

**Case
Report**

A Case of CABG in a Patient with High Risk of Coronary Obstruction during TAV-in-TAV

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A 94-year-old man who underwent transcatheter aortic valve (TAV) replacement 6 years ago was admitted because of exertional dyspnea. Transthoracic echocardiography revealed severe aortic regurgitation owing to TAV dysfunction. The patient was considered to have a high risk of occlusion of the sinus of Valsalva during TAV-in-TAV. Therefore, we performed TAV-in-TAV concomitant with coronary artery bypass grafting (CABG). The postoperative course was uneventful, and computed tomography 9 months later revealed patency of both the grafts. Concomitant CABG could be considered as one of the options in patients with a high risk of coronary occlusion during TAV-in-TAV.

Keywords: aortic valve stenosis, transcatheter aortic valve implantation, TAV-in-TAV, coronary obstruction

Introduction

The indications for transcatheter aortic valve replacement (TAVR) have been expanding in younger patients¹⁾; thus, transcatheter aortic valve (TAV)-in-TAV procedures would also be increasing. The sinus of Valsalva or coronary artery occlusion is a serious complication of TAV-in-TAV. Herein, we report the successful outcomes of TAV-in-TAV and coronary artery bypass grafting (CABG) in a patient with TAV dysfunction.

Case Report

A 94-year-old patient presented to our institution with exertional dyspnea. He had a history of TAVR by a

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26-mm CoreValve (Medtronic, Minneapolis, MN, USA) for treating severe aortic stenosis (AS) 6 years ago. Blood test results revealed significantly elevated serum brain natriuretic peptide (288.4 pg/mL). Transthoracic echocardiography (TTE) and transesophageal echocardiography revealed severe aortic regurgitation (AR) owing to TAV dysfunction with vena contracta and a left ventricular ejection fraction of 6.0 mm and 62%, respectively (**Fig. 1**). Contrast-enhanced computed tomography (CT) revealed no coronary stenosis. The TAV-to-aortic wall distance and valve-to-coronary (VTC) artery ostium distance were similar (**Fig. 2**). In addition, if TAV-in-TAV was performed, the displaced leaflets of the initial TAV, sandwiched between the two TAV stents, would extend above the sinotubular junction (ST) junction (**Fig. 2**). Therefore, we considered that the patient had a high risk of occlusion of the sinus of Valsalva or coronary artery and that coronary cannulation would be impractical following TAV-in-TAV.

Although his activity of daily living (ADL) was relatively well maintained (Rockwood's Clinical Frailty Scale 3), the patient was 94 years old. The less invasive surgical strategy was important for this patient because operation without cardiopulmonary bypass (CPB) was an advantage in this point. In addition, it has been reported that when the CoreValve was removed, the

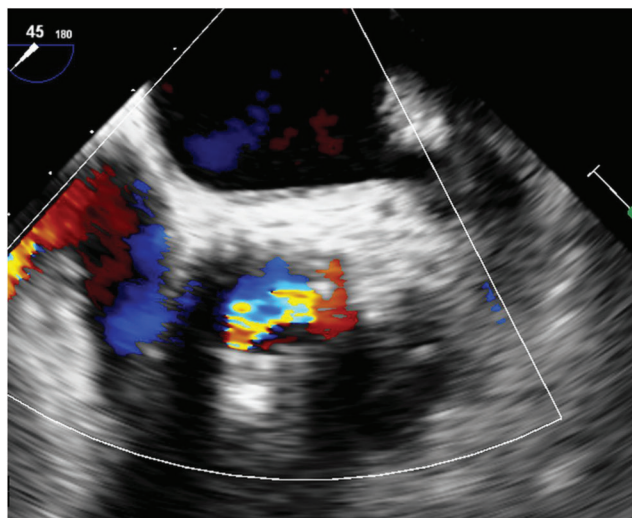


Fig. 1 Preoperative transesophageal echocardiography revealed severe AR and prolapse of the TAV leaflet, similar to the left coronary cusp. AR: aortic regurgitation; TAV: transcatheter aortic valve

ascending aortic replacement might be required due to adhesions with the ascending aorta.²⁾ Therefore, TAV-in-TAV via the ascending aorta concomitant with CABG under full sternotomy was planned. Informed consent from the patient and his family was obtained.

