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Transcaval access with an IVUS-assisted aorta-outward puncture

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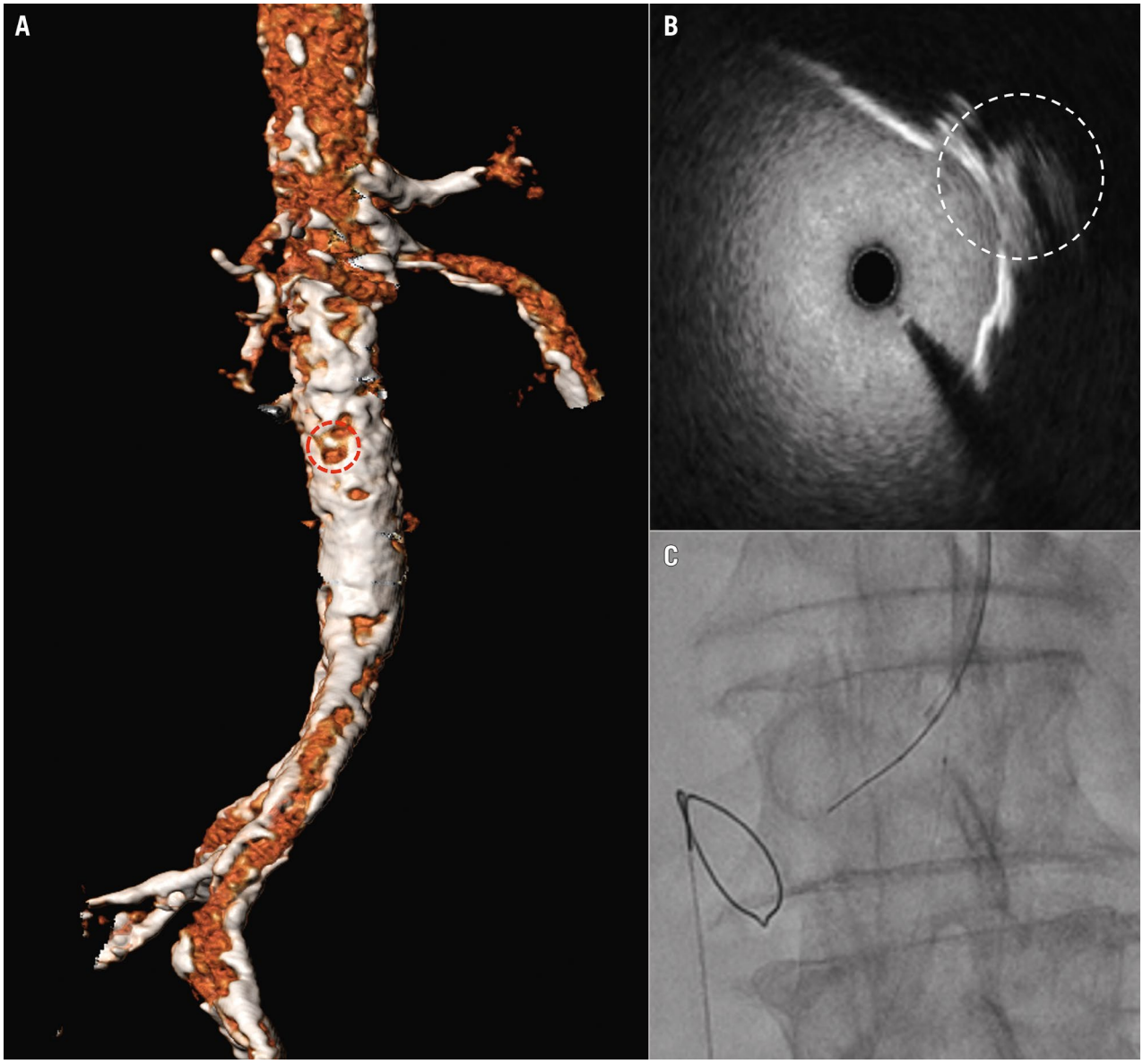

Figure 1. *Heavily calcified descending aorta and iliac-femoral axis. Note the narrow, "less calcified" window (A, red dotted circle) corresponding to the IVUS image target (B, white dotted circle) used for aortocaval traversal (C) in this transcaval TAVI procedure. IVUS: intravascular ultrasound; TAVI: transcatheter aortic valve implantation*

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Transfemoral access is the preferred choice for most transcatheter aortic valve implantation (TAVI) procedures. However, there are patient-specific femoral features that can limit its use. For this reason, alternative approaches, such as transcaval access, have been explored to overcome these limitations. In this procedure, an introducer is placed in the femoral vein and guided into the inferior *vena cava* (IVC). A fistula is then created between the IVC and the aorta using a guidewire-electrification technique. Finally, the fistula is closed with an Amplatzer occluder (Abbott). One factor that can make this approach difficult is the descending aorta calcium burden (since transcatheter electrosurgery techniques are more challenging through calcified areas and could increase the risk of vessel damage)[1].

