

## Combined Transcatheter Therapy of Aortic Stenosis and Thoracic Aortic Aneurysm

### Dear Editor,

Transcatheter aortic valve implantation (TAVI) and thoracic endovascular aortic repair (TEVAR) are independently well established techniques for treating aortic valve stenosis and thoracic aortic aneurysms. The co-existence of both lesions in patients occurs as they share similar risk factors but the treatment of patients with these combined lesions and high surgical risk remains unclear. The presence of a thoracic aneurysm was an exclusion criterion in the landmark PARTNER trial.<sup>1,2</sup> The presence of such a lesion increases the risks of aortic rupture and significant device interaction may occur during the procedure. There have thus been no prior reports of the feasibility of treating such patients with combined TAVI and TEVAR.

### Case Report

An 87-year-old male with hypertension, renal impairment and multiple laparotomies (gastrectomy and cholecystectomy) presented with New York Heart Association Class III heart failure at our centre. The logistic euroscore and Society of Thoracic Surgeons score was 23.9% and 4.7% respectively. Besides these surgical scores, the patient was very frail, thus TAVI was considered. Transthoracic echocardiogram revealed severe aortic valve stenosis with an aortic valve area of 0.68 cm<sup>2</sup> and mean transthoracic gradient of 76 mmHg with a preserved left ventricular ejection fraction of 70%. His coronary angiogram showed a 60% tubular stenosis of the mid right coronary artery and his iliofemoral angiogram confirmed a minimal luminal diameter of 7.8 mm.

The annulus was measured to be 24 mm on transesophageal echocardiogram. During this study, a complex aortic lesion consisting of severe atherosclerosis, ulceration and localised dissection and aneurysm was detected in the descending aorta (Fig. 1). This was confirmed to be a saccular aneurysm located on the inner curve at the inferolateral aspect of the aorta just distal to the left subclavian artery on computed tomography (Fig. 2). These findings were discussed with the vascular surgeon and alternative modes of therapy including open surgery with aortic repair and valve replacement were offered. The risks of combined TAVI and TEVAR were also discussed. The decision for TAVI and TEVAR was subsequently made. The concern was the risk of aortic

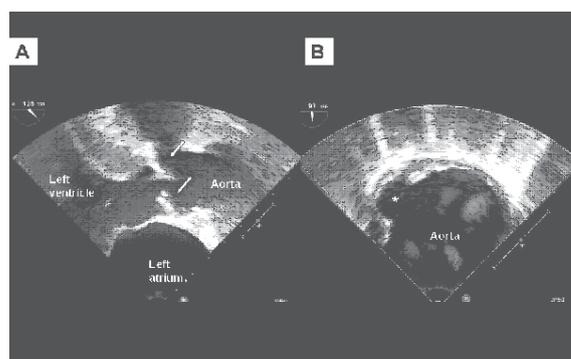


Fig. 1. Transesophageal echocardiogram showing severe aortic valve stenosis (A) and the aortic lesion (B). The arrows demarcate the severely calcified aortic valves and the asterisk marks the aneurysm.

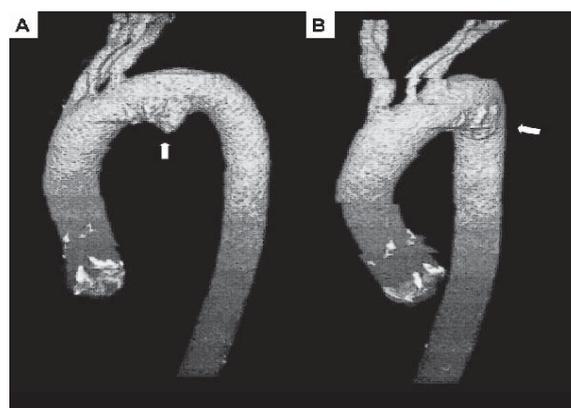


Fig. 2. Computed tomography of the aortic saccular aneurysm (marked by arrows) seen in the lateral projection (A) and the anterior posterior projection (B).

dissection if TAVI were to be done first as the SAPIEN XT valve (Edwards Lifesciences, Irving, California) would be delivered via a relatively short sheath and exits would be uncovered at the level of the abdominal aorta. Conversely, the risk of having TEVAR first would be stent graft migration due to interaction with the TAVI delivery system.

The heart valve team decided to proceed with a femoral cutdown to facilitate the advancement of the 19 Fr Edwards sheath. A JR4 diagnostic catheter was positioned carefully over a J-tipped 0.035 wire and then exchanged for an Amplatz Extra-Stiff Wire (Cook medical Inc, Bloomington, IN). Sequential dilations were performed using the Edwards dilators and the 19 Fr Edwards sheath was then placed in

