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CASE REPORT
Coronary heart disease

Percu-Ax aortic valve implantation with a double arm approach: a case report

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Background Transaxillary route for structural and coronary percutaneous interventions represents a valid alternative access in patients with obstructive peripheral disease. Nevertheless, its widespread use is limited by a less manageable haemostasis procedure.

Case summary In this case, we describe a minimalistic high-risk transcatheter aortic valve implantation (TAVI) procedure (TAVI Score 6.42%) conducted with a double arm approach (radial and axillary accesses) in an 88-year-old patient with severe aortic stenosis and multiple co-morbidities preventing both surgical (Society of Thoracic Surgeons mortality 7.9%) and percutaneous transfemoral approach (extensive peripheral artery disease). We also described the successful management of a complicated transaxillary haemostasis with this technique.

Discussion In our cases, a minimalist double-arm approach was successfully used for TAVI procedure as an alternative to transfemoral approach assuring effective and safe management of vascular access haemostasis.

Keywords Transcatheter aortic valve implantation • Axillary access • Percutaneous minimalistic approach • Personalized medicine • Case report

Learning points

- Transaxillary access represents an alternative to the transfemoral approach for transcatheter aortic valve implantation patients.
- Transaxillary cannulation and haemostasis are less standardized in comparison to transfemoral ones.
- The use of simultaneous radial access guarantees the effective management of both these procedural phases.

Introduction

Transaxillary transcatheter aortic valve implantation (TAVI) is an appealing alternative to the transfemoral route in patients with severe obstructive peripheral disease.[1–5] Indeed, upper extremities arteries are generally less stenotic, tortuous, and calcified even when ilio-femoral arteries are diseased.[6]

Originally, the access was obtained via surgical cutdown under general anaesthesia, but with the progressive miniaturizing of device profiles a true percutaneous access is now feasible. This approach offers the advantage of local anaesthesia, increased patient comfort and improved outcome due to reduced vascular complications.[2,7]

We report a case of minimalized double arm percutaneous access technique for TAVI in a high-risk patient not suitable for the transfemoral approach.

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Timeline

Day 0	Symptomatic severe aortic stenosis diagnosis unresponsive to medical therapy
Day 1	'Heart Team' approach to identify the best treatment strategy [Society of Thoracic Surgeons mortality 7.9%, transcatheter aortic valve implantation (TAVI) Score 6.42%].
Day 2	Cardiac and peripheral computed tomography angiography
Day 3	Successful transaxillary/transradial approach for high-risk TAVI procedure, but significant pinching of axillary lumen artery at the site of vascular sutures treated with transradial angioplasty
Day 4	Early mobilization of the patients
Day 8	Discharge from the hospital

Case presentation

An 88-year-old man with symptomatic severe aortic stenosis, chronic obstructive pulmonary disease, and extensive peripheral artery disease was referred to our cardiovascular department for elective valvular treatment. He reported a progressive worsening of his exercise tolerance (effort dyspnoea) in the last 6 months leading to a significant limitation in daily life activity in the last month (NYHA Class III).

Physical examination at admission revealed mild systolic hypertension (140/85 mmHg), rough systolic murmur radiating to both the carotid arteries, with no signs of peripheral or pulmonary oedema. Electrocardiogram showed sinus rhythm (60 b.p.m.) with left axis deviation and moderate ST-segment depression in lateral leads. Medical therapy at the time of admission included furosemide 50 mg/die, cordarone 200 mg/die, bisoprolol 2.5 mg/die (maximum tolerated dose), ramipril 2.5 mg/die, and apixaban 5 mg/die (paroxysmal atrial fibrillation).

Transthoracic echocardiogram showed left ventricle hypertrophy with normal systolic contractility (EF 60%) but moderate diastolic dysfunction (*E*/*E*′ 28), left atrial enlargement with mild mitral regurgitation, and calcified severe aortic stenosis (valve area of 0.5 cm^2 with mean gradient of 52 mmHg, VTIr 0.16). Coronary angiography excluded the presence of concomitant coronary artery disease.

Due to his advanced age and multiple co-morbidities, the patient was judged not suitable for traditional surgical valve replacement (Society of Thoracic Surgeons mortality 7.9%) and scheduled to TAVI (TAVI Score 6.42%).

