a rare phenomenon at 3 years following implantation. Webb et al. reported excellent durability of the TAVI balloon expandable devices at 5 years follow up [6]. The mechanism underlying the deterioration of the patient’s valve most likely relates to his previous endocarditis in 2012. Although the TEE showed no involvement of the aortic bioprosthesis, it is certainly feasible the infection resulted in disruption of the aortic-valve leaflets or its sutures to the self-expanding nitinol frame causing severe leaflet prolapse and AR. After a comprehensive review of the patient’s imaging and clinical status following the first VIV procedure, we could not identify any other predisposing condition for the development of leaflet failure of the implanted prosthetic valve; the valve frame was well expanded as shown in Fig. 2D, the valve leaflets worked properly as noted by the low-transvalvular gradients with no evidence of excessive turbulent flow across the prosthetic valve. Mylotte et al. reported in a systematic literature review 87 cases of prosthetic valve deterioration following TAVI. Structural valve failure was the responsible etiology in 13 patients. In one of these reported cases structural failure was secondary to bioprosthetic valve cusp rupture of a Corevalve® 29 mm causing severe AR. This patient, similarly to the present case, was successfully treated with the implantation of a second Corevalve® 29 mm within the previous [7].

In a review article by our group, we highlighted that infective endocarditis after TAVI is an infrequent but serious complication with an incidence of 0–2.3% of patients enrolled in large TAVI cohorts over a period of 2–3 years [8]. Dvir et al. reported the results of the Global Valve in Valve registry. This study demonstrated the safety and efficacy of this novel procedure for degenerated surgical bioprosthetic valves, with an early success rate (according to the VARC criteria) achieved in 93.1% of cases [1]. None of these reported cases, however, were due to a failure of a prior TAVI procedure.

In summary, we have demonstrated the feasibility of a second VIV-TAVI procedure for the treatment of severe AR. This therapeutic modality, according to our experi-
ence, can be safely performed for the treatment of TAVI valve-in-valve failure.

**Conflict of Interest**

None declared.

**References**

1. Dvir, D., J. Webb, S. Brecker, S. Bleiziffer, D. Hildick-Smith, A. Colombo, et al. 2012. Transcatheter aortic valve replacement for degenerative bioprosthetic surgical valves: results from the global valve-in-valve registry. Circulation 126:2335–2344.

2. Smedira, N. G., E. H. Blackstone, E. E. Roselli, C. C. Laffey, and D. M. Cosgrove. 2006. Are allografts the biologic valve of choice for aortic valve replacement in nonelderly patients? Comparison of explantation for structural valve deterioration of allograft and pericardial prostheses. J. Thorac. Cardiovasc. Surg. 131:558–564.

3. El-Hamamsy, I., L. Clark, L. M. Stevens, Z. Sarang, G. Melina, J. J. Takkenberg, et al. 2010. Late outcomes following freestyle versus homograft aortic root replacement: results from a prospective randomized trial. J. Am. Coll. Cardiol. 55:368–376.

4. Kappetein, A. P., S. J. Head, P. Généreux, N. Piazza, N. M. van Mieghem, E. H. Blackstone, et al. 2013. Updated standardized endpoint definitions for transcatheter aortic valve implantation: the Valv Academic Research Consortium-2 consensus document. J. Thorac. Cardiovasc. Surg. 145:6–23.

5. Sinning, J. M., C. Hammerstingl, M. Vasa-Nicotera, V. Adenauer, S. J. Lema Cachiguango, A. C. Scheer, et al. 2012. Aortic regurgitation index defines severity of peri-prosthetic regurgitation and predicts outcome in patients after transcatheter aortic valve implantation. J. Am. Coll. Cardiol. 59:1134–1141.

6. Toggweiler, S., K. H. Humphries, M. Lee, R. K. Binder, R. R. Moss, M. Freeman, et al. 2013. 5-year outcome after transcatheter aortic valve implantation. J. Am. Coll. Cardiol. 61:413–419.

7. Mylotte, D., A. Andalib, P. Thériault-Lauzier, M. Dorfmeister, M. Girgis, W. Alharbi, et al. 2014. Transcatheter heart valve failure: a systematic review. Eur. Heart J. 36:1306–1327.

8. Eisen, A., Y. Shapira, A. Sagie, and R. Kornowski. 2012. Infective endocarditis in the transcatheter aortic valve replacement era: comprehensive review of a rare complication. Clin. Cardiol. 35:E1–E5.

**Supporting Information**

Additional Supporting Information may be found in the online version of this article:

**Video S1.** Positioning and deployment of the Corevalve® 29 mm within the previously implanted Corevalve®.

**Video S2.** Absence of aortic regurgitation on aortic-root aortography following the implantation of the 2nd valve in valve procedure.