General anesthesia was induced. Two saphenous vein grafts (SVGs) were harvested from both the thighs. We performed trans-aortic echocardiography to determine the position of previous TAV. Based on this finding, we decided the position of safely partial aorta clamp and graft anastomosis. Following heparin administration, the SVG was anastomosed to the left anterior descending artery, posterior descending artery, and ascending aorta without CPB. The flow of SVGs was good. An 18-Fr DrySeal sheath (W.L. Gore, AZ, Flagstaff, USA) was inserted just above the proximal anastomoses of the SVGs, and a 26-mm Evolut-R was placed in the same position as the previous CoreValve. After the TAV-in-TAV, TTE revealed no AR, and aortography revealed delayed low flow to the sinus of Valsalva but good flow of the SVGs. The operative time was 277 min, and the patient was extubated in the operating room.

Edoxaban was initiated with aspirin as postoperative anticoagulant therapy because of paroxysmal atrial fibrillation. The postoperative course was uneventful, and the patient was discharged on the 12th postoperative day. CT performed at 9 months postoperatively revealed well-maintained SVG flow. A 4-year follow-up confirmed good patient clinical status (New York Heart

Association functional status I) and good valve function (transprosthetic pressure gradient: 10 mmHg, AR not traced) on TTE.

Discussion

Several specific complications during TAV-in-TAV are known, including occlusion of the sinus of Valsalva or coronary artery. The risk of these complications is associated with the supra-annular position of the TAV.^{1,3)} Furthermore, even if coronary flow is maintained, coronary cannulation can be challenging.³⁾ The distance between the TAV stent and the aortic wall of less than 3 mm at the level of the coronary artery ostium and the edge of the displaced leaflets, and a mesh width of less than 3 mm⁴⁾ are reported to be difficult or impractical for coronary cannulation. Furthermore, initial TAV implantation in a higher position has recently been recommended owing to the risk of pacemaker implantation and perivalvular leakage,³⁾ which is attributed to the risk of occlusion of the sinus of Valsalva or coronary artery. Other methods of preventing these complications include the BASILICA (bioprosthetic or native aortic scallop intentional laceration to prevent iatrogenic coronary artery obstruction) and Snorkel stenting techniques. However, these techniques are technically difficult and unreliable.

We considered the patient to have a high risk of occlusion of the sinus of Valsalva or coronary artery based on the preoperative CT findings. Although he was 94 years old, his ADL was preserved. Therefore, we opted for TAV-in-TAV concomitant with CABG in this patient. The complication specific to this procedure is difficulty to determine the position of graft anastomosis. As a solution for this problem, trans-aortic echocardiography was useful. Postoperative CT performed 9 months later revealed good flow of the SVGs, suggesting that the bypass was effective in current coronary flow. In addition, the mesh gaps of the initial and current transcatheter heart valve (THV) frames were nearly completely eliminated. The distance between the stent and the aortic wall was reduced following TAV-in-TAV, making coronary cannulation impractical (**Fig. 3**).

TAVR was reimbursed for AS in Japan in 2013,⁵⁾ and the number of patients requiring this procedure is increasing. In addition, the long-term results of TAVR are becoming clearer and the indications for TAVR are expanding to younger patients.¹⁾ Therefore, it is important to consider the patient's prognosis at the time of

