

Case  
Report

# A Case of Ascending Aortic Replacement and Aortic Valve Replacement in a Patient with Giant Pseudoaneurysm of the Ascending Aorta due to Prosthetic Valve Endocarditis after Transcatheter Aortic Valve Replacement Using Evolut PRO

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**An 82-year-old man who underwent transcatheter aortic valve replacement (TAVR) using a 34-mm Evolut PRO (Medtronic, Minneapolis, MN, USA) for severe aortic stenosis 21 months previously presented with fever. Transesophageal echocardiography showed thickening of the valve leaflets of the transcatheter heart valve and movable structures such as verrucae on the upper edge of the Evolut PRO stent. Contrast-enhanced cardiac computed tomography showed a 72-mm saccular pseudoaneurysm on the dorsal aspect of the ascending aorta at the superior border of the Evolut PRO stent. Because of a suspected infected aortic aneurysm caused by prosthetic valve endocarditis (PVE), we performed aortic valve replacement using 23 mm Avalor (Medtronic, Minneapolis, MN, USA) and ascending aortic replacement using 26 mm Gelweave (Vascutek Terumo Inc, Scotland, UK). The postoperative course was uneventful. This report highlights that patients with PVE after TAVR may develop pseudoaneurysms of the ascending aorta.**

**Keywords:** aortic valve stenosis, transcatheter aortic valve implantation

## Introduction

Prosthetic valve endocarditis (PVE) after transcatheter aortic valve replacement/transcatheter aortic valve implantation (TAVR/TAVI) is a rare, but potentially fatal, complication. Herein, we report a case of PVE after TAVR using Evolut PRO presenting with pseudoaneurysm formation in the ascending aorta. The patient required surgical aortic

valve replacement (SAVR) with simultaneous ascending aortic replacement.

## Case Report

An 82-year-old man who underwent TAVR using a 34-mm Evolut PRO for severe aortic stenosis 21 months previously presented with fever. Because the blood culture was positive for coagulase-negative *Staphylococcus*, he was treated with antibiotics; however, the cause of the fever remained unknown even after various examinations in the local hospital. Since the patient had been repeatedly admitted and discharged for the same episodes for over 1 year, he was referred to our hospital for further investigation of the unknown fever.

On admission, the patient was asymptomatic, afebrile, and non-tachycardic. His blood pressure, heart rate, temperature, and SpO<sub>2</sub> were 121/74 mmHg, 86 bpm, 36.2°C, and 98% (room air), respectively. Laboratory data demonstrated a normal white blood cell count (6870/μL)

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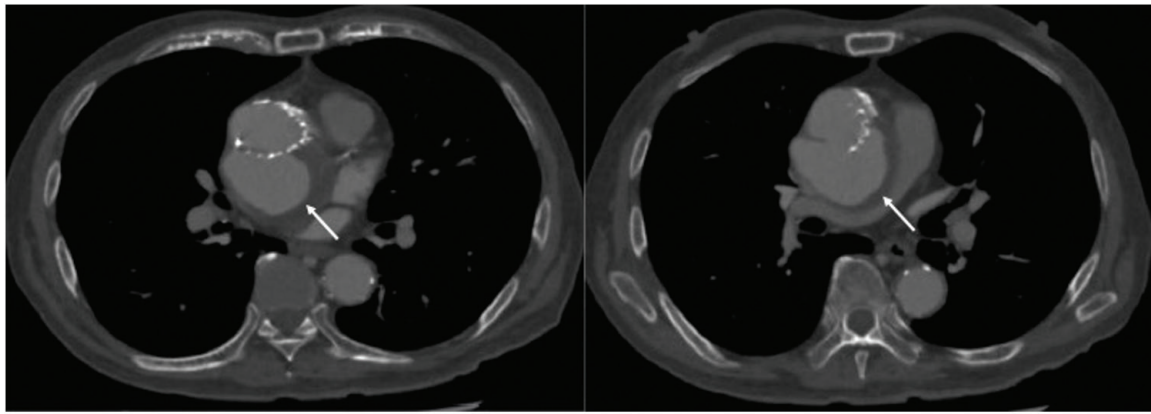
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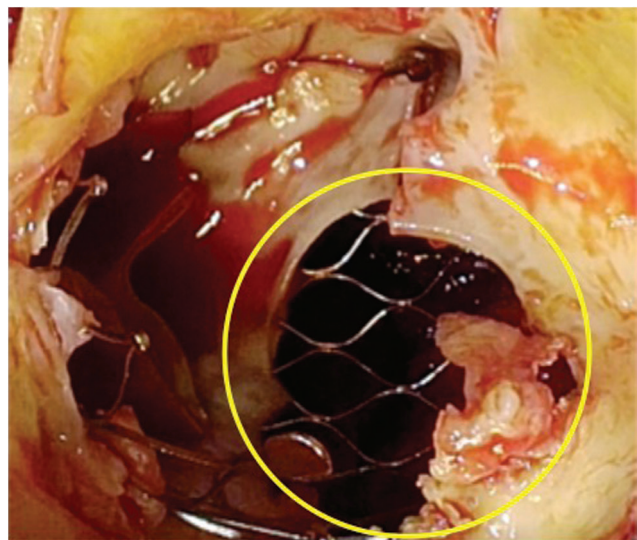