Pre-procedural multislice computed tomography confirmed a bilateral calcific disease of both iliac-femoral axes with tortuosity and inadequate lumen diameters (*Figure 1*). Conversely, the subclavian-axillary axes showed adequate dimensions (i.e. diameters 5.1 mm) and an acceptable degree of kinking and calcification (*Figure 2*). Thus, to minimize access-related complications and facilitate peri-procedural management, a completely percutaneous TAVI was planned using an angio-guidewire-ultrasound (AGU) technique by both arms.[8]

Transcatheter aortic valve implantation procedure was performed under conscious sedation, in a hybrid operating suite by a multidisciplinary team including cardiologists, cardiac surgeons, and anaesthesiologists. After local anaesthesia of both wrists, left and right radial arteries were cannulated with 6-Fr glide sheath (Terumo) introducers. By means of a multipurpose 6-Fr diagnostic catheter, a 0.35″ guidewire was retrogradely advanced from the left radial artery into the left axillary artery up to an angiographically ideal point (i.e. adequately large extra-thoracic segment). Ultrasound guidance was then used to scan the vessel wall and exclude the presence of any calcific plaque. Merging data from both imaging techniques, the optimal axillary access point was identified and flagged by the J-tip of the guidewire[1] (*Figures 2* and *3A*).

After local anaesthesia of the left delto-pectoral groove, puncture of the anterior surface of the left axillary artery was assured by AGU technique and a 9-Fr sheath was inserted with a standard Seldinger technique. Two Perclose ProGlide™ (Abbott Vascular Devices) were implanted immediately before sheath introduction according to the pre-close technique.[9]

From the right radial access, a left Judkins 6-Fr diagnostic catheter was used to obtain selective antegrade left subclavian cannulation, and a 0.14″ guidewire 300 cm in length (Choice™ extra-support, Boston Scientific Corp., Natick, MA, USA) was positioned distally in the left forearm to ensure axillary artery access in case of acute vascular complication (i.e. vessel rupture) (*Figure 3B,C*) and to facilitate end-procedural haemostasis.

Using the left radial access, a second 0.14″ guidewire 300 cm in length (Choice™ extra-support, Boston Scientific Corp., Natick, MA, USA) was then positioned distally up to ascending aorta to ensure also homolateral rescue axillary artery access.

At this point, heparin was administered intravenously to achieve an activated clotting time >250 s, a stiff guidewire (Innowi®, Symedrix GmbH, Deisenhofen) was positioned into the left ventricle and used to obtain a rapid pacing during preliminary valvuloplasty with 18 mm balloon diameter (True Balloon BARD peripheral vascular, Inc., Tempe, AZ, USA) (*Figure 3D*).

Finally, a 14-Fr equivalent 29 mm self-expanding Evolut R transcatheter aortic valve (Medtronic, Minneapolis, MN, USA) was successfully implanted with trivial residual para-valvular regurgitation (*Figure 3E*).

During valve introducer pulling out, a percutaneous transluminal angioplasty balloon (6.0 mm × 20 mm) was simultaneously advanced into the subclavian artery via the right radial access. This assured a temporary blood flow blockade during percutaneous vessel closure manoeuvres[10] (*Figure 3F*). Finally, anticoagulation was reversed with protamine infusion, the introducer device was removed, and axillary haemostasis was immediately obtained with the vascular closure systems.

The Choice ES guidewires remained *in situ* to secure access into the vessel at any procedural phase. The final angiography check of the puncture site from the right radial route revealed a complete haemostasis but with a significant pinching of the lumen artery at the site of vascular sutures (*Figure 3G*). After a failed first attempt to cross the

