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EDITORIAL COMMENT

Repeat Transcatheter Aortic Valve Implantation Through an Embolized Transcatheter Aortic Valve

No Matter of Concern*

Marco Barbanti, MD, Giuliano Costa, MD

Prosthesis embolization is a rare complication that may occur during transcatheter aortic valve implantation (TAVI). Previous series showed that aortic embolization is more frequent and can be effectively managed using a fully percutaneous approach. Transcatheter aortic valve (TAV) dislocation into the left ventricle occurs in a minority of cases, and open heart surgery often is the only treatment of this life-threatening complication (1,2).

A report from the PARTNER (Placement of Aortic Transcatheter Valves) trial and more recently the results from the TRAVEL (TranscatheteR HeArt Valve EmboLization and Migration) registry showed that, although TAV embolization led to poorer acute outcomes, the presence of a TAV in the aorta seems not to be associated with an increased risk of mortality and stroke at 1 year (2,3). However, long-term data of patients experiencing this complication are scarce, and whether an embolized device could degenerate and impair blood flow or interfere with any eventual future transcatheter interventions is unknown.

In this issue of *JACC: Case Reports,* Ihdayhid et al. (4) described a case of repeat TAVI for a balloon-expandable TAV that degenerated 13 years after implantation in a patient who had experienced aortic TAV embolization during the first TAVI procedure. The first procedure had been performed in 2007, when TAVI therapy was in its infancy. Pre-procedural computed tomography angiography (CTA) was not routinely performed during TAVI workup, and available sizes of transcatheter bioprostheses were limited. In this case, a 23-mm Cribier-Edwards TAV (Edwards Lifesciences, Irvine, California) was chosen for the first TAVI, based on annular diameter measured by transesophageal echocardiogram. During the index procedure, the first TAV embolized to the aorta and was secured in the abdominal aorta. A second TAV of the same size was then advanced and deployed in its anatomic position. When the patient returned 13 years later because of TAV failure, CTA performed before TAVI-in-TAVI revealed that the degenerated bioprosthesis was constrained within the native annulus and measured <20 mm at its inflow portion. This observation led the operators to choose a 20-mm SAPIEN 3 valve (Edwards Lifesciences) for the repeat TAVI, even though the degenerated 23-mm TAV theoretically could have accommodated a same-size device. The procedure was uneventful, and residual transaortic gradient was good (mean gradient 7 mm Hg).

Repeat TAVI is a feasible and safe treatment of TAV degeneration (5,6). The Redo TAVR Registry recently showed that the TAVI-in-TAVI procedure has a high rate of device success (85.1%) and very low rates of procedural complications (6). As corroborated by this case report, proper CTA evaluation is mandatory for repeat TAVI. It would allow clarification of the underlying causes of device degeneration and adoption of a highly tailored approach in anticipation of any potential issues that could arise during or after the procedure. In particular, an emerging issue after

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From the Division of Cardiology, Centro Alta Specialità e Trapianti, Azienda Ospedaliero Universitaria Policlinico "G. Rodolico-San Marco," Catania, Italy.

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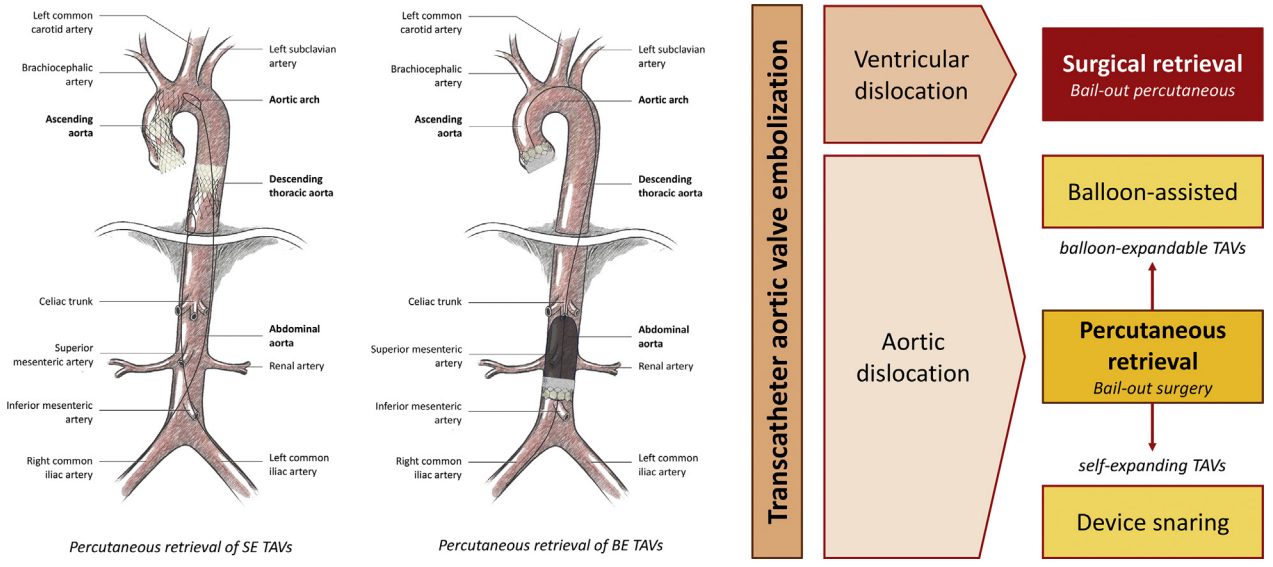
FIGURE 1 **Management of Transcatheter Aortic Valve Embolization**



