Case Reports

Balloon Repositioning of Transcatheter Aortic Valve

after Migration into the Left Ventricular Outflow Tract, Followed by Valve-in-Valve Procedure

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Transcatheter aortic valve replacement is an established option for treating patients with symptomatic aortic stenosis; however, severe, life-threatening complications, such as valve migration, are possible. We report the case of an 82-year-old woman whose Edwards SAPIEN XT valve migrated into the left ventricular outflow tract one day after transcatheter aortic valve replacement. We used an inflated balloon to adjust the position of the migrated valve before performing a valve-in-valve procedure via a transapical approach, which resulted in a good valve implantation. ***(Tex Heart Inst J 2017;44(4):274-8)***

Patients with severe aortic stenosis and coexisting conditions are not good candidates for surgical aortic valve (AV) replacement because they face a high risk of perioperative complications. Transcatheter AV replacement (TAVR) provides a less invasive treatment option for these patients,[1] but the procedure is not without risk. Transcatheter heart valve (THV) migration is a rare but serious TAVR complication that usually occurs during or up to an hour after the procedure.[2] Downward migration into the left ventricular outflow tract (LVOT) or left ventricle (LV) is life-threatening and necessitates an urgent bailout procedure; however, such procedures can be complex and may result in serious secondary complications.[3] We report an unusual case of late downward THV migration into the LVOT, which occurred one day after TAVR, and the procedure we used to correct it.

Key words: *Aortic valve stenosis/therapy; balloon valvuloplasty; foreign-body migration/etiology/prevention & control/therapy; heart valve prosthesis implantation/adverse effects/instrumentation/methods; treatment outcome*

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Case Report

In June 2015, an 82-year-old woman with symptomatic, severe aortic stenosis was referred to our hospital for TAVR evaluation. Transthoracic echocardiograms revealed severe aortic stenosis (AV area, 0.93 cm^2), a peak pressure gradient of 95 mmHg, a mean pressure gradient of 57 mmHg, an aortic annular diameter of 21 mm, and an LV ejection fraction of 0.85. On multidetector computed tomography (MDCT), the calculated aortic annular area was 3.82 cm^2 (Fig. 1). The patient's risk of operative death was 5.42% according to the logistic EuroSCORE[4] and 5.3% according to the Society of Thoracic Surgeons score.[5] Her Clinical Frailty Scale score was 6.[6]

The patient underwent TAVR, performed under general anesthesia via a transfemoral approach and with fluoroscopic and transesophageal echocardiographic (TEE) guidance. After confirming the dimensions of the annulus by means of aortography from the perpendicular view, we implanted a 23-mm Edwards SAPIEN XT valve (Edwards Lifesciences LLC; Irvine, Calif) with nominal inflation volume under rapid pacing (180 beats/min). After deployment, aortograms revealed good THV expansion and mild aortic regurgitation. Transesophageal echocardiograms revealed several areas of mild paravalvular leakage (PVL) that were not associated with annular calcification (Fig. 2). Aortograms showed that the THV was appropriately positioned at the annulus at the left coronary and noncoronary cusps; however, the THV appeared to be inclined with respect to the annular line. Therefore, we adjusted the C-arm angle to view the THV perpendicularly, and this confirmed that the THV was deployed slightly below the right coronary cusp (RCC) (Fig. 3). We considered performing balloon postdilation but decided not to, because the patient was hemodynamically stable. Accordingly, we completed the routine procedure.

The patient remained hemodynamically stable overnight but had an audible systolic murmur the next morning. Transthoracic echocardiograms revealed that the

THV had migrated into the LVOT, below the level of the native valve annulus. Results of MDCT confirmed that the THV was just below the annulus at the noncoronary and left coronary cusps, and 7.1 mm lower than the annulus at the RCC (Fig. 4); the THV was sufficiently dilated (diameter, 23 mm).