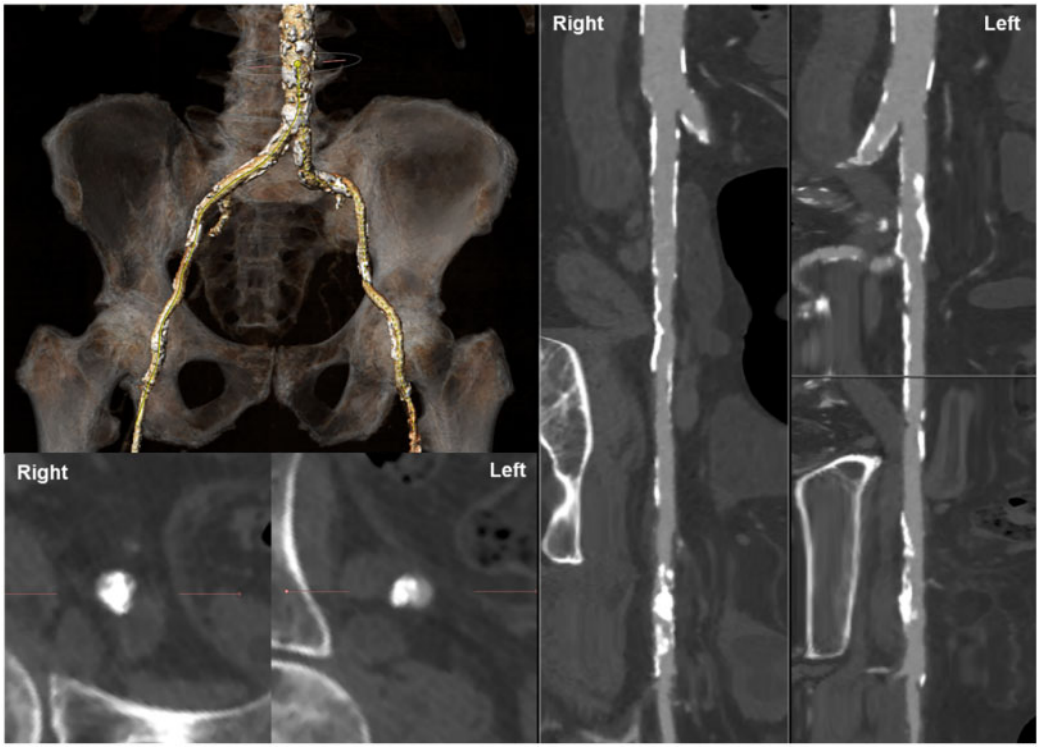

Figure 1 Computed tomography scan of iliac-femoral axes showing tortuosity and bilateral calcified stenosis.

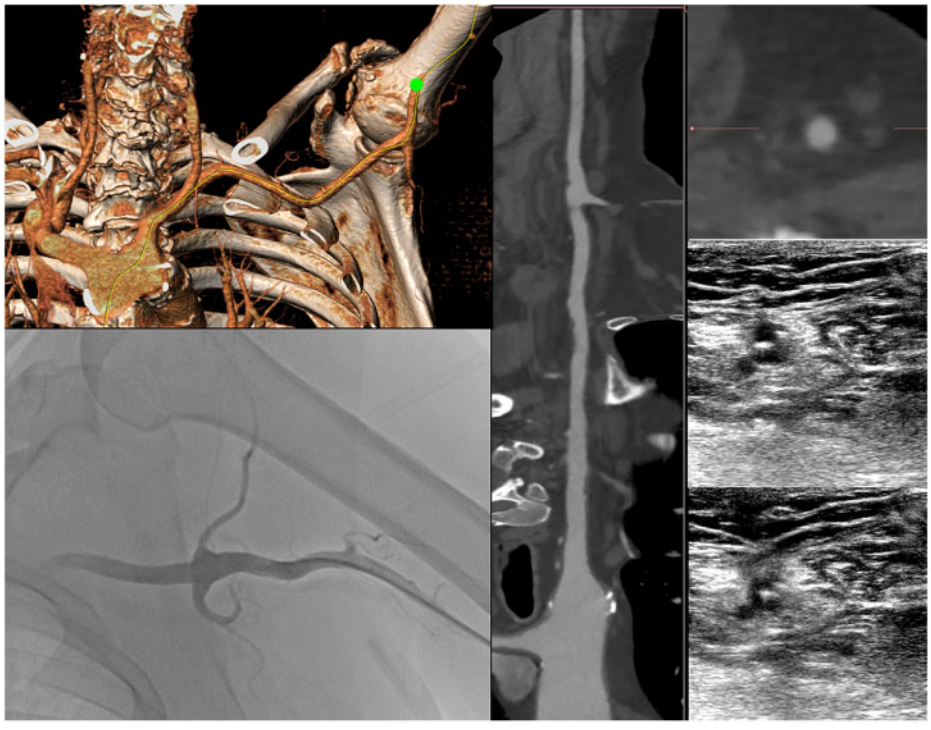

Figure 2 Computed tomography scan, echo, and angiographic images of left axillary artery.

