Case Report

Combined Minimally Invasive Transcatheter Approach for Aortic Stenosis and Abdominal Aortic Aneurysm: A Case Report

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Introduction

An aortic aneurysm is defined as a localized arterial dilation exceeding the normal vessel diameter by more than 50% or the expected diameter of the specific aortic segment by more than 2 standard deviations.[1,2] The prevalence of abdominal aortic aneurysm (AAA) among individuals aged > 65 years is significantly higher in men.[3-5] AAA rupture is associated with high mortality, estimated at 80%-90%, particularly when prehospital deaths are taken into account.[6] The management of this condition has advanced substantially, particularly following the development of vascular endografts with improved safety and flexibility profiles.[7,8] These technological advances have expanded therapeutic options for patients considered to be at high surgical risk or with anatomical characteristics unfavorable for open surgical repair.[3-5,7,8]

Severe aortic stenosis (AS) is the leading cause of left ventricular (LV) outflow tract obstruction and most commonly manifests clinically as dyspnea, dizziness or syncope, and angina pectoris.[9,10] Symptomatic severe AS, even when clinical manifestations are mild, requires intervention because, in the absence of valve replacement, it is associated with a poor prognosis, with a mean survival of only 2-3 years and a high risk of sudden cardiac death.[10] In patients with severe calcific AS, surgical aortic valve replacement (SAVR) and transcatheter aortic valve implantation (TAVI) are the mainstays of treatment, providing symptom relief and improved survival.[11] The coexistence of severe AS and AAA has been increasingly observed, a phenomenon attributed in part to population aging.[12]

In patients with multiple comorbidities, including non–dialysis-dependent chronic kidney disease (CKD), who undergo combined percutaneous interventions, exposure to iodinated contrast medium (ICM) may contribute to deterioration of kidney function. In this setting, carbon dioxide digital subtraction angiography (CO_2-DSA) has been used as a strategy to reduce the ICM burden and consequently minimize the risk of postprocedural deterioration of kidney function.[13,14]

We report the case of a 79-year-old man with multiple comorbidities who was diagnosed with symptomatic severe AS and AAA and had a history of SAVR with a bioprosthetic valve. The therapeutic strategy consisted of TAVI followed by endovascular aneurysm repair (EVAR) of the abdominal aorta, both performed during the same procedure.

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Keywords

Abdominal Aortic Aneurysm; Endovascular Aneurysm Repair; Aortic Valve Stenosis; Transcatheter Aortic Valve Replacement; Heart Valve Diseases

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Case report

A 79-year-old man was electively admitted for combined treatment of symptomatic severe AS and an infrarenal AAA. His medical history was complex and included non–dialysis-dependent CKD, chronic obstructive pulmonary disease, and paroxysmal atrial fibrillation. In 2014, he had undergone SAVR with a bioprosthetic valve. During the immediate postoperative period, he experienced two successfully resuscitated cardiac arrests and a stroke of presumed cardioembolic etiology, resulting in permanent right-sided hemiparesis. Regarding lifestyle factors, he was a former smoker and reported occasional alcohol consumption.

Following discussion by the multidisciplinary Heart Team and given the persistence of symptoms despite optimal medical therapy, a sequential percutaneous strategy was selected, with both procedures performed during the same operative session. The procedure was performed under general anesthesia. Vascular access was obtained through the right femoral vein for temporary pacemaker insertion, the left femoral artery for ancillary devices, and the right radial artery for invasive blood pressure monitoring. For the main right femoral arterial access, an 8-F introducer sheath was used, followed by preclosure with two ProGlide® devices (Abbott) according to a standardized ultrasound-guided technique.

A stiff hydrophilic guidewire, supported by a 5-F JR catheter, was then advanced into the thoracic aorta, carefully traversing the infrarenal aneurysm and allowing placement of an 18-F introducer sheath. The dysfunctional aortic bioprosthesis was crossed using a JR catheter and hydrophilic guidewire, which were subsequently exchanged for a pigtail catheter and a 0.035″ × 260-cm Confida® guidewire positioned at the LV apex.

After confirmation of the transvalvular gradient by simultaneous LV and aortic pressure measurements, a 26-mm SAPIEN 3 prosthesis was implanted in a valve-in-valve configuration. Under rapid ventricular pacing at 180 bpm and continuous angiographic and transesophageal echocardiographic monitoring, the prosthesis was successfully deployed and expanded. Postdilation was subsequently performed using a 26-mm balloon (+2 mL), while maintaining the rapid ventricular pacing protocol. Postimplantation assessment showed no paravalvular leak, valvular regurgitation, or pericardial effusion, with appropriate positioning and stability of the prosthesis. Final pressure measurements demonstrated a marked reduction in the mean transvalvular gradient to 4.0 mmHg (Figures 1A, 1B, and 1C).

