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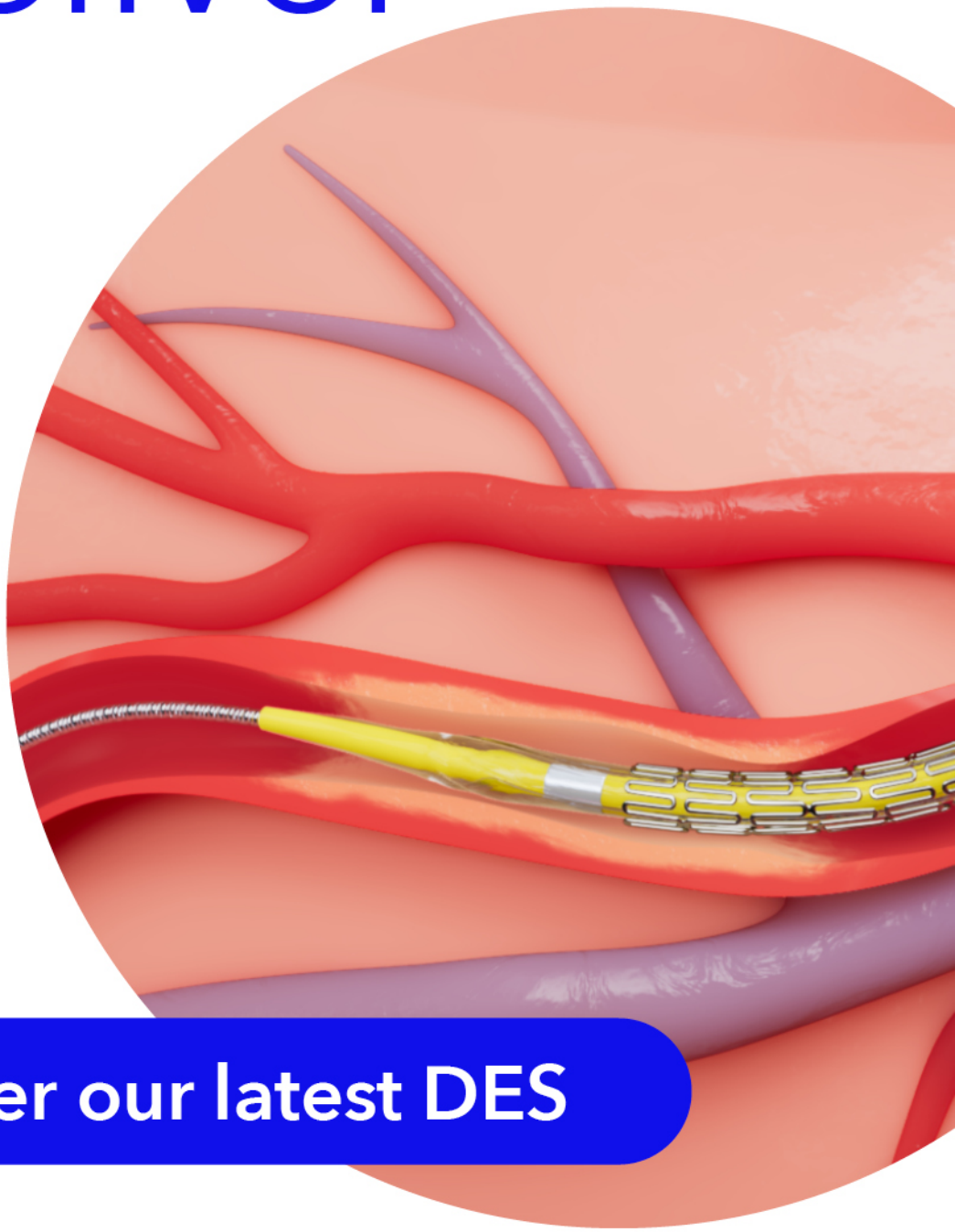

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CASE REPORT

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Not all pseudoaneurysms are femoral—A transcaval transcatheter aortic valve replacement rare complication

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Abstract

We report a case of a 73-year-old male with multiple comorbidities, including postpoliomyelitis severe scoliosis, referred to our tertiary center due to a severe symptomatic aortic stenosis, considered high risk for surgical aortic valve replacement (AVR). Due to unsuitable femoral and subclavian accesses, the patient underwent a transcaval transcatheter AVR (TAVR) procedure, complicated by the development of an iatrogenic infrarenal aortic pseudoaneurysm with aortocaval fistula. Scoliosis can cause varying anatomic relationships between retroperitoneal vessels and intervertebral disk spaces, which increase the difficulty of the procedure and consequently lead to this vascular complication. Although most aortocaval fistulas close spontaneously after 1 year, the risk of pseudoaneurysm rupture in this critical area was crucial in the decision of a new successful percutaneous aortic stent intervention.