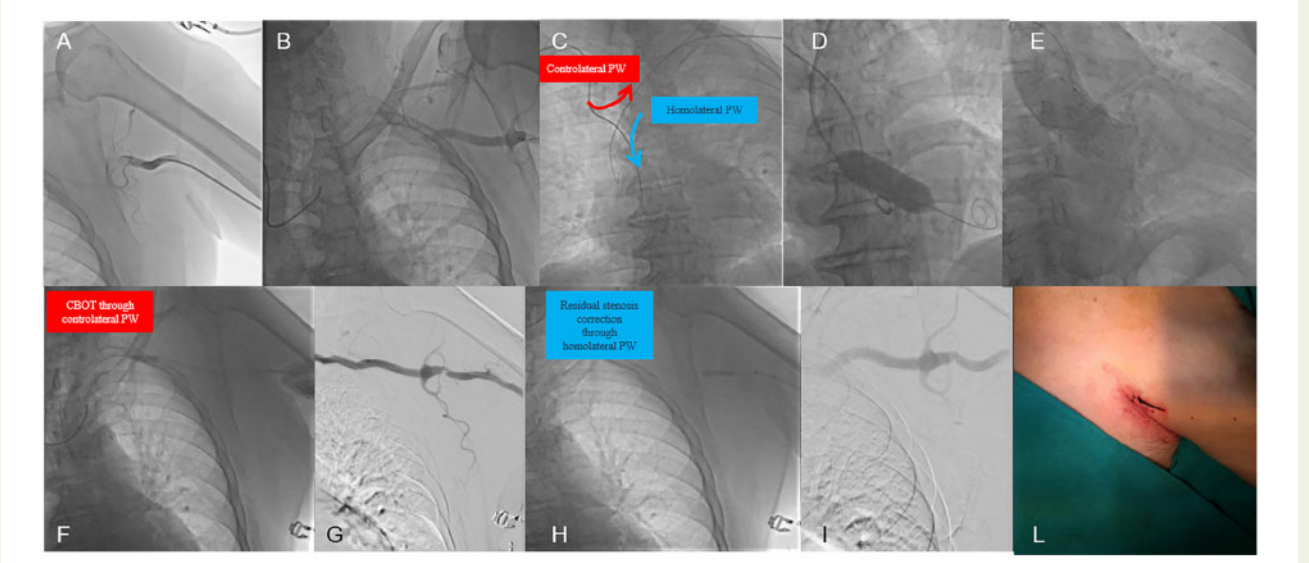

Figure 3 Main procedural phases. CBOT, contralateral balloon occlusion technique; PW, protection wire.

iatrogenic stenosis antegradely due to low support, the suture-caused pinching was successfully crossed retrogradely by left radial access and corrected by a gentle prolonged angioplasty (*Figure 3H*). The final angiographic check excluded residual bleeding or major vessel injury (*Figure 3I*).

Post-procedural course was uneventful (*Figure 3L*); the patient was mobilized after 24 h and transthoracic echocardiography showed a transvalvular gradient of 5 mmHg with trivial para-valvular regurgitation. At 1-month follow-up, the patient described a sensible subjective improvement in activity tolerance and echocardiogram re-evaluation confirmed the pre-discharge findings.

Discussion

This case report is the first reported procedure of percutaneous double-arm approach (radial + axillary access).

The advantages of the proposed approach are the following: (i) local anaesthesia facilitating post-procedural patient recovery; (ii) accurate and safe axillary artery cannulation using the AGU technique[5]; (iii) fully controlled percutaneous closure of vascular access; (iv) multiple solutions for the management of access site vascular complications (antegrade or retrograde balloon haemostasis).

In our experience, the systematic adoption of a standardized technique for selection and management of large arterial vascular access (i.e. combination of AGU and LITE techniques) significantly improves both feasibility and safety of percutaneous TAVI.[9]

In our current practice, the transaxillary approach is the second percutaneous option for patients with no practicable transfemoral route. Indeed, transaxillary access represents a valid alternative in terms of both vascular access-related risk and technical complexity when compared to other hybrid (transcarotid, transapical, or transaortic) approaches.[4]

Also, the management of possible vascular complications results very similar to that adopted with a transfemoral approach, notwithstanding the use of a sensibly smaller ancillary access (i.e. radial artery). Indeed, the progressive miniaturizing of both available radial introducer (e.g. slender introducer sheath) and peripheral angioplasty devices (e.g. 6–7-Fr compatible covered stent) guarantees almost the same technical solutions including covered stent implantation. This case well summarizes this aspect showing the escalation of the different solutions for the treatment of an access site-related complication.

Conclusions

The double-arm minimalistic approach seems to be a promising option to guarantee effective and safe management of transaxillary access for TAVI in patients with obstructive peripheral vascular disease. A larger case series is warranted to confirm this preliminary experience.

Lead author biography

Carlo Trani is an interventional cardiologist expert in cardiac intervention for coronary and structural heart disease including transcatheter aortic valve implantation (TAVI). He is the director of the interventional Cardiology unit at Fondazione Policlinico Universitario A. Gemelli, IRCCS hospital in Rome (Italy).

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidelines.

Conflict of interest: none declared.

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