Endovascular treatment of the infrarenal AAA was then performed. Because of preexisting CKD, a nephroprotective strategy using CO_2 delivered through the Angiodroid® system as the primary contrast agent was adopted. This strategy enabled angiographic mapping and endograft positioning with minimal exposure to ICM, with the aim of reducing the risk of acute kidney injury (Figures 2A and 2B). Over an extra-stiff Lunderquist® guidewire, a 25 × 103-mm Endurant® bifurcated endograft was deployed with preservation of the renal arteries. The reconstruction was extended bilaterally into the common iliac arteries using ETLW® endografts, while preserving the internal iliac arteries. Final angiography demonstrated complete exclusion of the aneurysm sac, no endoleaks, and preserved arterial flow (Figures 3A and 3B). Vascular access sites were closed percutaneously using suture-mediated closure devices, with additional ProGlide® devices required to control bleeding at the access site.

Postoperatively, the patient remained in the intensive care unit and was hemodynamically stable, in sinus rhythm, with improvement in dyspnea. Transient thrombocytopenia was observed, with a nadir platelet count of 85,000/μL and spontaneous recovery. The patient was discharged on postoperative day 2 in good overall condition, with outpatient follow-up scheduled.

Discussion

Degenerative cardiovascular diseases, such as severe AS and AAA, are prevalent among older adults and may coexist in the same patient.[12] The present case falls within this context, as the patient not only had both conditions but also had multiple comorbidities that conferred high cardiovascular risk and increased the complexity of the therapeutic strategy.

Traditionally, TAVI for AS and EVAR of the abdominal aorta are performed as separate procedures. However, sequential performance of both interventions during a single session has emerged as an alternative for selected high-risk patients, with the potential to reduce exposure to multiple procedures and facilitate faster recovery.[12] Severe AS is associated with an increased risk of complications during noncardiac surgery, and its coexistence with AAA adds complexity to hemodynamic management during aneurysm repair, underscoring the importance of an individualized and integrated therapeutic strategy.[12,15,16]

Case reports and small case series have demonstrated the technical feasibility of concomitant TAVI and EVAR during the same session.[17-19] This strategy may be associated with a shorter overall hospital stay and potentially fewer perioperative complications. In a multicenter retrospective study involving 44 patients, 25 of whom underwent concomitant procedures, Gallito et al.[17] observed a shorter hospital stay and fewer pulmonary complications with the simultaneous approach, with no apparent difference in survival during follow-up. Although promising, these findings should be interpreted with caution given the small sample size and observational nature of data.

Alternatively, TAVI and EVAR may be performed as staged procedures, and the sequence of interventions should be

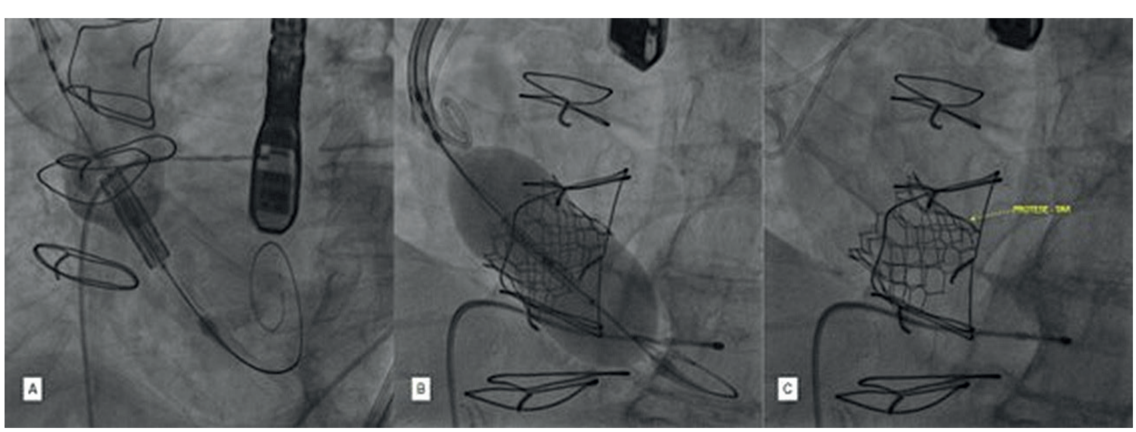

Figure 1 – *Steps of TAVI in a valve-in-valve configuration. A) Positioning of the SAPIEN 3 prosthesis within the dysfunctional aortic bioprosthesis. B) Expansion of the SAPIEN 3 prosthesis by balloon inflation. C) Postimplantation result demonstrating appropriate prosthesis positioning.*

