Transfemoral Aortic Valve-in-Valve Replacement in Patient with Aortic Root Pseudoaneurysm

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***Background*:** *Transcatheter aortic valve replacement (TAVR) was successfully performed to treat aortic regurgitation (AR) in a patient with a failed aortic valve replacement complicated by aortic root pseudoaneurysm.*
***Case Presentation*:** *A 92-year-old male presented with acute decompensated congestive heart failure secondary to AR of a previously implanted stentless aortic bioprosthesis, complicated by a 2.5 x 1.7 cm pseudoaneurysm of the aortic root.*
***Conclusions*:** *Complex aortic root and valve disease can be safely and effectively addressed through the use of TAVR in high-risk patients. The presence of a pseudoaneurysm should not preclude successful TAVR.*

Keywords: *aortic valve regurgitation; stentless valve; valve-in-valve; transcatheter aortic valve replacement; pseudoaneurysm; heart failure; Freestyle bioprosthesis*

BACKGROUND

Transcatheter aortic valve replacement (TAVR) is a viable alternative to surgical aortic valve replacement (SAVR) for the treatment of aortic stenosis (AS) in intermediate and high-risk patients.[1,2] Limited data exists regardingconcerning TAVR in the setting of acute aortic regurgitation of previously failed prostheses, and to our knowledge no data exists with TAVR in the setting of aortic root pseudoaneurysms.

CASE PRESENTATION

A 92-year-old male presented to the emergency department with acute decompensated congestive heart failure (CHF) – New York Heart Association class IV – secondary to severe aortic regurgitation (AR) from degeneration of a previously implanted stentless valve. His past medical history was significant for hypertension, hyperlipidemia, hypothyroidism, obstructive sleep apnea, and previous aortic stenosis treated with aortic valve replacement using a 29mm Freestyle (Medtronic, Inc., Minneapolis, Minnesota) stentless bioprosthesis implanted as a modified subcoronary technique in 2007. His Society of Thoracic Surgeons predicted risk of mortality score was 9.8. He was, therefore, at high risk for SAVR. Pre-operative transthoracic echocardiogram confirmed severe AR and preserved left ventricular ejection fraction.

A computed tomographic angiogram with 3D reconstruction confirmed adequate iliofemoral arterial access. However, the proximal ascending aorta contained a stable focal outpouching along the right aspect of the aortic root measuring 2.5 cm x 1.7 cm. This was consistent with a pseudoaneurysm and contained heavy clot burden (Fig. 1). The aortic annular perimeter measured 85 mm, with a derived diameter of 27 mm and an area of 573 mm^2. Based on these measurements, a 29mm Medtronic Evolut R CoreValve transcatheter heart valve system (Medtronic, Inc., Minneapolis, Minnesota) was selected.

Pre-operative left heart catheterization confirmed severe bioprosthetic AR (Fig. 2A) and aortic root pseudoaneurysm (Fig. 2B).

The self-expanding CoreValve was positioned appropriately across the Freestyle Valve and deployed slowly under rapid-pacing at 120 beats/min in the latter two-thirds of the deployment. Final implant depth was 8mm. Hemodynamic pressure measurements revealed a subsequent decrease in left ventricular end-diastolic pressure from 25 mmHg to 14 mmHg post-valve deployment. These results, along with ascending

Figure 1. Computed tomographic angiogram of the ascending aorta and root. Pseudoaneurysm measuring up to 2.5 cm × 1.7 cm.

aortography and transesophageal echocardiography, suggested trace perivalvular insufficiency with an aortic valve mean gradient of 7 mmHg. The pseudoaneurysm in the aortic root was also noted to have almost no flow following deployment of the TAVR (Fig. 2C). The patient was discharged home without complications on post-operative day three.

CONCLUSIONS

This is the first known reported case of transcatheter aortic valve-in-valve replacement in the context of a pre-existing aortic root pseudoaneurysm. As such, two important conclusions can be drawn from the operative course and results.

