First successful trans-catheter aortic valve implantation through ascending aorta using Edwards SAPIEN THV system

Vinayak Bapat*, Martyn Thomas, Jane Hancock, Karen Wilson

Department of Cardiothoracic Surgery and Cardiology, Guy’s and St. Thomas’ Hospital, London, UK

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Abstract

Trans-catheter aortic valve implantation is rapidly becoming an established modality of treatment for patients with critical aortic stenosis who are high risk for conventional aortic valve replacement. This approach also has its limitations; however, with growing experience and improvements in the delivery system, it may be possible to overcome these limitations. We describe a case where conventional trans-catheter approaches, that is, transfemoral or trans-apical using the Edwards THV system, were not possible but successful implantation was achieved through the trans-aortic route.

Keywords: Aortic valve; Aortic stenosis; Trans-catheter valve

1. Introduction

Trans-catheter aortic valve implantation (TAVI) is a novel way of treating aortic stenosis (AS) in high-risk patients[1]. Currently, only two devices are CE marked and commercially available: the Edwards SAPIEN THV valve (Edwards Lifesciences, Irvine, CA, USA) can be implanted via the ventricular apex (trans-apical (TA) approach) or femoral artery (transfemoral (TF) approach); and the CoreValve ReValving system (Medtronic, Minneapolis, MN, USA) is approved for only retrograde approach through femoral approach or subclavian artery approach. We describe a case where SAPIEN THV valve was implanted through an alternative approach because implant via TA or TF was not possible.

2. Clinical summary

An 84-year-old woman with symptomatic AS was referred for consideration of aortic valve replacement (AVR). Her assessment confirmed critical AS (valve orifice area: 0.6 cm²; mean gradient: 46 mm Hg; peak gradient: 94 mm Hg). Coronary angiography demonstrated normal coronary arteries. Her logistic EuroSCORE was 26% (Euro-SCORE, European System for Cardiac Operative Risk Evaluation). Her co-morbidities included severe kyphoscoliosis (Fig. 1(a)), chronic obstructive pulmonary disease (COPD), poor lung function (forced expiratory volume in 1 s (FEV1): 0.9) and peripheral vascular disease. She was considered high risk for conventional AVR and hence referred for TAVI. Since trans-oesophageal echocardiography measured the aortic annulus as 21 mm, she was suitable for a 23-mm Edwards SAPIEN device. TF route was not feasible because of a tortuous descending aorta (Fig. 1(b)) and small-calibre femoral arteries (< 7 mm). TA approach was also not possible because she had undergone left mastectomy followed by radiotherapy to the left chest for breast carcinoma and had severe chest deformity (Fig. 1(a)). Besides, the ventricular apex was behind the sternum and would have posed technical difficulties in performing the procedure. Hence, we planned to perform a mini-sternotomy and perform TAVI through the ascending aorta as computed tomography (CT) scan confirmed it to be free of calcification.

The procedure was performed under general anaesthesia in the catheter lab under fluoroscopy and three-dimensional (3D) trans-oesophageal echo guidance. Upper partial sternotomy was performed and the pericardium incised to expose the ascending aorta. A pigtail catheter was introduced through the left femoral artery and a transvenous pacing wire was introduced through the right femoral vein. An area on the ascending aorta was identified which (1) was free of calcification, (2) would allow us to direct the sheath in a straight line to deploy the device and (3) leave enough room between the tip of the sheath and the aortic valve to allow...
the balloon to expand fully during deployment of the device (Fig. 2(a)). Two pledgeted purse strings were taken on the selected spot. A 6-Fr multipurpose catheter was introduced through a small puncture within the purse string and the aortic valve was crossed with a soft wire. With the help of a Judkins catheter, an extra stiff wire was placed through the valve in the ventricle. A 24-Fr sheath was then inserted over this wire and held at the 2-cm mark. Balloon valvotomy was performed with a 20-mm balloon. A 23-mm device was then implanted after careful positioning with the help of transoesophageal echocardiography (TOE) and fluoroscopy (Fig. 2(b)). Care was taken to crimp the device in a reverse manner to the conventional TA approach. A good result was obtained with minimal paravalvular leak (Fig. 2(c)). The sheath was withdrawn and purse strings tied. The pericardium was left open and the sternum closed with a retrosternal suction drain. The patient was extubated 2 h after the procedure and discharged after 5 days.
3. Discussion

Since its introduction by Cribier and colleagues, TAVI has been successfully adapted in many centres across the world in the treatment of degenerative AS [2]. Early results with TAVI using SAPIEN valve and CoreValve have shown encouraging results with >90% implant success [1]. CoreValve is a self-expanding device, which can be used in only retrograde fashion and has 26- and 29-mm devices available. The SAPIEN valve is a balloon-expandable device, which can be implanted either antegrade via left ventricular apex or retrogradely via the femoral artery and has 23- and 26-mm devices available. Despite these choices, it is possible that some patients may not be suitable for any of these approaches.

Partial sternotomy has been used for minimally invasive AVR as well as for endovascular stent procedures where conventional approach was not feasible [3,4]. We used partial sternotomy to access the ascending aorta as conventional approaches, that is, TF or TA, were not possible in this patient. We used the TA THV assembly in a retrograde manner to implant the device as it is a shorter system in length and hence stable and easier to control. It may be possible to use the TF retroflex system through this approach and may have an advantage over the TA system in passing the device through the aortic valve as it has a nose cone at the tip. A literature search revealed a single case report of CoreValve insertion using a similar approach through ascending aorta [5]. Conventional CoreValve approaches, that is, TF and trans-subclavian artery, were not possible in this patient and a successful CoreValve implantation was performed through the aorta in a manner similar to our case [6].

4. Conclusion

This case highlights the feasibility of this approach using Edwards THV system. We believe that this approach should be considered if conventional approaches are not possible or should be considered as an alternative to TA in patients with poor lung function or chest deformity.

References