determined by the predominant clinical condition, vascular anatomy, risk of aneurysm rupture, and severity of AS, preferably following multidisciplinary evaluation.[20] In some circumstances, EVAR may be performed first because of the theoretical concern that an increase in systemic blood pressure after correction of AS could increase the risk of aneurysm rupture. Conversely, TAVI may be prioritized when AS is the primary determinant of symptoms or immediate clinical risk.[21] In the present case, sequential TAVI and EVAR were performed during a single operative session, a strategy associated with a favorable clinical course and hospital discharge on postoperative day 2.

Despite its potential advantages, performing TAVI and EVAR during a single session poses technical and logistical challenges and requires careful planning and an experienced multidisciplinary team. The sequence of interventions should be determined by factors including the severity of AS, risk of AAA rupture, and individual

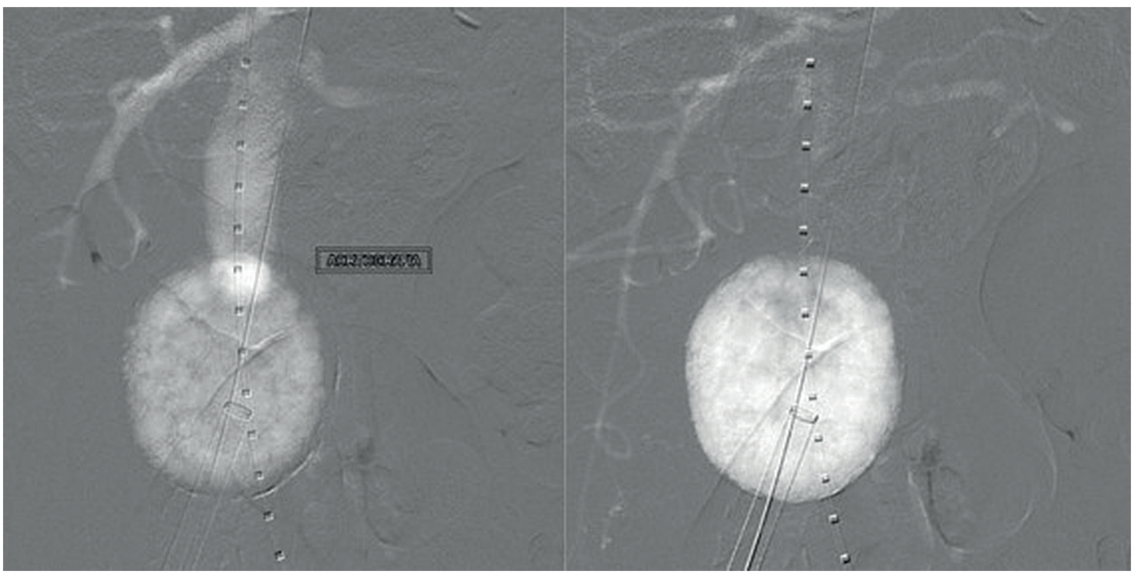

Figure 2 – *CO_2-DSA before the intervention demonstrating a large infrarenal AAA.*