We treated a 78-year-old male with a history of chronic obstructive pulmonary disease (COPD), severe peripheral vasculopathy with bilateral bypasses in inferior extremities, previous myocardial infarction, and severe aortic stenosis with high operative risk and a challenging anatomy that hindered alternative access.

A preprocedural computed tomography (CT) scan showed diffuse and severely calcified atheromatosis in the descending aorta. Due to severe aortic wall calcifications and a narrow window without calcium **(Figure 1, Supplementary Figure 1)**, the team foresaw a potentially unfeasible or dangerous entry into the aorta. To facilitate crossing, we decided to modify the classic transcaval crossing trajectory, from the descending aorta into the IVC, for an aorta-outward traversal through a less calcified aortic surface.

Intravascular ultrasound (IVUS) evaluation of the descending aorta calcification was carried out to visualise the path for and steer guidewire traversal **(Figure 1, Moving image 1)**. After locating a less calcified target, simultaneous aortic and caval angiograms were acquired to correlate anatomical landmarks with the IVUS findings. Aortocaval traversal was made with an electrified 190 cm Gaia Second wire (ASAHI). After crossing, the wire was snared into the IVC, a FineCross microcatheter (Terumo) was advanced into the IVC and the Gaia Second wire exchanged for a 300 mm BMW wire (Abbott) **(Supplementary Figure 2)**. Sequential dilations of the descending aortic wall were performed with semicompliant balloons, but due to incomplete expansion, we used a non-compliant balloon (3.0 mm OPN NC balloon [SIS Medical]) **(Supplementary Figure 3)**. We crossed a 5 Fr 45 cm Flexor introducer sheath (COOK), with the balloon-assisted tracking technique, from the IVC into the aorta, followed by predilation with 4.0 mm and 5.0 mm balloons over a Lunderquist Extra-Stiff wire (COOK) in order to be able to cross a 14 Fr eSheath (Edwards Lifesciences) **(Supplementary Figure 4)**. After the transcaval pathway was ready, a 27 mm Navitor valve (Abbott) was implanted **(Supplementary Figure 5)**. For aortocaval closure, we used a 10 mm/8 mm Amplatzer Duct Occluder (Abbott) over an Agilis NxT Steerable Introducer (Abbott) **(Supplementary Figure 6)**. Femoral vein access was closed with a figure-of-8 suture.

The transcaval approach is a good alternative when the gold-standard transfemoral access is not possible. In patients with complex anatomical features, such as a heavy calcium burden, that could preclude a transcaval path, a modification in the electrification trajectory of the classic technique can be feasible in selected patients when performed by experienced operators. Availability of a vascular access needs to be considered for bailout resolutions in case of vessel damage.

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Conflict of interest statement

The authors have no conflicts of interest to declare.

