CASE REPORT

Valve-in-Valve Transcatheter Aortic Valve Replacement in a High-Risk Patient with a Biocor Bioprosthesis and a Flail Prosthetic Valve Leaflet

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Received: 22 July 2021; Revised: 10 October 2021; Accepted: 21 October 2021

Abstract

An 80-year-old woman with a history of surgical aortic valve replacement with a 21 mm St. Jude Medical Biocor porcine aortic valve 14 years prior presented with New York Heart Association (NYHA) class III symptoms, severe aortic insufficiency from a degenerated prosthesis, and a large echocardiographic mobile mass representing a highly mobile prosthetic leaflet. The patient worsened to NYHA class IV symptoms despite medical management. The Society of Thoracic Surgery mortality risk score was extremely high. However, a valve-in-valve transcatheter aortic valve replacement (TAVR) was found to be a reasonable option. We used a 20 mm SAPIEN 3 Ultra valve (Edwards Lifesciences Inc., Irvine, CA, USA) with a SENTINEL embolic protection device (Boston Scientific, Marlborough, MA, USA). During valve deployment, the echocardiographic mobile mass was visually pinned between the new TAVR valve and the surgical bioprosthetic valve. No large embolic debris was noted within the embolic protection device, and the patient remained without any new focal neurologic deficits in the perioperative period and at the 30-day follow-up. The severe aortic insufficiency resolved, and the patient clinically improved to NYHA class II symptoms.

Keywords: Bioprosthetic; TAVR; Regurgitation

Introduction

Prosthetic aortic valves have differing durability and longevity. Bioprosthetic valve (BPV) life is finite, averaging 15 years in the elderly population [1]. Several factors of valve degeneration are not well understood; however, calcification appears to contribute to degeneration and leaflet tears [2–4]. Within the last 10 years, the number of aortic valve replacement (AVR) procedures has doubled [5], and as the quantity of AVR procedures increases, clinicians will inevitably face increased prosthetic valve failures. Herein, we present a successful case of relatively urgent valve-in-valve (ViV) transcatheter AVR (TAVR) with embolic protection in a high-risk patient with BPV failure and a large echocardiographic mobile mass.

Case Report

An 80-year-old woman with a 21 mm St. Jude Medical Biocor porcine aortic valve replacement
in 2006 presented to her primary cardiologist with new worsening dyspnea on mild exertion. The patient’s medical history was significant for type 2 diabetes mellitus, hypertension, hyperlipidemia, remote ischemic stroke, chronic kidney disease, anemia, chronic obstructive pulmonary disease, and atrial fibrillation. Thoracic echocardiography at that time revealed a large (2 cm × 0.75 cm) extremely mobile mass within the BPV associated with severe aortic insufficiency (AI), moderate mitral insufficiency, and a preserved left ventricular ejection fraction. Coronary angiography demonstrated mild nonobstructive coronary artery disease. The patient was treated empirically with broad-spectrum antimicrobial therapy for possible infective endocarditis, despite a lack of major Duke criteria or any stigmata of infective endocarditis.

The patient was referred to the structural heart team at our institution, and transesophageal echocardiography was performed. Transesophageal echocardiography revealed that the mobile mass most likely represented a prosthetic flail leaflet without vegetation (see supplementary video files 1 and 2). The patient was evaluated by the palliative care team for hospice evaluation given her other comorbidities. However, she insisted on an aggressive plan to treat her worsening New York Heart Association (NYHA) class IV symptoms and associated paroxysmal nocturnal dyspnea despite increasing doses of diuretics.

With the patient having an estimated Society of Thoracic Surgery (STS) mortality risk score greater than 30%, a ViV TAVR was thought to be the best option. We suspected that a ViV TAVR would result in patient prosthesis mismatch (PPM) given the patient’s significant risk factors: ViV TAVR, female sex, and prosthesis smaller than 23 mm [6]. However, the estimated surgical mortality appeared greater than the risk of PPM with ViV TAVR. The patient and her family elected to proceed with TAVR as her comorbidities did not make her risk of death within 1 year prohibitive for the procedure.