KEYWORDS
aortic pseudoaneurysm, aortocaval fistula, transcaval access

1 | INTRODUCTION

Alternative accesses (nontransfemoral) remain necessary in 10%–20% of patients undergoing transcatheter aortic valve replacement (TAVR), due to iliofemoral arterial vessel disease.[1,2] Paradoxically, these patients are generally at higher risk and are thus less favorable candidates for open surgery or traditional transthoracic alternative-access TAVR.[3] However, until today, no randomized trial has compared the different alternative approaches, making the choice based on the characteristics of the patient and center expertise.[2]

Caval-aortic access for TARV was first described by Greenbaum et al.[4] and presupposes the concept that interstitial hydrostatic pressure exceeds venous pressure.[5] Thereby, in retroperitoneal space, the opening created in the vena cava will decompress aortic bleeding into the venous compartment, rather than accumulating as hemorrhage.[5] The highest cohort published until today showed transcaval TARV is a safe and effective option for high-risk patients with limited options, although with a major vascular complication rate of 13%.[6]

The authors describe a patient with severe symptomatic aortic valve stenosis, considered high risk for surgical AVR and with unsuitable femoral, subclavian, and transcarotid accesses, that underwent a transcaval TAVR procedure and showed a rare vascular complication.

2 | CASE REPORT

A 73-year-old man with a previous history of arterial hypertension, dyslipidemia, poliomyelitis causing marked scoliosis and restricted mobility, osteoporosis, pulmonary restrictive disease, and ischemic stroke was referred for TAVR due to symptomatic low-flow low-gradient aortic stenosis. He complained of exertional dyspnea and thoracic pain. Echocardiography showed aortic valve stenosis with a peak gradient of 45 mmHg and mean gradient of 27 mmHg, a valve area of 0.9 cm^2, and a left ventricle ejection fraction of 41%. The preprocedural planning with contrast-enhanced computed

tomography (CT) confirmed a severe functional bicuspid valve calcification (Calcium score of 4317 AU) concomitant with severe femoral, transcarotid, and subclavian calcification (minimal luminal area of <5 mm). In contrast, transcaval suitability was favorable with a target entry site at the third lumbar vertebra, 55 mm below the renal arteries.

During the initial transcaval TAVR procedure, due to marked scoliosis and osteoporosis that led to the anatomical distortion of the relation between inferior vena cava (IVC) and aorta, it was difficult to define the target zone for crossing the IVC electrified guidewire to the aorta (Figure 1A). In a first puncture, it was possible to reach the aorta from the IVC with the guidewire, nevertheless, this site was abandoned because it was not possible to cross the lesion with a microcatheter. After the second attempt of crossing succeeded, a microcatheter was advanced over it and exchanged for a stiff wire, upon which the TAVR delivery system was subsequently advanced. The standard TAVR procedure was performed with a self-expandable valve with no complications and a good final result. For caval-aortic tract closure, the operators used a nitinol occluder device (Amplatzer® Duct Occluder 12/10), after heparin reversal. The device achieved a stable position in the transcaval tract with residual aortocaval flow. The patient was transferred to cardiac unit care for surveillance. In the first 48 h, the patient had a progressive reduction of hemoglobin without transfusion yield (12 g/dl to minimum hemoglobin of 7.1 g/dl), while maintaining an unremarkable physical exam and no macroscopic blood loss. The transthoracic echocardiogram demonstrated normal transcatheter valve function and excluded pericardial effusion. After 48 h, the hemoglobin level stabilized and the patient remained asymptomatic.

At this point, the main differential diagnoses included vascular complications related to access-site as aortocaval fistula, hemolysis, aortic dissection, femoral access-site bleeding, and hematoma. Hemolysis was excluded and a CT scan confirmed a well-positioned occluder device without residual aortocaval flow but showed a right infrarenal pseudoaneurysm measuring 16 x 11 mm (axial) with concomitant aortocaval fistula at that level (Figure 1B-D).