Reference

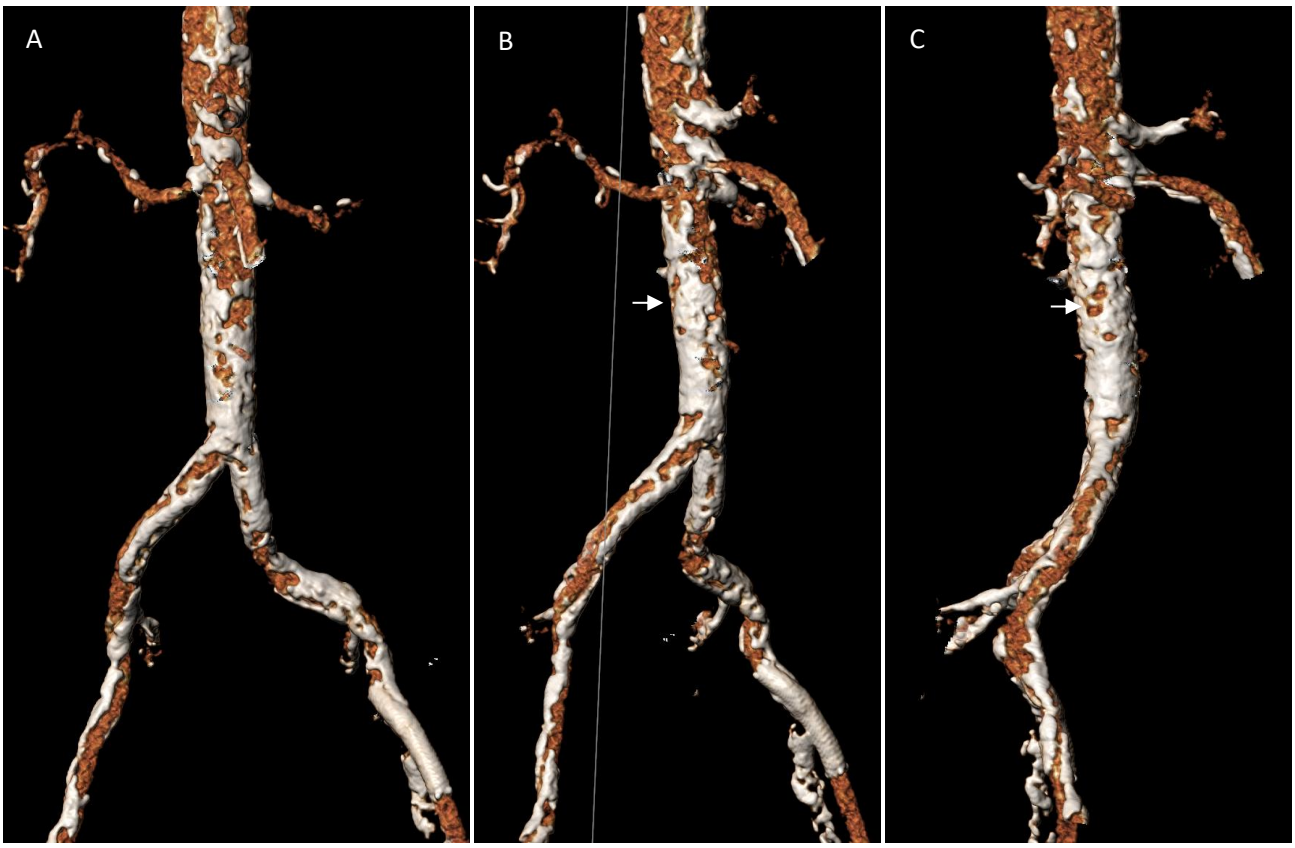
1. Lederman RJ, Greenbaum AB, Khan JM, Bruce CG, Babaliaros VC, Rogers T. Transcaval Access and Closure Best Practices. *JACC Cardiovasc Interv.* 2023;16:371-95.

Supplementary data

Supplementary Figure 1. CT reconstruction.
Supplementary Figure 2. Coronary wire puncture from the descending aorta into the inferior vena cava.
Supplementary Figure 3. Preparation for sheath passage.
Supplementary Figure 4. Large bore introducer sheath into descending aorta.
Supplementary Figure 5. 27 mm Navitor implantation.
Supplementary Figure 6. Aortocaval fistula closure.
Moving image 1. IVUS evaluation of descending aorta calcification: note the narrow, less calcified target for traversal (appearing as a dotted circle).