To avoid the risk of further valve migration into the LV, we performed an emergency valve-in-valve implantation via the transapical approach. An anterolateral left thoracotomy was performed in the 5th intercostal space to expose the LV apex. Under fluoroscopic and TEE guidance, the apex was punctured and a 0.035-in soft spring coil wire (Lake Region Medical, a division of Integer; Frisco, Texas) was passed in antegrade fashion through the migrated THV and native AV and into the aorta (Fig. 5A); then the apex opening was dilated to accommodate a 14F sheath, and the wire was exchanged for an Amplatz Super Stiff™ Guidewire (Boston Scientific Corporation, Natick, Mass). The wire was placed in

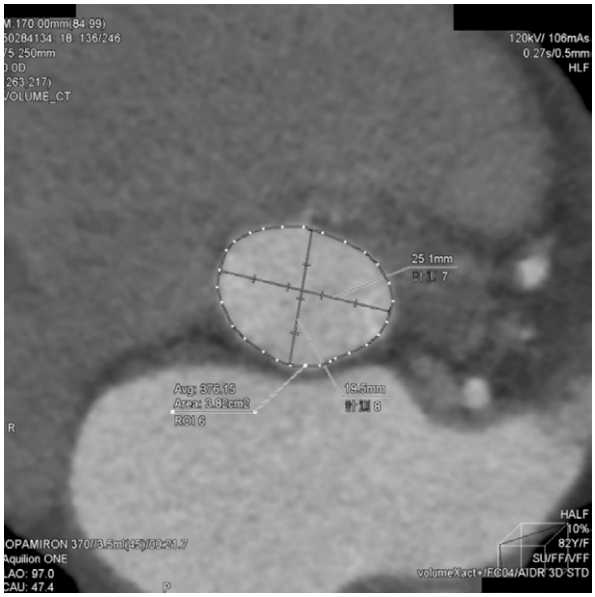

Fig. 1 *Multidetector computed tomogram shows the aortic annulus (calculated area, 3.82 cm^2; dimensions, 19.5 × 25.1 mm).*

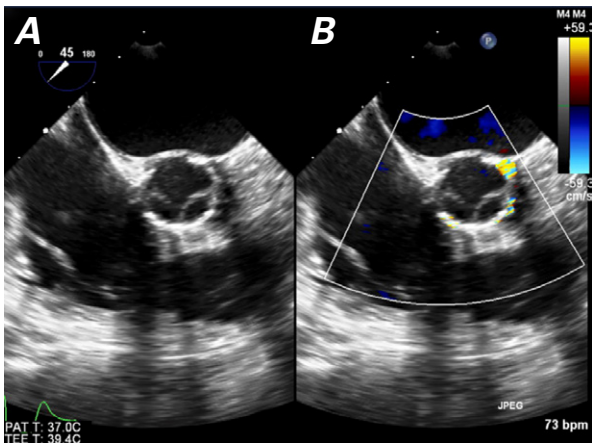

Fig. 2 *Transesophageal echocardiograms show **A**) good expansion of the implanted valve, and **B**) in color-Doppler mode, several mild paravalvular leaks that were not associated with annular calcification.*

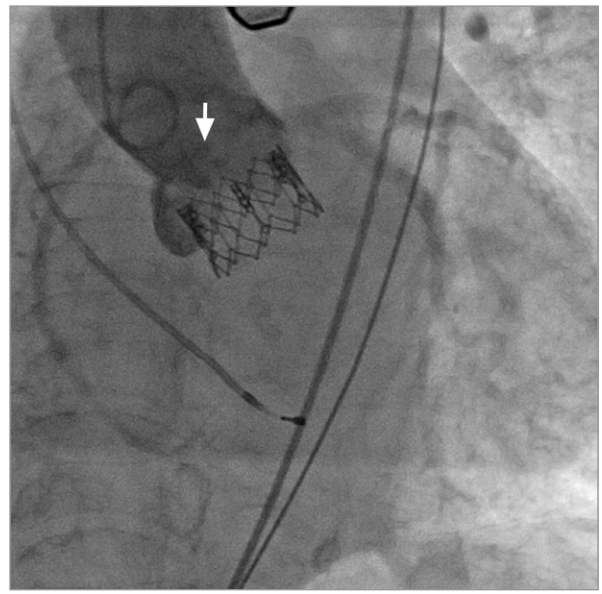

Fig. 3 *Aortogram obtained through optimal positioning of the C-arm shows the transcatheter aortic valve slightly below the native right coronary cusp (arrow).*

Fig. 4 *Multidetector computed tomogram shows the transcatheter heart valve within the left ventricular outflow tract. The valve was 7.1 mm lower than the aortic annulus at the right coronary cusp, and it was just below the annulus at the left coronary and noncoronary cusps.*

the descending aorta with a multipurpose catheter, and the 14F sheath was exchanged for a 24F Edwards SAPIEN Ascendra introducer sheath. Next, a 25-mm Z-Med II balloon catheter (NuMED Inc.; Hopkinton, NY) was advanced over the wire and through the migrated THV. Under rapid pacing (180 beats/min), the balloon was inflated and then pushed forward to move the THV up to the aortic annulus (Fig. 5B). At this point, the THV seemed to be slightly higher at the RCC than it had been before repositioning. A 26-mm Edwards SAPIEN XT valve was then deployed, with nominal inflation volume, at a higher position to cover the 23-mm THV and the native AV (Fig. 5C). Balloon postdilation was performed with nominal inflation volume across the 26- and 23-mm valves. A final aortogram (Fig. 5D) and TEE revealed only mild aortic regurgitation, so we completed the procedure in routine fashion.