First, the complexity of the patient's presenting cardiovascular anatomy, including a significant pseudoaneurysm containing extensive thrombi, raised concern for the possibility of intraoperative embolization and consequent cerebrovascular accident (CVA). The patient did not suffer a stroke subsequent to the valve replacement procedure. Although the placement of a cerebral protection device, which is now

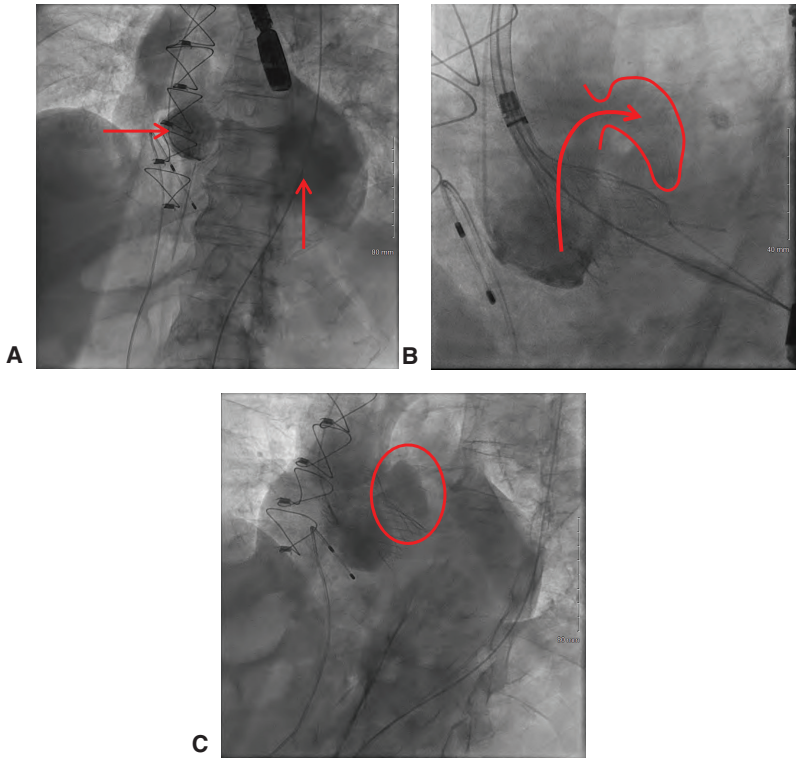

Figure 2. Cardiac catheterization. (A) Severe aortic regurgitation, as shown by complete opacification of the left ventricle (red arrow). (B) Pre-operative aortic root angiogram illustrating opacification of the pseudoaneurysm. (C) Post-deployment angiogram without visible flow in the pseudoaneurysm.

commercially available, may mitigate the risk of CVA, a pseudoaneurysm should not preclude placement of a TAVR.

Second, pseudoaneurysm formation is a demonstrated long-term complication of stentless Freestyle valve replacement, particularly in cases with a full root replacement, and may be due to an immune-mediated process.[3] In this case, dilatation of the aortic root caused by the pseudoaneurysm did not preclude the successful implantation of the transcatheter heart valve. We postulate that the presence of an aortic root pseudoaneurysm in the setting of failed bioprosthesis should not serve as contraindications for a valve-in-valve TAVR. Complex TAVR procedures such as this, should be performed in high-volume centers of excellence with experience in both TAVR and open valve surgery.

Authors' contributions

MN was a major contributor in writing the manuscript. SL performed the valve replacement procedure described herein and was a major contributor in writing the manuscript. All authors read and approved the final manuscript.

Conflict of interest and funding

The authors declare that they have no conflict of interest and no funding was provided for this case report.

Previous Presentation

This article has not been presented previously anywhere, including at a meeting of a scientific organization or a symposium.

REFERENCES

1. Leon MB, Smith CR, Mack M, Miller DC, Moses JW, Svensson LG, et al. Transcatheter aortic-valve implantation for aortic stenosis in patients who cannot undergo surgery. NEJM 2010;363(17):1597–1607.

2. Adams DH, Popma JJ, Reardon MJ, Yakubov SJ, Coselli JS, Deeb GM, et al. Transcatheter aortic-valve replacement with a self-expanding prosthesis. NEJM 2014;370(19):1790–8.

3. David TE, Armstrong S, Maganti M, Butany J, Feindel CM, Bos J. Postimplantation morphologic changes of glutaraldehyde-fixed porcine aortic roots and risk of aneurysm and rupture. J Thorac CardioVasc Surg 2009;137(1):94–100.