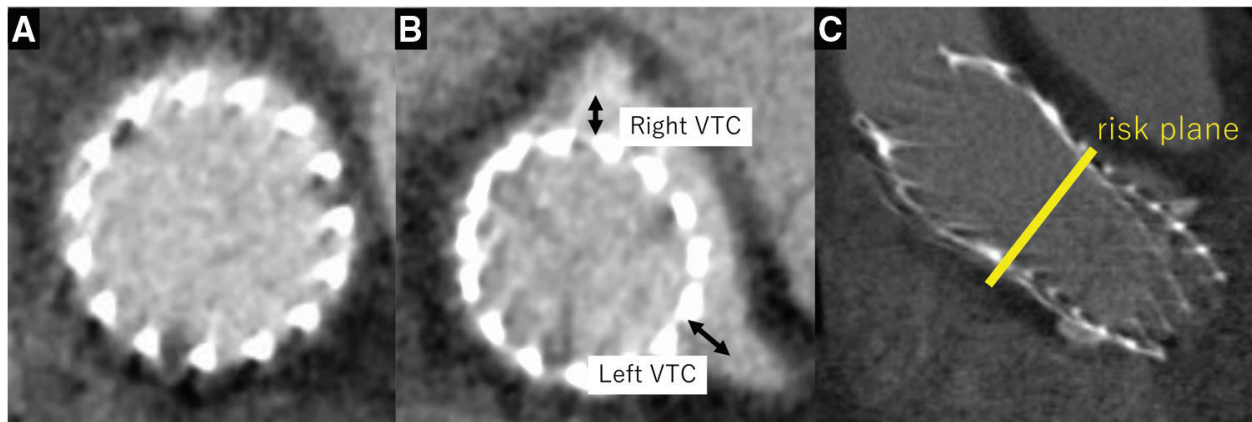


Fig. 2 (A) Preoperative coronary CT revealed that the THV and the aortic wall were in contact with nearly the entire circumference at the ST junction. (B) Right VTC distance was 2.8 mm and left VTC distance was 3.8 mm. (C) Yellow line represents the risk plane that was defined as the level under which the stent frame of the initial TAV would be covered after its leaflets were displaced vertically with the implantation of a second TAV. CT: computed tomography; ST junction: sinotubular junction; VTC: valve-to-coronary; TAV: transcatheter aortic valve; THV: transcatheter heart valve

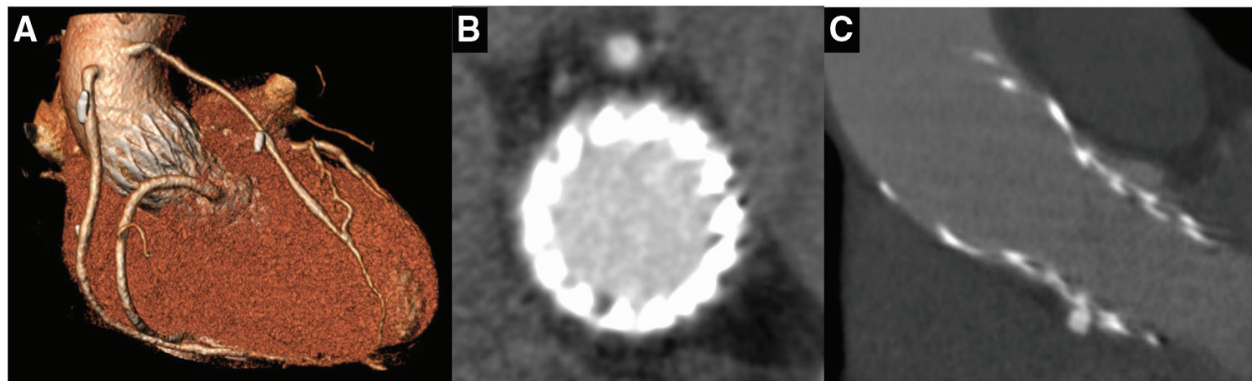


Fig. 3 (A) Postoperative coronary CT revealed good blood flow from the SVGs to the coronary arteries. (B and C) Owing to the overlapping stent frames and occlusion of the sinus of Valsalva, cannulation of the coronary arteries was considered impractical. SVGs: saphenous vein grafts

initial TAVR, including the position of implantation, device selection, and surgical aortic valve replacement, while considering the possibility of TAV-in-TAV. There are some reports of the result of TAV-in-TAV in the West.⁶⁾ However, there are no reports of that in Japan, and the result of TAV-in-TAV in Japan is unclear. Therefore, TAV-in-TAV is not yet covered by insurance in Japan. It is also necessary to incorporate efforts for the development of new TAVs with low stent frames.

Conclusion

This is the first report of successful TAV-in-TAV concomitant with CABG. Considering the patient's ADL,

CABGs may be considered as one of the treatment options in patients at a high risk of sinus of Valsalva or coronary artery occlusion during TAV-in-TAV.

Disclosure Statement

None.

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