

Percutaneous paravalvular leak closure after CoreValve transcatheter aortic valve implantation using an arterio-arterial loop

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Abstract: Significant periprosthetic aortic regurgitation after transcatheter aortic valve implantation has become a major concern of this technique given its association with impaired survival. We report the successful closure of such defect using a vascular occlusion device with the creation of an arterio-arterial loop to gain enough support to advance the delivery sheath into the left ventricle.

Keywords: Paravalvular leak (PVL); transcatheter aortic valve implantation (TAVI); closure device

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An 84-year-old male was admitted to our Institution due to symptoms and signs of heart failure. Diagnostic work-up revealed the presence of a severe aortic stenosis with moderately impaired left ventricular function (LVF 35%). He was scheduled for transcatheter aortic valve implantation (TAVI), since the patient was considered at a high surgical risk. The patient received a 29-mm CoreValve (Medtronic Inc., Minneapolis, USA) through transfemoral route. Due to significant paravalvular regurgitation (PVR) the valve was post-dilated with a 25-mm Nucleus balloon (NuMED, NY, USA) with the final result of moderate (2+) PVR. The course was uneventful after the procedure and the patient was discharged home. However, at 3-month follow-up the patient complained of symptoms of heart failure. A transthoracic echocardiogram revealed the presence of severe PVR and a severely impaired LVF (20%). Transesophageal echo (TEE) and invasive angiogram showed a severe crescent-shape PVR of 10 mm width located in the posterior aspect of the TAVI frame with patent coronary arteries (Figures 1-3). After discussion with the heart team the patient was considered a candidate for transcatheter paravalvular leak (PVL) closure.

Under general anesthesia and TEE control two 6-Fr sheaths were placed in the right radial (for control

aortography) and left femoral arteries (for procedure). Through femoral route a 6-Fr AL1 diagnostic catheter (Cordis, USA) and a 0.0035' straight Terumo wire were used to probe the defect (Figure 4A). The leak could be crossed and 4 Fr Terumo Glidecath diagnostic catheter (Terumo Medical Corporation, USA) was placed in the LV cavity. Terumo wire was exchanged by a Confida wire (Medtronic Inc., Minneapolis, USA) in order to gain support to advance a 7-Fr TorqVue sheath for AVP-III device insertion (St Jude Medical, USA; selected based upon the measurements of TEE). However, after several attempts the sheath could not be advanced to the LV due to the severe annulus calcification (Figure 4B). Then, the defect was crossed with the AL1, but this time through the radial access. Once the wire was advanced to the LV, it was manipulated into the LV to direct the tip to the left ventricular outflow tract (LVOT) and cross the TAVI leaflets to reach the ascending aorta. Since we had our 7 Fr TorqVue sheath located in that position we were able to directly insert the Terumo wire inside, thus creating an arterio-arterial loop (Figures 5,6). The TorqVue sheath was kept in place to increase the support and a 7.5-Fr JR4 Sheathless catheter (Asahi, Japan) inserted through radial artery was advanced into de

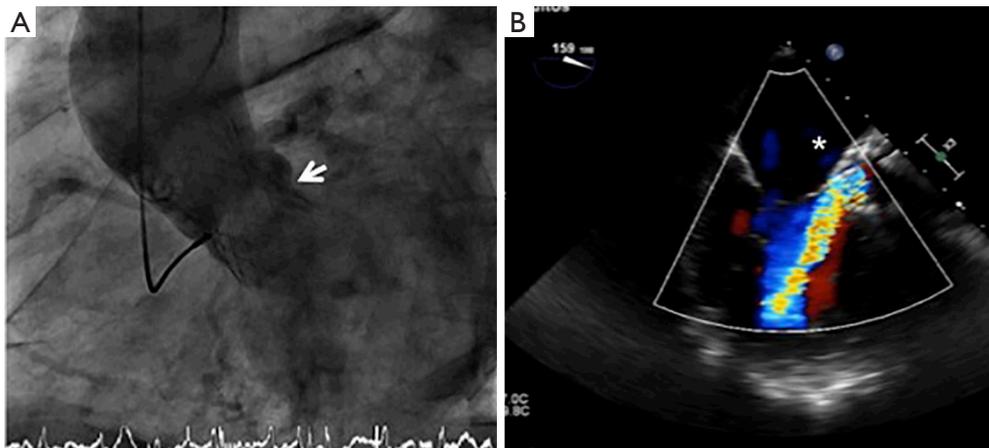


Figure 1 Severe paravalvular leak. (A) Aortogram showing severe aortic regurgitation due to paravalvular leak (arrow); (B) TEE in LVOT projection demonstrating the presence of a wide jet of aortic insufficiency close to anterior mitral leaflet (asterisk). TEE, transesophageal echo; LVOT, left ventricular outflow tract.



Figure 2 Initial aortogram showing severe PVR (1). PVR, paravalvular regurgitation.

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Figure 3 X-plane TEE showing the severe paravalvular regurgitation (2). TEE, transesophageal echo.