**Fig. 1** Contrast-enhanced cardiac CT showed a 72-mm saccular pseudoaneurysm on the dorsal aspect of the ascending aorta at the superior border of the Evolut PRO stent (white arrow). CT: computed tomography

and a slightly elevated level of C-reactive protein (0.87 mg/dL). The B-type natriuretic peptide level was almost normal (48.5 pg/ml).

Transthoracic echocardiography showed that the valve function in Evolut PRO was fine, with a mild periventricular leukomalacia and an aortic valve area of 2.1 cm<sup>2</sup>. Left ventricular function was also fine, with an ejection fraction of 62%; however, the presence of vegetation was not clear due to halos in the stent frame. Transesophageal echocardiography showed thickening of the valve leaflets of the transcatheter heart valve (THV) and movable structures, such as verrucae, on the upper edge of the Evolut PRO stent. In addition, contrast-enhanced cardiac computed tomography (CT) showed a 72-mm saccular pseudoaneurysm on the dorsal aspect of the ascending aorta at the superior border of the Evolut PRO stent (**Fig. 1**). Positron emission tomography–CT did not show any abnormal accumulation suggestive of infection in either the THV or pseudoaneurysm in the ascending aorta.

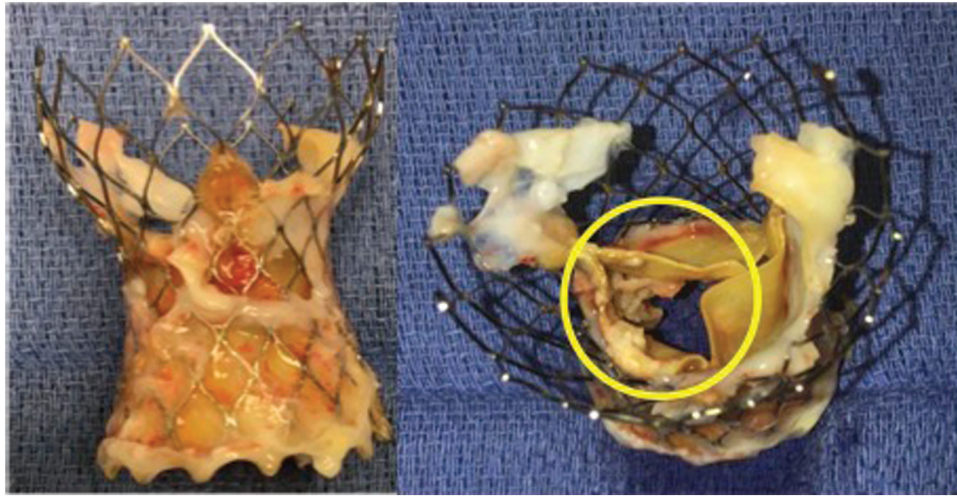
Although the operative risk was expected to be relatively high, we explained to the patient that there was a risk of PVE recurrence and pseudoaneurysm rupture. Finally, the patient agreed to undergo the surgery. Surgery was performed under general anesthesia in the supine position. After cardiac arrest, the distal side of the ascending aorta was dissected, the stent site of the Evolut PRO showed almost complete intimal regeneration, and a large pseudoaneurysm was found on the dorsal side of the ascending aorta at the upper border of the Evolut PRO (**Fig. 2**). The Evolut PRO was carefully dissected from the aortic intima while applying ice water to the Evolut PRO as appropriate. Because of severe adhesion to the aortic valve leaflets and left ventricular outflow tract, the Evolut PRO was cut longitudinally with nippers and removed by



**Fig. 2** The stent site of the Evolut PRO showed almost complete intimal regeneration, and a large pseudoaneurysm was found on the dorsal side of the ascending aorta at the upper border of the Evolut PRO (yellow circle).

rounding it while grasping it with a lister. The left ventricular outflow tract of the removed Evolut PRO was covered with vegetation (**Fig. 3**). The left and right coronary artery inlets and the aortic roots were intact. After resection of the native valves with marked calcification, aortic valve replacement was performed using 23 mm Avalor (Medtronic, Minneapolis, MN, USA) and ascending aortic replacement was performed using 26 mm Gelweave (Vascutek Terumo Inc, Scotland, UK).