BE = balloon-expandable; SE = self-expanding; TAV = transcatheter aortic valve.

TAVI-in-TAVI is the creation of a double stent layer that interposes between the aortic valve and coronary arteries. This barrier can create an obstacle to coronary re-access and might even sequestrate the blood flow within the sinuses of Valsalva. This occurs more frequently when supra-annular, long-stent TAVs with a closed cell design are used in both the first and second TAVIs, and the sinotubular junction is not large enough to allow blood flow to easily refresh the seized sinus of Valsalva zones from above. It must be emphasized that optimal TAV selection for TAVI-in-TAVI procedures has yet been determined. Ihdayhid et al. (4) did not report any information on aortic root anatomy that would have been of interest in understanding the reason behind the selection of a second balloon-expandable device for repeat TAVI. Indeed, a supra-annular bioprosthesis theoretically could have an advantage in terms of effective orifice area compared to an intra-annular device for TAVI-in-TAVI, especially when dealing with such a small reference internal diameter. Nevertheless, the more stable deployment and positioning, as well as the several structural improvements, of the SAPIEN 3 valve ensured an optimal hemodynamic result.

Valve embolization during TAVI is a rare phenomenon. It occurs almost exclusively during or immediately after TAV deployment and is mainly caused by sizing error, initial device malpositioning, pacing failure (for balloon-expandable TAV implantations), or excessive tension stored in the delivery system during TAV release. Careful evaluation of patient hemodynamics and operator experience are the main drivers of treatment strategy choice (1). When a device embolizes to the aorta, the management may differ according to the type of valve (**Figure 1**). In case of embolization of a balloon-expandable valve, it is crucial to maintain the guidewire across the valve to avoid inversion of the device. The embolized TAV then should be pulled back to the descending aorta by retrieving a valvuloplasty balloon inflated distally to the valve. In case of embolization of a self-expanding valve, which has a taller and larger frame than a balloon-expandable valve, percutaneous treatment is based on the possibility of engaging and retrieving the embolized valve with a snare system. If the lumen of the thoracic aorta has a minimum diameter that exceeds the larger diameter of the valve, the device can be effectively pulled back to the abdominal aorta. However, in the majority of cases the valve cannot be retrieved from beyond the aortic arch in a safe manner, and it is preferable to secure it at the level of the ascending aorta, above the sinotubular junction, in order to avoid encumbrance of the aortic root distally and supra-aortic trunks origins proximally. In any case, assessment of the patency of the aortic side branches by angiography or post-procedural CTA is recommended.

In this case report, Ihdayhid et al. (4) showed that the embolized valve remained stable at the level of

the abdominal aorta during follow-up, and CTA assessment showed that its leaflets remained well open through the entire cardiac cycle. This allowed easy passage of the delivery system through the valve without any obstruction by the prosthetic leaflets. Implantation of a CP stent (NuMED, Inc., Hopkinton, New York) inside the embolized TAV to repair it and avoid any interference with blood flow by the prosthetic leaflets has been described paper (7). However, in case of TAV embolization, the prosthetic leaflets of an embolized valve do not maintain their functionality due to the lack of difference in diastolic pressure, which is constant throughout the entire course of the aorta (7). As a result, the leaflets are not subjected to the same stress as when they are in the intended aortic position; therefore, at least theoretically, they are less prone to structural deterioration. This condition should be carefully evaluated by pre-procedural CTA in order to avoid any undesirable embolization of thrombotic material downstream.

In conclusion, TAV embolization is a serious and life-threatening complication that requires prompt and effective management. A fully percutaneous approach performed at experienced centers is feasible and safe, and is associated with favorable results. Data on the long-term outcomes of embolized TAV are scarce, and this case report, although limited by its anecdotical nature, provides important insights into the long-term impact of TAV deployed in a heterotopic position.

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ADDRESS FOR CORRESPONDENCE: Dr. Marco Barbanti, Division of Cardiology, A.O.U. Policlinico "G. Rodolico-San Marco," Via Santa Sofia 78, 95123 Catania, Italy. E-mail: mbarbanti83@gmail.com.

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