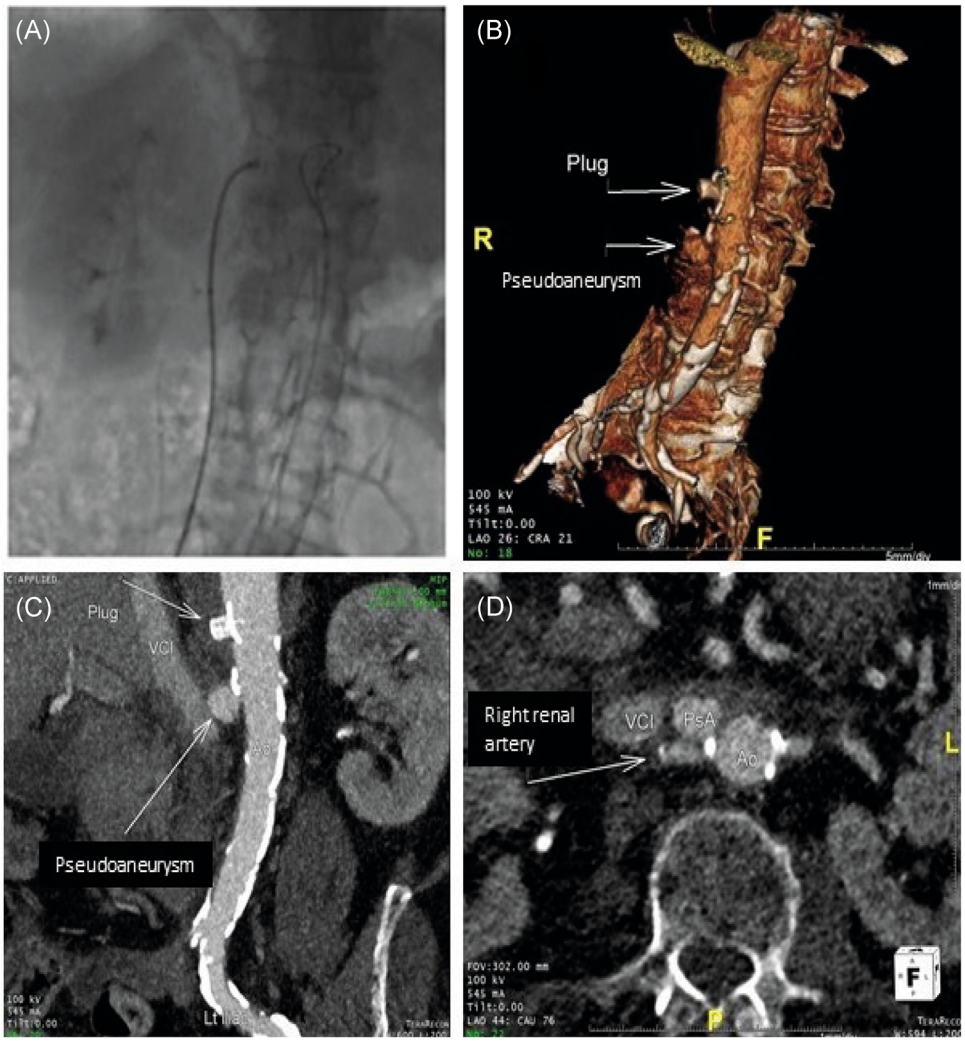

FIGURE 1 (A) Fluoroscopy during transcaval procedure: crossing the electrified guidewire in inferior vena cava to the aorta; (B and C) Computerized tomography (CT) angiography 3D reconstruction (B) and CT coronal plane demonstrating aortic pseudoaneurysm and the occluder device; (D) CT axial plane demonstrating the relation between aortic pseudoaneurysm and right renal artery [Color figure can be viewed at wileyonlinelibrary.com]

In a multidisciplinary team composed of interventional cardiologists and vascular surgeons, the patient underwent percutaneous aortic stent implantation (BeGraft peripheral stent®, 16 x 48 mm) with excellent results, confirmed by angiography and CT (Figure 2). The patient was discharged home with no other complications.

3 | DISCUSSION

We describe a < 75 years-old patient with symptomatic aortic valve stenosis, multiple comorbidities, and restricted mobility that would affect postoperation rehabilitation. Due to increased surgical risk, the Heart Team decided on TAVR. However, preprocedural planning showed unsuitable femoral, subclavian, and transcarotid accesses, and transthoracic approaches were unattractive because of reduced ventricular function and pulmonary disease.

A procedure planning based on CT is fundamental to identify calcium-free crossing targets in the abdominal aorta along with optimal fluoroscopic projection angles and level with respect to lumbar vertebrae, to identify possible obstacles and jeopardized vascular branches such as renal arteries.[7] Although preprocedural CT demonstrated a favorable suitability, the operators had extreme difficulty defining the target zone. It is well recognized that in adults with scoliosis of the thoracolumbar spine, there is varying anatomic relationships between retroperitoneal vessels and intervertebral disk spaces.[8] The authors assume this was the main reason for the first failed attempt of crossing, and consequently, for the creation of the aortic pseudoaneurysm with aortocaval fistula. Coregistration of the CT images with fluoroscopy could have helped to identify the optimal crossing level, which the authors intend to use in the future.