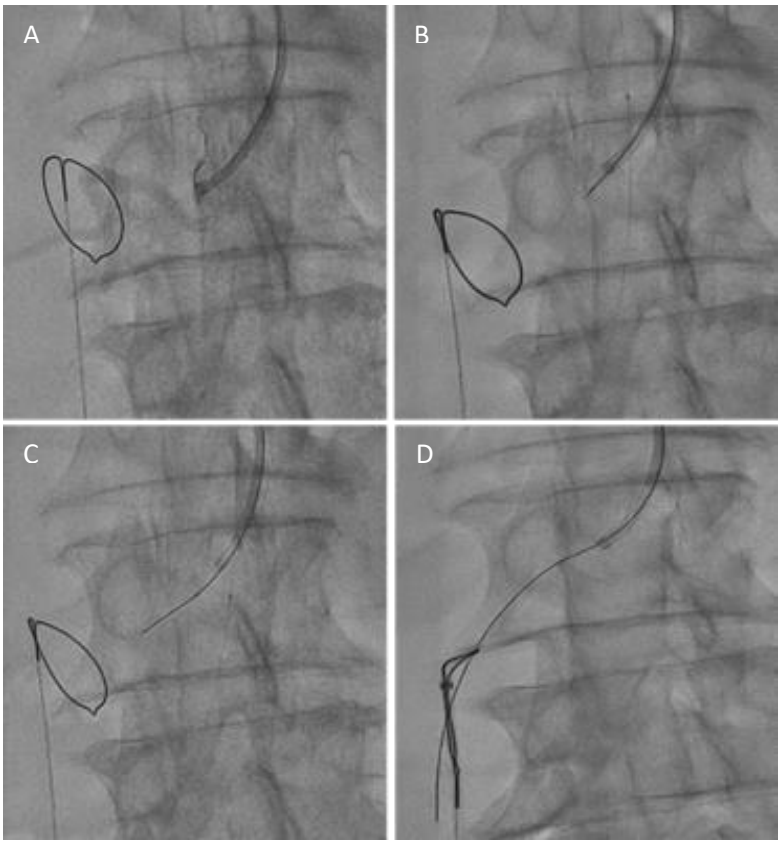
The supplementary data are published online at: https://eurointervention.pcronline.com/doi/10.4244/EIJ-D-24-00429

Supplementary data



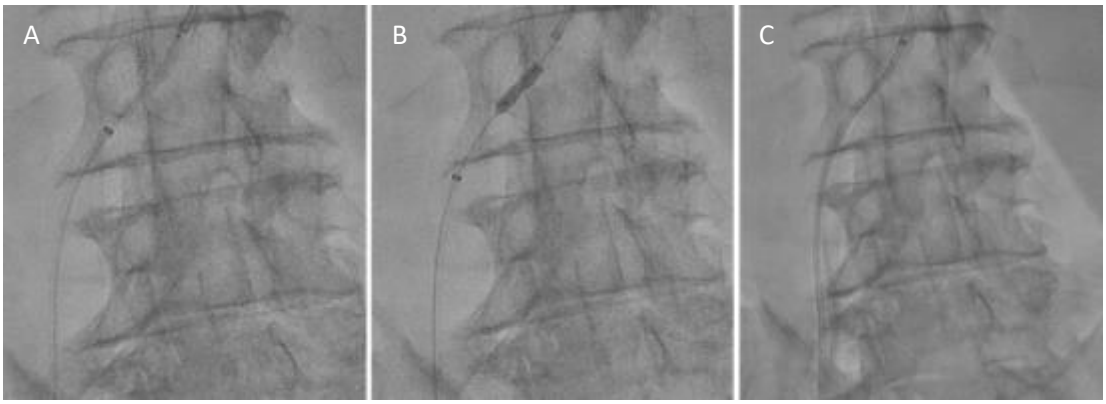
Supplementary Figure 1. CT reconstruction.

Anterior (A), oblique (B) and lateral (C) views showing heavy calcification of descending Aorta. Note the narrow window of calcium free tissue (white arrow) in the oblique and right lateral views of the descending Aorta wall.



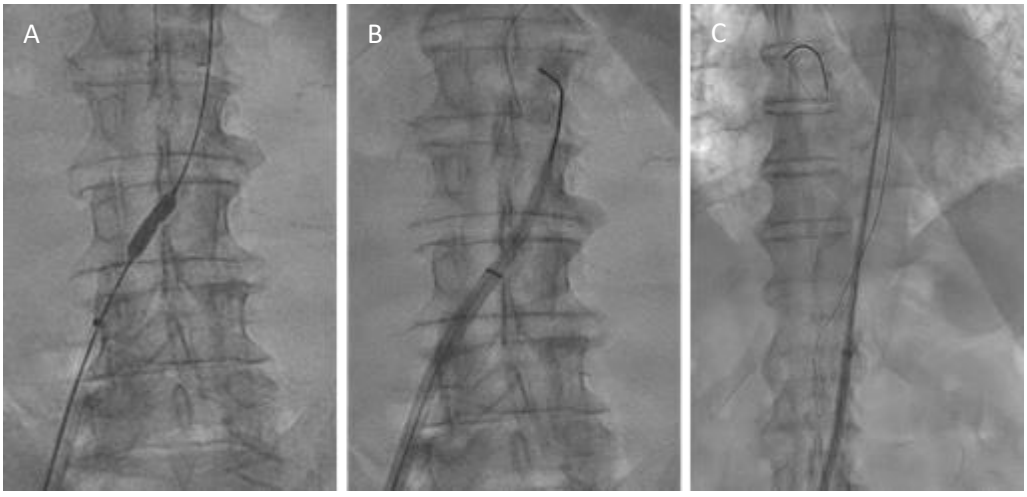
Supplementary Figure 2. Coronary wire puncture from the descending aorta into the inferior *vena cava*.