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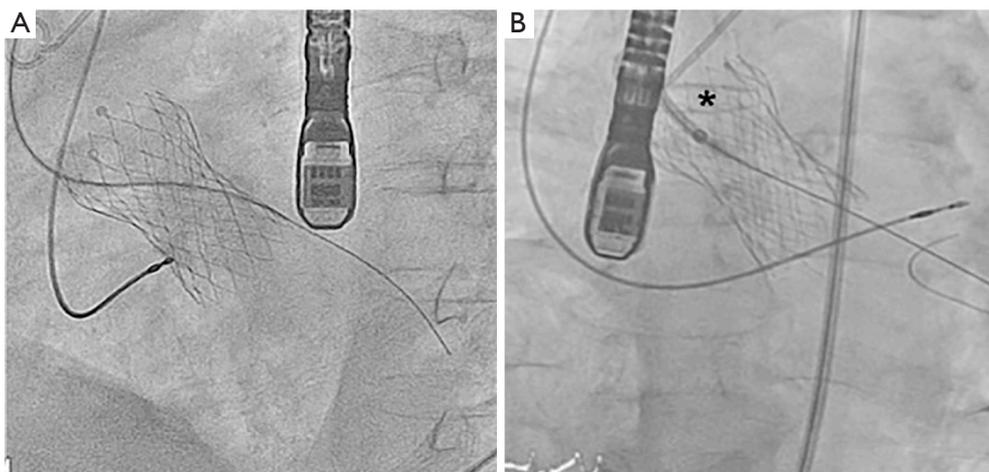


Figure 4 Interventional procedure. (A) Through an AL1 catheter a straight tip Terumo wire was advanced into the LV; (B) severe resistance was encountered and the TorqVue sheath (asterisk) could not pass through. Severe calcification is noted in the annulus.

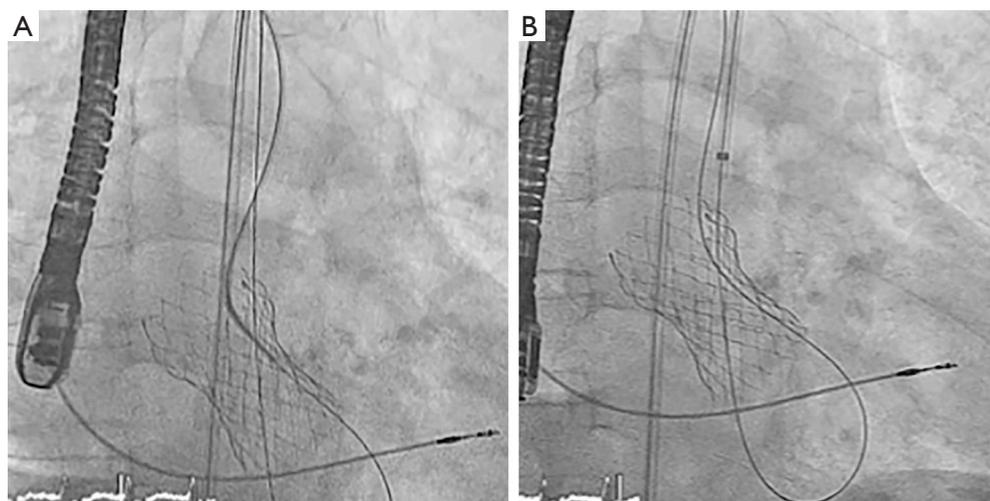


Figure 5 Interventional procedure with creation of the arterio-arterial loop. (A,B) The Terumo wire crosses the defect and is externalized through the middle of the valve and then inserted into de femoral sheath.



Figure 6 Creation of the arterio-arterial loop (3). Available online: <http://www.asvide.com/articles/1379>



Figure 7 AVP-III oriented into LV (4). AVP, amplatzer vascular plug; LV, left ventricle. Available online: <http://www.asvide.com/articles/1380>

LV. Then a 10 mm × 4 mm AVP-III was positioned into the LV. We firstly unsheathed completely the device in order to orientate it with its long axis parallel to the major defect diameter (Figure 7). Once the occluder was properly oriented it was partially recaptured to be positioned into de defect. Eventually the device was implanted with significant reduction of the PVR to mild degree (Figures 8,9). A buddy-wire was left into de LV in case a second occluder was required. However, echo, angiogram and hemodynamic measurements confirmed the excellent result of the case, so no more devices were needed (Figures 10-12).