The patient underwent ViV TAVR with a 20 mm SAPIEN 3 Ultra valve (Edwards Lifesciences Inc., Irvine, CA, USA). To reduce stroke risk, we used a SENTINEL cerebral embolic protection (Boston Scientific, Marlborough, MA, USA), a filterlike device. During valve deployment, the echocardiographic mobile mass was visually pinned between the new TAVR valve and the surgical BPV (see supplementary video files 3–5). No large embolism was filtered from the SENTINEL device (Figure 1). BPV fracture before TAVR valve placement has been shown to improve the valve’s hemodynamics and decrease PPM in patients, although risks include coronary obstruction and ischemic stroke [7, 8]. We suspected that BPV fracture could result in increased embolic risk of the flail leaflet and therefore it was not performed.

The patient remained without new focal neurologic deficits in the perioperative period and at the 30-day follow-up. Postoperative echocardiography demonstrated resolved AI with stable mitral insufficiency. The aortic valve mean gradient was elevated as expected at 19 mmHg, indicative of at least moderate PPM. The patient’s symptoms changed from NYHA class IV to NYHA class II, and the patient was discharged home.

**Discussion**

ViV TAVR for degenerative prosthetic valves is a reasonable option for many patients, especially when there is a high risk of repeated surgical AVR.
(SAVR). ViV TAVR has been performed with success in other cases with mobile masses or flail leaflets, although in one case the mass did embolize and was retrieved [9, 10]. In our patient’s case, ViV TAVR was a life-saving measure that improved her quality of life. Early detection of valve degeneration is preferred for optimal patient outcomes, as emergency repeated AVR is associated with mortality of 22.6% compared with 1.4% for elective repeated AVR [11]. Unfortunately, degenerative prosthetic valves are often discovered late, when patients have high operative risk.

The goal of prosthetic valve surveillance should be to detect significant valvular degeneration early so that the patient can undergo lower-risk procedures. Prosthetic valve surveillance and evaluation is performed with an echocardiogram, which is indicated for any change in symptoms in an AVR patient. A routine annual echocardiogram is recommended at 5 and 10 years after the surgical implantation, even if the patient is asymptomatic [12]. With an inconclusive echocardiogram in a symptomatic patient, further workup is indicated with other imaging modalities, such as cinefluoroscopy, cardiac computed tomography, or cardiac magnetic resonance imaging [13].

When a BPV fails, AVR options are a redo SAVR procedure or a ViV TAVR [14]. Individualized patient care is necessary when one is weighing the risks and benefits of redo SAVR versus ViV TAVR. The higher operative morbidity and mortality associated with redo SAVR must be weighed against the risk of significant PPM, permanent pacemaker placement, and coronary obstruction with ViV TAVR [6, 15].

Newer studies suggest that ViV TAVR is associated with decreased risk of stroke, myocardial infarction, and major bleeding, as well as reduction in all-cause mortality during the perioperative period and no significant difference in all-cause mortality at 2 years [16]. However, ViV TAVR is more likely to cause PPM because the new valve is deployed within the ring of the existing BPV, which leaves less space for the new TAVR valve orifice area. Ultimately both perioperative mortality and overall mortality increase proportionally to PPM severity [17]. Therefore, it is important to understand the predictors of severe PPM when one is considering ViV TAVR versus redo SAVR. Overall predictors of PPM are a valve prosthesis diameter of 23 mm or less, female sex, a ViV procedure, young age, severe mitral or tricuspid insufficiency, larger body surface area, lower ejection fraction, and atrial fibrillation [6].

In addition to PPM, each patient’s stroke risk should be individually assessed. ViV TAVR stroke risk has not been fully established, but recent studies do not show any increased stroke risk in comparison with native valve TAVR [18]. Use of the SENTINEL embolic protection device in TAVR procedures has been reported to significantly lower the risk of stroke, death, and major bleeding at 30 days [19]. In this case of a clearly elevated risk of stroke, a ViV TAVR with embolic protection was successfully performed without new focal neurologic deficits in the perioperative period or at the 30-day follow-up.

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Supplementary Material: This paper offers supplementary material which can be found at the following link: https://cvia-journal.org/supplementary-figures-2/