A 6F-ECR4.0 guide catheter was used for microcatheter assisted electrified guidewire puncture. IVUS and angio positioning (A,B), electrified wire traversal to inferior vena cava (C) and snaring (D).



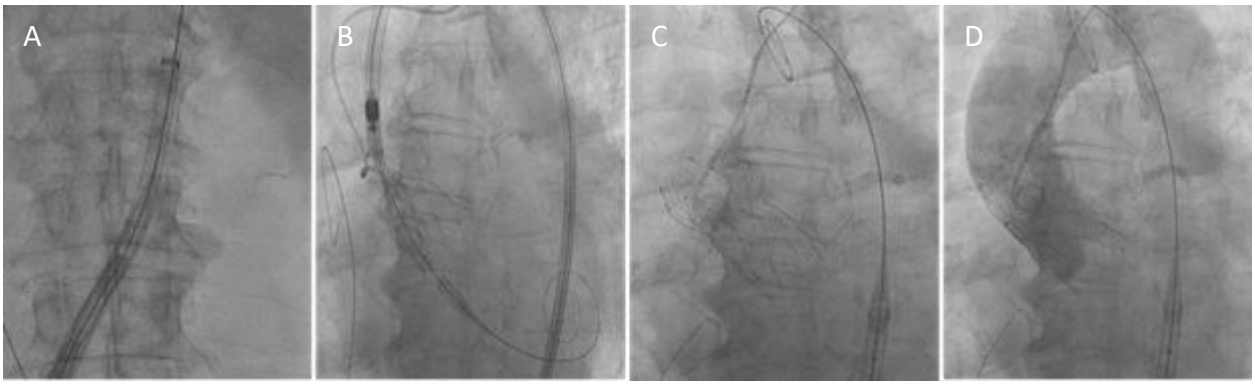
Supplementary Figure 3. Preparation for sheath passage.

Predilation with 3.0mm semicompliant balloon (A) and 3.0mm OPN NC balloon (B). 5F Flexor introducer sheath passage into Aorta (C).



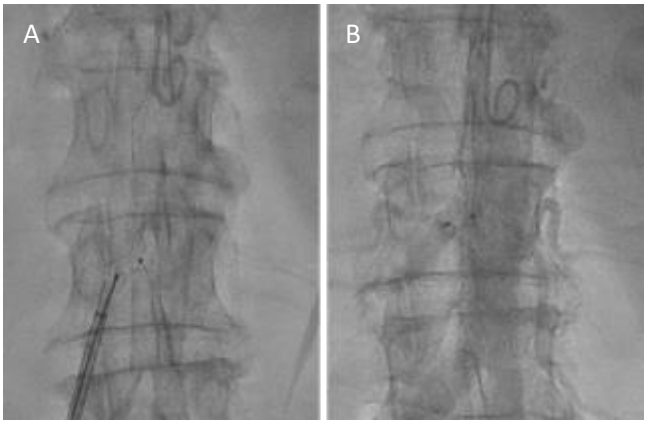
Supplementary Figure 4. Large bore introducer sheath into descending aorta.

Predilation with 5.0mm Advance balloon over extra-stiff wire (A), passage of 14F eSheath into the Aorta (B, C).



Supplementary Figure 5. 27 mm Navitor implantation.

23mm balloon annulus predilation followed by FlexNav delivery system through 14F expandable sheath (A), successful deployment of a 27mm prothesis (area (456mm^2) derived diameter 24.1mm, perimeter 78mm) into valvular plane (B, C) and final result with no leak (D).



Supplementary Figure 6. Aortocaval fistula closure.

Aortic closure with 10/8mm Amplatzer occluder (A). Note the residual leak, common in transcaval approach (B).