It is acceptable and not unusual to have a persistent aortocaval shunt immediately postprocedure, provided that is not causing significant retroperitoneal bleeding or heart failure.[3,6] In fact, 1-year prospective data showed that even persistent fistulas after discharge did not cause heart failure symptoms nor influence survival, and most transcaval-related aortic abnormalities healed over time

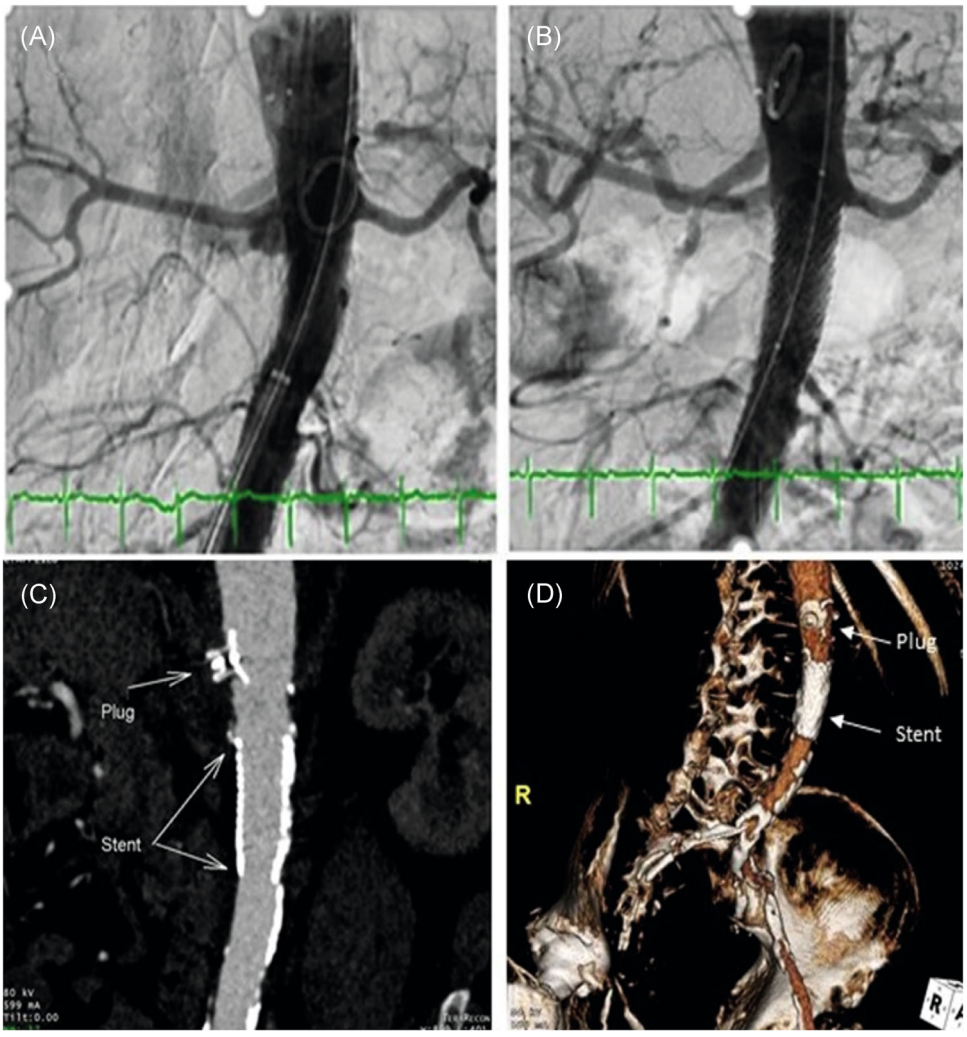

FIGURE 2 (A and B) Aortic angiography before and after percutaneous aortic stent implantation for correction of pseudoaneurysm. (C) Computerized tomography (CT) coronal plane and angiography 3D reconstruction (D) showing correct stent implantation with the exclusion of the pseudoaneurysm [Color figure can be viewed at wileyonlinelibrary.com]

(93% occluded fistulas on follow-up).[5] It is thought that these fistulas behave differently from others (as femoral arteriovenous fistulas after catheterization) probably related to the polyester-seeded nitinol closure devices implanted, which promote thrombosis.[5] For that reason, the operators did not reposition the device after noting a residual aortocaval flow before the procedure ended and the majority of the fistulas close at 1 year. However, and in contrast to true aneurysms, pseudoaneurysms are surrounded by an injured arterial wall or single fibrous tissue, with increased risk of rupture or compression of adjacent structures.[9] Therefore, and although the clinical condition of the patient had stabilized, the multidisciplinary team decided to intervene by endovascular treatment, since he was considered to be a high risk for open surgical repair.

4 | CONCLUSIONS

To our knowledge, this is the first reported infrarenal pseudoaneurysm complication by transcaval TAVR. Although most aortocaval fistulas are closed spontaneously after 1 year and are not linked to survival, in our case the risk of pseudoaneurysm rupture in this critical area was crucial in the decision for intervention.

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CONFLICT OF INTERESTS

The authors declare no conflict of interests.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, upon request.

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