situ. Balloon aortic valvuloplasty with a 20-mm NuMED Nucleus™ balloon (NuMED, Inc.) was performed with rapid ventricular pacing. The Edwards Novaflex delivery system (Edwards Lifesciences, Irving, California) was loaded in the usual way and then delivered over the stiff wire.<sup>3</sup> The flexion of the sheath was performed later than usual (at the take-off of the left subclavian artery) to avoid trauma to the aneurysmal site. The valve was uneventfully deployed under rapid ventricular pacing at a rate of 180 per min in the standard manner.<sup>4</sup> The final result was good with the mean transaortic gradient reduced to 13 mmHg with only trivial paravalvular regurgitation and no endoleak seen. Following this, the Novaflex sheath was gradually anteflexed across the aortic arch, avoiding the aneurysmal section. While keeping the stiff wire in situ (in the left ventricle), the 19 Fr Edwards sheath was exchanged for a 22 Fr Cook sheath. The wire was intentionally kept in the left ventricle to avoid having to pass the stiff wire again across the Edward SAPIEN XT valve and risk dislodging it. A 34 mm x 150 mm Zenith® Proform TX2® graft was then delivered and deployed over the stiff wire successfully (Fig. 3). The sheath was subsequently removed and the access site was closed surgically. The repeat transthoracic echocardiogram showed normal aortic prosthetic function at 6 months with mean gradient of 10 mmHg and aortic valve area of 2.5 cm<sup>2</sup>. The patient remained well at 23 months of follow-up and remained in NYHA class I.

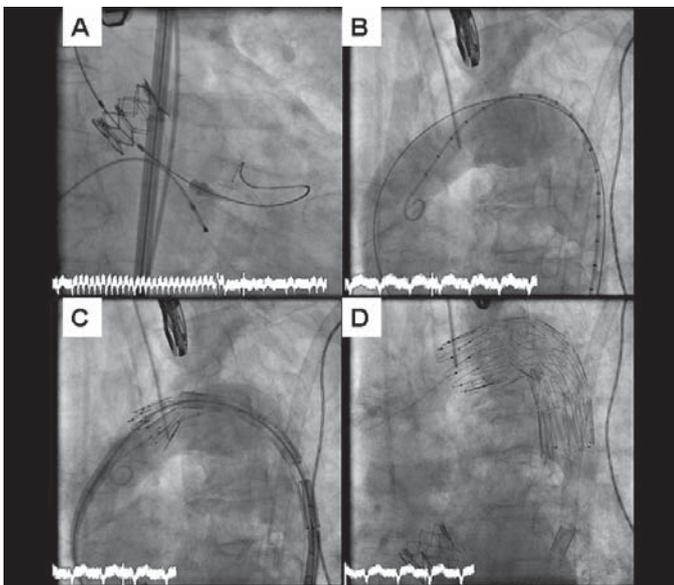


Fig. 3. Fluoroscopic images of the Edwards SAPIEN XT valve and the Zenith® Proform TX2® graft. (A) Deployment of the SAPIEN XT valve. (B) Assessing dimensions with a marker pigtail catheter. (C) Deployment of the stent graft. (D) Fluoroscopic image of both the stent graft and the SAPIEN XT valve.

## Discussion

Aortic aneurysms can be associated with severe aortic valve stenosis. This could be in the setting of bicuspid aortic valve stenosis with ascending aortic aneurysms or dissection. A large proportion of patients with aortic valve stenosis share similar risk factors and pathology as atherosclerotic lesions and the co-existence of these lesions are likely. Due to the potential risks of an aortic dissection, the presence of significant aortic diseases has been excluded in clinical trials of TAVI.<sup>1,2</sup> To our knowledge, this is the first reported case of a combined TAVI and TEVAR and highlights the challenges of such a procedure.

Firstly, the choice of access is important. The sheaths required in TEVAR are often larger than those of TAVI; so, the selection of an adequate femoral size is crucial. The choice of TAVI first, followed by TEVAR next, is favoured by the anatomy in this patient as we were confident that the stiff delivery system and wire were more likely to contact the outer curve of the aorta in this patient and avoid the aortic lesion. This may not always be the optimal sequence especially if the lesion is situated on the outer curve.

There was also a consideration of staging the procedure (i.e. performing TAVI first and then TEVAR on another date). This also has the benefit of reduced contrast load. In the end, this was not done as we felt that we could avoid 2 separate large arteriotomies. Moreover, the stent graft was needed for standby should a dissection occur during TAVI.

There was also a concern that the acutely increased cardiac output and blood pressure following TAVI may predispose to progression of the aneurysm or dissection. If TEVAR were to be performed before TAVI, the chief concern would be device interaction as the long stent graft is likely to interact with the stiff Edwards Novaflex delivery system, resulting in dislocation of the stent graft. The use of contrast could be significant in this group of patients. We mitigated this by obtaining the optimal valve plane for TAVI during the initial workup rather than during the procedure. The presence of calcium landmarks also enabled us to minimise contrast injection during valve deployment.

Finally, it is important to keep the wire in the left ventricle after a successful TAVI as rewiring and positioning of a stiff wire near the newly deployed Edward SAPIEN valve for the purposes of TEVAR may predispose to valve migration or even embolisation.

## Conclusion

Combined TAVI and TEVAR may be feasible in selected patients. Preprocedural planning is crucial to the choice of access, the sequence of the procedure and the prevention of complications.

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