Migration of the transcatheter valve into the left ventricle

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Transcatheter aortic valve implantation (TAVI) has emerged as an alternative treatment modality to medical management for patients with severe aortic stenosis who are deemed inoperable by surgical aortic valve replacement (1). Correct positioning and deployment of the transcatheter valve is recognized as one of the major technical challenges in performing TAVI. Malpositioning of the valve, which occurs when it is deployed too high or too low in relation to the aortic annulus, may be associated with adverse outcomes such as arrhythmias, coronary occlusion, mitral insufficiency and aortic injury. Transcatheter valves can embolize into the aorta if the valve is malpositioned too high or, less commonly, migrate into the left ventricle when the valve is malpositioned too low. We hereby present a video demonstration of valvular migration into the left ventricle followed by valve malpositioning in the aorta.

A 75-year old man who had previous coronary artery bypass graft surgery presents with worsening symptoms of dyspnoea from severe aortic stenosis. He has a history of diabetes mellitus, renal impairment and hypertension, with mild to moderate left ventricular dysfunction. His logistic Euroscore was 31% and the Society of Thoracic Surgeons score was 15%. A recent angiogram demonstrated severe triple vessel disease with a patent LIMA-to-1st-diagonal-to-LAD graft and an occluded saphenous vein graft to the circumflex artery. The right coronary artery was never grafted due to a previous inferior infarct. Echocardiography identified a calcific trileaflet valve with a peak gradient of 73 mmHg, a mean gradient of 44 mmHg and an aortic valve area of 0.7 cm^2.

After a multi-disciplinary discussion by the Heart Team, the patient was planned for TAVI using the Edwards SAPIEN valve (Edwards Lifesciences, Irvine, California) via a transfemoral approach with femoral extracorporeal membrane oxygenation (ECMO) support in view of his underlying ischaemic heart disease. ECMO was initiated at 2.5 L/minute and balloon valvuloplasty was successfully performed with mild aortic regurgitation. The 26 mm Edwards SAPIEN valve was positioned for deployment during rapid ventricular pacing and the initial aortic root fluoroscopy was deemed acceptable by the Heart Team. However, after deployment and cessation of rapid ventricular pacing, it was evident that the valve had been positioned too low down the annulus, and it subsequently migrated into the left ventricle.

Attempts were then made to retrieve the migrated valve from the left ventricle by inflating the balloon below the level of the SAPIEN valve and then pulling the migrated valve through the aortic annulus with traction. This ultimately proved to be a futile exercise as the valve could not be pulled through the left ventricular outflow tract. The wire was then removed and the deployed valve was left in an insecure position below the annulus. An aortic root injury caused by the traction applied to the valve was suggested by the accumulation of a pericardial effusion on transoesophageal echocardiography.

In this untenable position, a decision was made to implant a second valve via the transapical approach to treat the aortic stenosis and seal the suspected aortic injury. A left thoracotomy was performed and a wire was passed through the apex and through the deployed transfemoral valve, which was now spinning freely in the left ventricle. The second 29 mm SAPIEN transapical valve was then passed over the wire to be deployed in the aortic position. However, after deployment of the transapical valve, it was evident that the valve was misplaced too high and there was significant aortic regurgitation. Pericardial bleeding, which had been suspected on echocardiography, was confirmed

upon opening the pericardium, and continued after the second valve deployment. The patient was then commenced on full ECMO support and given Cell saver washed red cells, packed cells and factor replacement.

With great trepidation, a third 29 mm SAPIEN valve was implanted transapically and deployed below the second valve. This valve-in-valve deployment was deemed successful, achieving an improved seal around the annulus with less paravalvular regurgitation and reduced bleeding into the pericardial space. At this stage, attention was then directed at retrieving the original migrated valve in the left ventricle, which had a wire across it through the left apex. The deployment balloon for the transapical valve was inflated and used to withdraw the migrated transfemoral valve towards the apex of the heart. A pair of Roberts forceps was then used to enter the apex of the heart to retrieve the migrated valve under image intensifier guidance. Bleeding was controlled with tightening of purse-string sutures around the apex with additional pledgeted sutures. After surgical control of bleeding, the patient was weaned off ECMO and transferred to the intensive care unit.

As a result of malpositioning of the transcatheter valve at the time of deployment, valve embolization into the aorta or migration into the left ventricle can occur depending on whether the valve has been misplaced too high or too low. In the current literature, the incidence of valve embolization range from 0.3% to 7.5% (2,3). Migration of the transcatheter valve into the left ventricle is a rare but serious adverse outcome that has only been described in case reports (4). One of the main reasons for valve embolization or migration is the failure to ensure the correct coaxial plane is established prior to the deployment of the valve. It is now recognized that the perpendicularity of the valve plane to the long axis of the three aortic sinuses and the coaxial position of the deployment apparatus must be confirmed by fluoroscopy prior to valve deployment. The use of 3-D CT reconstruction with road mapping of the aortic root may greatly improve the accuracy of valve deployment. Other described causes of valve malpositioning include inadequate ventricular pacing during deployment of the valve, non-uniformly distributed leaflet calcification, and prior valvular interventions (4,5). Our experience of valve migration into the left ventricle is a relatively rare adverse outcome that has been rectified by implantation of additional transcatheter valves through the transapical route without conversion to open surgery.

A number of lessons can be learned from this challenging case report. Firstly, this case demonstrates the importance of performing TAVI procedures from a multidisciplinary Heart Team approach including cardiothoracic surgical support. Secondly, it highlights the difficulty and importance of correctly positioning the valve at the time of deployment to ensure accurate coaxial lie. Finally, after the original valve had migrated into the left ventricle, it became apparent that any attempt at retrieving the valve through the annulus was futile. Our approach of retrieving the migrated valve from the left ventricle through the apex under ECMO support should be considered as an option in this rare but challenging scenario.

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References

1. Leon MB, Smith CR, Mack M, et al. Transcatheter aortic-valve implantation for aortic stenosis in patients who cannot undergo surgery. N Engl J Med 2010;363:1597-607.
2. Svensson LG, Dewey T, Kapadia S, et al. United States feasibility study of transcatheter insertion of a stented aortic valve by the left ventricular apex. Ann Thorac Surg 2008;86:46-54; discussion 54-5.
3. Thomas M, Schymik G, Walther T, et al. Thirty-day results of the SAPIEN aortic Bioprosthesis European Outcome (SOURCE) Registry: A European registry of transcatheter aortic valve implantation using the Edwards SAPIEN valve. Circulation 2010;122:62-9.
4. Pang PY, Chiam PT, Chua YL, et al. A survivor of late prosthesis migration and rotation following percutaneous transcatheter aortic valve implantation. Eur J Cardiothorac Surg 2012;41:1195-6.
5. Tay EL, Gurvitch R, Wijeysinghe N, et al. Outcome of patients after transcatheter aortic valve embolization. JACC Cardiovasc Interv 2011;4:228-34.