Complete atrioventricular block developed during implantation of the 26-mm THV, so the patient underwent permanent pacemaker implantation 3 days later. Subsequently, she did well and was discharged 21 days after the TAVR procedure. At her 6-month follow-up,

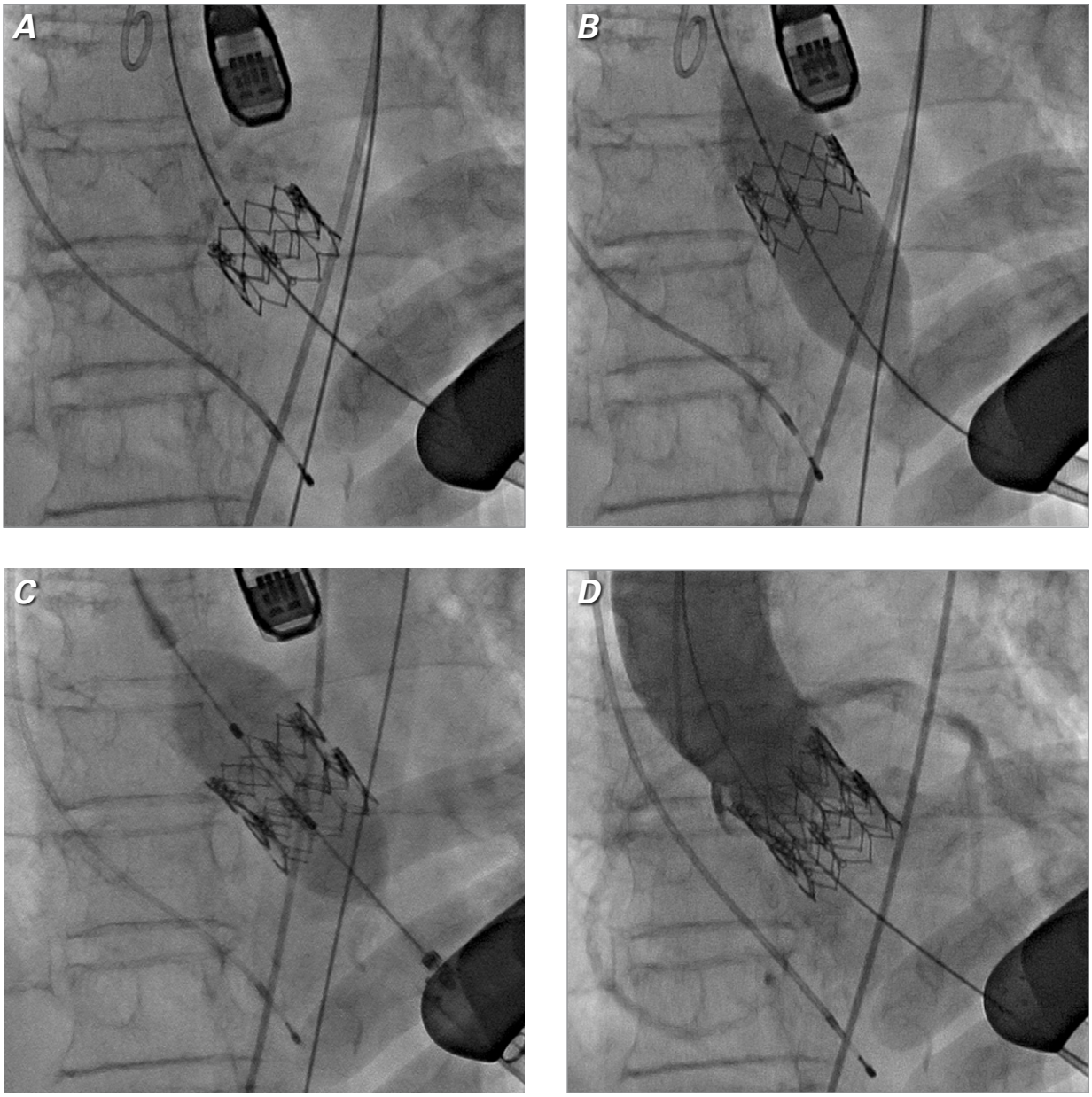

Fig. 5 *Fluoroscopic images.* ***A****) A 0.035-in spring-coil wire was passed in antegrade fashion through the migrated transcatheter heart valve and native aortic valve via a transapical approach.* ***B****) A 25-mm Z-Med II balloon catheter was inflated and pushed forward to move the transcatheter heart valve up to the aortic annulus.* ***C****) The valve-in-valve procedure was performed with a 26-mm Edwards SAPIEN XT valve.* ***D****) Aortogram shows the implanted transcatheter valve covering the native aortic and migrated valves, with mild aortic regurgitation.*

she was asymptomatic and in good general condition. Transthoracic echocardiography confirmed good THV function, as follows: AV area, 2.57 cm^2; peak and mean pressure gradients, 11 and 6 mmHg, respectively; and LV ejection fraction, 0.85.

Discussion

Transcatheter heart valve migration is a rare but serious TAVR complication. Ibebuogu and colleagues[2] reviewed the literature on device embolization and found that embolization occurred within one hour of implantation in 90% of cases and later (range, 4 hr–43 d) in 10% of cases.[7-12] In the case reported by Clavel and colleagues,[11] a 79-year-old man went into cardiogenic shock 2 days after a valve-in-valve procedure when the valves migrated into the LV, causing LVOT obstruction. The patient died during the operation intended to remove the bioprosthetic valves and to perform standard AV replacement. In our patient, the THV migrated downward one day after TAVR. Positioned just beneath the stenotic native AV, the THV functioned without obstruction, so the patient remained hemodynamically stable.

In retrospect, the THV migration in our patient might have been related to several factors. We implanted a 23-mm SAPIEN XT valve because the patient's annular area, calculated with MDCT, was 3.82 cm^2. However, the tracing on the MDCT (Fig. 2) appears to be slightly smaller than the actual annular area. The size of the annulus might have been larger. We also might have underestimated the degree of PVL. After THV deployment, TEE revealed several areas of PVL (Fig. 2), but we characterized them as mild, and they were not associated with annular calcification. We should have regarded these findings as indicative of possible underexpansion of the valve. Balloon postdilation might