Postoperative pathology of the aortic wall showed surrounding fibrous connective tissue with hemorrhage and inflammatory cell infiltration as well as vitreous-like degeneration, calcification, and cholesterol cleft. The postoperative course was uneventful, and antibiotic



**Fig. 3** The Evolut PRO stent was rigidly adhered to the intima of the aortic wall. The left ventricular outflow tract side of the removed Evolut PRO was covered with vegetation (yellow circle).

therapy was continued. The patient is now 2 months post-operative without any signs of recurrence or heart failure.

## Discussion

The average incidence of PVE after TAVR is 3.25%.<sup>1)</sup> Risks include decreased renal function (estimated glomerular filtration rate [eGFR] <30 ml/min/1.73 m<sup>2</sup>), high body surface area, high preoperative pressure gradient, critical preoperative systemic status, apex approach, atrial fibrillation, and amount of contrast agent administered during the procedure.<sup>2)</sup> With regard to the risk of developing infective endocarditis, there is no significant difference in incidence when comparing SAPIEN (Edwards Lifesciences, Irvine, CA, USA) and Evolut.<sup>1)</sup> To date, the risk for pseudoaneurysms of ascending aortic after TAVI has not been reported; therefore, it could not be evaluated.

PVE accounts for 43.1% of indications for surgical explantation after TAVR.<sup>3)</sup> In the current case, intraoperative findings showed that the Evolut stent was embedded in the aortic wall and had caused damage to the intima, resulting in pseudoaneurysm formation. The ascending aortic diameter at the time of the initial TAVR was 38 mm and the Valsalva sinus diameter was 36 mm, while the recommended ascending aortic diameter and Valsalva diameter for Evolut 34 mm implantation are ≤43 mm and ≥29 mm, respectively. Therefore, it is safe to assume that there was no mismatch in the choice of prosthetic valve size at the time of the initial TAVR, which revealed that the risk of pseudoaneurysm formation was not high at the time of the initial implantation.

However, the prosthetic valve was presumed to have been infected for a long time, with repeated improvement and recurrence, and the infection had spread to the ascending aorta via the Evolut stent. Tissue damage caused by the infection leads to vulnerability of the intima, which eventually leads to intimal failure and a pseudoaneurysm. Intraoperative findings showed that the Evolut stent was stuck far into the pseudoaneurysm.

Several points should be considered in the surgical technique for THV explantation at the time of surgery. This case was a self-expanding prosthetic valve, and the stent was made of a shape-memory alloy called Nitinol, which softens very easily below a certain temperature, so it can be detached relatively easily when it is cooled to a certain temperature.<sup>4)</sup> In addition, the Evolut is fixed by a special cup-shaped outflow portion fitting the ascending aorta,<sup>5)</sup> and it is important to safely dissect the adhesions from the ascending aorta. In the case of revision surgery for SAPIEN, it has been reported that the stent could be safely explanted by detaching it in a circumferential manner with nippers and proceeding with detachment.<sup>6)</sup>

In the current case, the device was cooled and softened, and the outflow of the Evolut and ascending aorta were carefully dissected to secure a space for nippers; the dissection proceeded from the non-coronary cusp with as little damage to the basal intima as possible.

Pseudoaneurysm formation due to intimal damage caused by infection requires replacement of the ascending aorta. However, if we pay attention to the detachment of adhesions between the surrounding tissue and ascending aorta, especially when detaching the Evolut stent, using the method described above, and if the ascending aorta is



not damaged, it may be possible to perform AVR alone. However, in such cases, as in this case, ascending aortic replacement may also be considered due to the possibility that the vulnerability of the ascending aorta may be sub-clinical (not visible to the naked eye, but actually vulnerable) due to spreading stent infection. In fact, ascending aortic replacement was observed more frequently in patients with Evolut than in those with SAPIEN at surgical explantation of the THV.<sup>7)</sup> Regarding the difference in the need for ascending aortic replacement at the time of surgical review, 22% of patients required it after Evolut implantation and 9% after SAPIEN implantation. However, there was no difference in the need for root replacement; this represents a significant difference.<sup>7)</sup>

## Conclusion

We report a case of PVE after TAVR using Evolut PRO presenting with pseudoaneurysm formation in the ascending aorta, which was successfully treated with simultaneous ascending aortic replacement and SAVR. We suggested the possibility of infection in patients with PVE after TAVR and the formation of pseudoaneurysms of the ascending aorta.

## Informed Consent

The patient agreed that doctors could use and publish his disease-related article with deleted personal information.

## Disclosure Statement

All authors declare that they have no conflicts of interest.

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