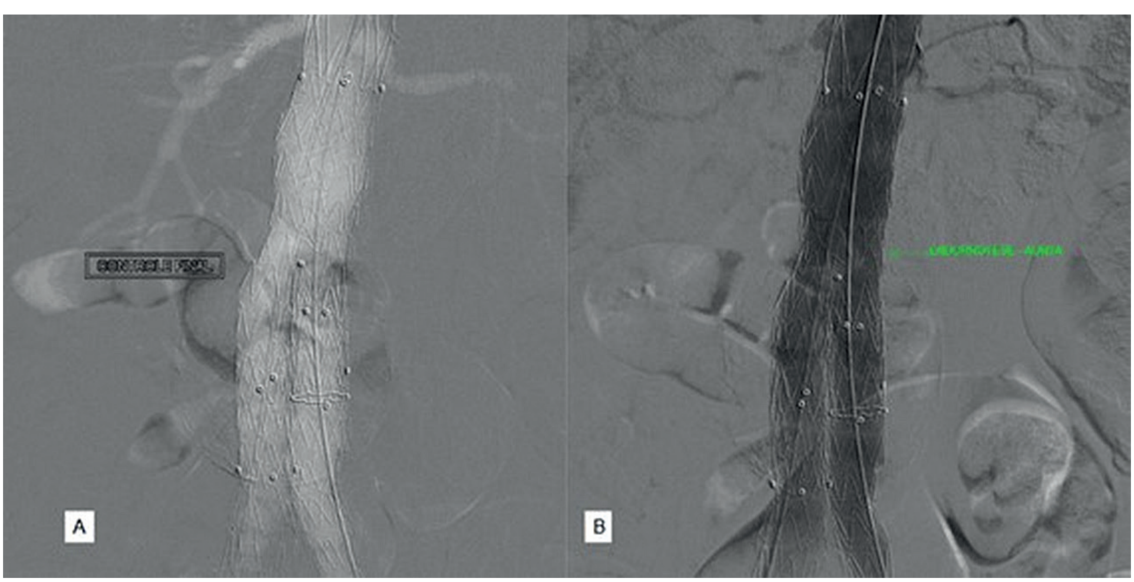

Figure 3 – *EVAR of the AAA. A) Control angiography after endograft deployment, demonstrating appropriate positioning and preserved flow in the renal and iliac arteries. B) Angiography demonstrating the final result.*

anatomical characteristics.[16,21] In addition, appropriate management of antithrombotic therapy is important to balance the risks of thrombotic and bleeding events,[16,22] while advanced imaging modalities contribute to procedural planning and accurate device deployment.[16,21] Heart Team discussion therefore plays a pivotal role in patient selection and in determining the most appropriate therapeutic strategy.

Performing both procedures during a single session offers potential advantages, particularly the possibility of reducing hospital length of stay and accelerating recovery, which are especially relevant for older, frail patients with multiple comorbidities.[12,15] This strategy also avoids repeated exposure to anesthesia and the risks inherent in two separate procedures.[22] In the current case, preservation of kidney function was an additional concern because of non–dialysis-dependent CKD. The use of CO_2-DSA with reduced exposure to ICM represents a useful strategy for minimizing contrast burden in patients with impaired kidney function.[13,14]

Conversely, the single-session approach has inherent limitations related to greater technical complexity and the need for a specialized team, detailed planning, and availability of specific resources.[12,15] The longer procedural duration may increase exposure to anesthesia and radiation,[16,22] while the need for specialized devices, materials, and infrastructure may increase procedure-related costs.[21]

The prognosis after sequential TAVI and EVAR is multifactorial and depends largely on careful patient selection and the experience of the treating team.[16,21] This approach is generally considered for patients at high surgical risk, in whom performing separate procedures may entail greater risk because of the coexistence of both conditions.[12,15] Preliminary evidence suggests favorable periprocedural outcomes in carefully selected patients, with acceptable morbidity and mortality rates.[16,21]

Long-term survival is influenced by procedural success, preexisting comorbidities, and the patient's overall clinical status. Thus, regular postoperative follow-up is essential to assess prosthetic device performance and monitor cardiovascular outcomes.[12,22] Future studies involving larger cohorts and longer follow-up periods are needed to more accurately determine the impact of this strategy on the prognosis of patients with complex clinical conditions.[12,22]

This case report has several limitations that should be considered. No electrocardiogram was obtained before the interventions, which limited characterization of the patient's baseline electrocardiographic findings. In addition, quality of life was not systematically assessed using specific validated instruments before the procedures or during early and late postoperative follow-up.

Conclusion

This case report demonstrates the feasibility and successful combined use of TAVI and EVAR for the concomitant treatment of severe AS and AAA in an older patient with multiple comorbidities and high surgical risk. The single-session minimally invasive approach enabled treatment of both conditions, with a favorable clinical course, short hospital stay, and early recovery. These findings support the potential of this strategy as a therapeutic alternative for carefully selected patients, particularly those in whom conventional surgical procedures are associated with high risk.

Author Contributions

Conception and design of the research: Silva NA; acquisition of data: Silva NA, Trindade VT, Carrijo ENA, Carrijo LBS; analysis and interpretation of the data: Silva NA, Garcia NJM, Trindade VT, Carrijo ENA, Carrijo LBS, Gardenghi G, Prudente ML; writing of the manuscript: Silva NA, Garcia NJM, Gardenghi G; critical revision of the manuscript for intellectual content: Neto JM, Gardenghi G, Prudente ML.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This study is not associated with any thesis or dissertation work.

Ethics Approval and Consent to Participate

This study was approved by the Research Ethics Committee Leide das Neves Ferreira – LNF under protocol number 92462825.6.0000.5082, dated 10/14/2025. All procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

Use of Artificial Intelligence

The authors did not use any artificial intelligence tools in the development of this work.

Availability of Research Data

The data cannot be made publicly available.

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