have insured sufficient valve expansion and secure anchoring of the THV. In subsequent cases with a high probability of distal migration, we have performed balloon postdilation, and we also have had more than one radiologist calculate the annular area. Furthermore, in addition to evaluating valve placement by using aortography and TEE, we consider the resistance encountered during valve deployment to be important. Although subjective, balloon inflations that go too smoothly may indicate that the THV has not been sufficiently expanded.

We considered several options for urgent revision of our patient's valve position. Retrieving the THV by open-heart surgery was too risky for this patient. Using a retrograde approach to snare the THV was also considered, but this would have been difficult because it was entirely beneath the calcified native valve. In a similar case reported by Cao and colleagues,[13] attempts to retrieve a migrated valve through the annulus were futile. A valve-in-valve technique via a transfemoral approach was also risky because interference from the wire might have caused the valve to migrate further into the LV. Left ventricular migration is life-threatening and usually necessitates urgent surgical removal.[14] Dumonteil and associates,[15] however, reported a case of THV migration into the LV just after implantation via a transapical approach; bailout was accomplished with a valve-in-valve technique. Similarly, we used a valve-in-valve technique via a transapical approach because we considered it relatively easy to cross the wire through the migrated THV from the apex and because, if the wire were crossed, the THV would be prevented from embolizing into the LV. Before beginning the valve-in-valve procedure, we slightly adjusted the position of the THV by inflating a 25-mm balloon catheter and pushing the valve forward to the annulus. With the first THV in a more favorable position, we deployed a 26-mm SAPIEN XT valve; at 17 mm in length, it covered both the migrated THV and the native valve. A 29-mm valve would have been too large and might have caused the annulus to rupture.

This case report demonstrates the importance of monitoring patients, even after an uneventful TAVR. We recognized THV migration to the LVOT at an early stage by using auscultation. If there had been any delay in identifying the problem, the THV might have migrated to the LV. Adjusting the position of the THV with a balloon catheter and performing the valve-in-valve technique via a transapical approach proved safe in our patient.

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