PVR after TAVI has been linked to an impaired survival (8). The management of paravalvular leaks after TAVI is still a matter of controversy. Mild degrees of PVR (<2/4) might be clinically followed as they are thought to be benign and not progressive in the majority of patients (9). However, more severe degrees of AR may be clinically relevant and deserve intervention. Usually, balloon post-dilatation is the first option for paravalvular leaks following TAVI, using a slightly oversized balloon. In our case, balloon dilatation was the first-line intervention, but failed to solve the PVR. The possibility of implanting a valve-in-valve has also been described (10), with an excellent result. However, this strategy may be of limited value if the leak is produced by the presence of bulky calcification of the annulus. And finally, the use of occlusion devices may be an appropriate technique to deal with such paravalvular leaks. Percutaneous closure of PVL has been described as a safe and effective strategy to reduce the regurgitant

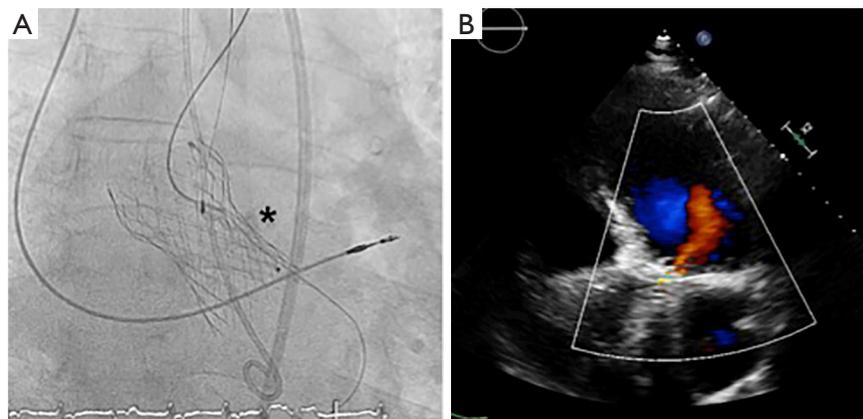


Figure 8 Deployment of closure device and result. (A) AVP-III deployed through the defect (asterisk); (B) TTE showing mild aortic regurgitation. AVP, amplatzer vascular plug; TEE, transesophageal echo.

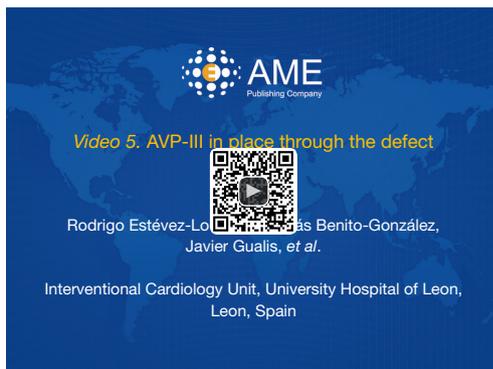


Figure 9 AVP-III in place through the defect (5). AVP, amplatzer vascular plug.

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volume and improve patients' symptoms (11,12). Most of the cases reported are treated using the AVP-IV that can be delivered through small diagnostic catheters (11). However, when the leak is big enough, large sheaths may be necessary to implant the appropriate device. In self-expanding prostheses the presence of the valve struts and the annulus calcification may offer high resistance to the advancement of delivery systems mainly when using large sheaths. Arterio-venous loop is frequently used in PVL closure in surgical mitral prosthesis. Notwithstanding, it requires transeptal puncture, place the wire into the left atrium and snare it, therefore increasing the complexity of the procedure. Nevertheless, in our opinion the arterio-arterial loop is easier to create since both arterial

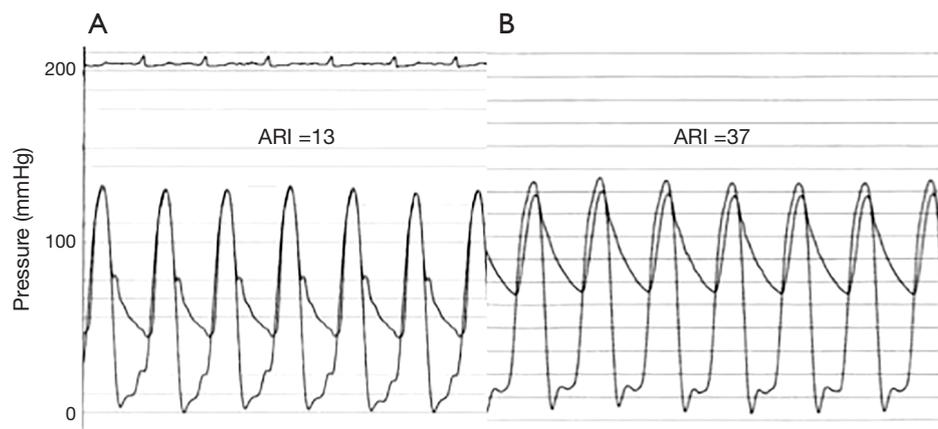


Figure 10 Hemodynamic measurements. (A,B) Hemodynamic measurements pre and post deployment of the device. There is a significant improvement after occlusion of the PVL with a normalization of the aortic regurgitation index (ARI). PVL, paravalvular leak.



Figure 11 Aortogram showing almost completely closure of the defect (6).

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Figure 12 TTE with mild residual aortic regurgitation (7). TEE, transesophageal echo.

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sheaths were previously in place. The management of the wire in the LV to achieve the ascending aorta could be challenging, as it is the insertion of the wire in the sheath to create the loop. When direct insertion is not possible, the wire should be snared to be externalized through the arterial access. Once the loop is performed the support to advance large sheaths is significantly increased as it was demonstrated in our case, and the occluder device could be successfully deployed.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Informed Consent: Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

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