

HYBRID INTERVENTION

Simultaneous TAVI and EVAR in a High-Risk Patient With Severe Aortic Stenosis and Abdominal Aortic Aneurysm

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Abstract

Background. Severe aortic stenosis (AS) and abdominal aortic aneurysm (AAA) may coexist in elderly patients and pose significant therapeutic challenges, particularly in those with prohibitive surgical risk. Minimally invasive endovascular approaches, including transcatheter aortic valve implantation (TAVI) and endovascular aneurysm repair (EVAR), offer alternative treatment strategies.

Case Presentation. We describe a 78-year-old male with severe symptomatic AS and a 55-mm infrarenal AAA, along with multiple comorbidities including chronic obstructive pulmonary disease, reduced ejection fraction, advanced peripheral artery disease, and chronic kidney disease. Due to extremely high operative risk, the multidisciplinary heart team recommended a fully percutaneous approach. The patient underwent successful circumflex percutaneous coronary intervention, peripheral arterial revascularization, EVAR using an Endurant graft system (Medtronic) with CO₂ angiography, and transfemoral TAVI with a CoreValve Evolut R 29-mm bioprosthesis (Medtronic), performed sequentially in a single session under conscious sedation. The procedure was uneventful, and the patient was discharged on day three with no complications.

Conclusion. Simultaneous TAVI and EVAR represent a viable option for carefully selected high-risk patients with coexisting severe AS and AAA who are unsuitable for open surgery. This hybrid strategy minimizes anesthetic exposure, shortens hospitalization, and may reduce perioperative risk. Larger multicenter studies are needed to further refine patient selection and procedural sequencing.

Introduction

Severe aortic stenosis (AS) is a progressive and life-threatening valvular disease affecting up to 3% of adults over 65 years. In patients deemed unsuitable for open surgery, transcatheter aortic valve implantation (TAVI) has become the preferred therapeutic option.¹



Figure 1. Computed tomography (CT) image demonstrating the infrarenal abdominal aortic aneurysm.

A 78-year-old male with a medical history of atrial fibrillation, hypertension, hyperlipidemia, chronic kidney disease, and severe chronic obstructive pulmonary disease (COPD) presented with progressive lower-extremity claudication. Physical examination revealed stable vital signs and palpable femoral pulses. Electrocardiography showed atrial fibrillation. Transthoracic echocardiography demonstrated left ventricular ejection fraction of 40% with inferior wall hypokinesia and severe AS (mean gradient: 65 mmHg).

Carotid Doppler ultrasonography revealed advanced atherosclerotic disease (right carotid 78%, left carotid 70–80% stenosis). Coronary angiography showed total occlusion of the left anterior descending (LAD) coronary artery, severe circumflex stenosis (82–90%), and moderate right coronary artery (RCA) disease.

Computed tomography angiography revealed an infrarenal AAA measuring 55 mm with adequate proximal neck morphology and minimal mural thrombus.

Heart Team Decision

Given the patient's severe COPD, reduced ejection fraction, extensive vascular disease, and elevated perioperative mortality risk, the heart team recommended a staged-in-one-session fully percutaneous strategy:

1. Percutaneous coronary intervention of the circumflex artery;
2. Peripheral revascularization: right superficial femoral artery (SFA) chronic total occlusion (CTO) recanalization, and left SFA balloon angioplasty;
3. EVAR using an Endurant stent graft system performed with CO₂ angiography to avoid contrast-induced nephropathy;
4. TAVI via transfemoral access with deployment of a CoreValve Evolut R 29 mm prosthesis.

Supplementary Video. CO₂ angiography demonstrating abdominal aortic anatomy prior to endovascular aneurysm repair in a high-risk patient with severe renal dysfunction.

Abdominal aortic aneurysm (AAA), defined as an aortic diameter ≥ 30 mm, also presents commonly with advancing age.² Once the aneurysm exceeds 55 mm, the risk of rupture increases significantly, making endovascular aneurysm repair (EVAR) the preferred modality for patients unfit for open repair (Figure 1).

The coexistence of severe AS and AAA introduces a clinical dilemma: both conditions independently carry high procedural risk, and traditional open surgery is generally contraindicated in frail individuals. Increasing evidence suggests that a combined, single-session TAVI–EVAR approach may be safe and effective in appropriately selected patients. Herein, we present a high-risk case managed successfully with a fully percutaneous hybrid intervention.

Case Presentation

A 78-year-old male with a medical history of atrial fibrillation, hypertension, hyperlipidemia, chronic kidney disease, and severe chronic obstructive



Given the large infrarenal aneurysm and the need to advance large-bore transfemoral devices for TAVI, the heart team decided to perform EVAR first followed by TAVI in the same session, in order to stabilize the aneurysm and reduce the theoretical risk of aneurysm rupture or wall stress during manipulation of the valve delivery system.

Both femoral arteries were accessed with large-bore sheaths, and the entire intervention was performed under conscious sedation. No intra- or postoperative complications occurred. The patient was discharged on postoperative day three with stable renal function and marked symptomatic improvement.³

Discussion

Patients with concurrent severe AS and AAA represent a complex treatment population due to competing hemodynamic and anatomical risks.⁴ Traditional open surgical repair carries substantial morbidity, often rendering patients ineligible for standard procedures. In such cases, combining TAVI and EVAR within a single session provides several theoretical and practical advantages:

- **Avoiding hemodynamic collapse:** Repairing the AAA first may provoke acute afterload shifts in the presence of untreated AS, whereas delaying AAA repair after isolated TAVI may expose the patient to rupture risk.
- **Minimized anesthesia exposure:** Conscious sedation prevents pulmonary complications, particularly in COPD and frail, elderly patients.
- **Single vascular access session:** Reduces bleeding and access-related complications.⁵

• Early recovery and reduced hospital stay.

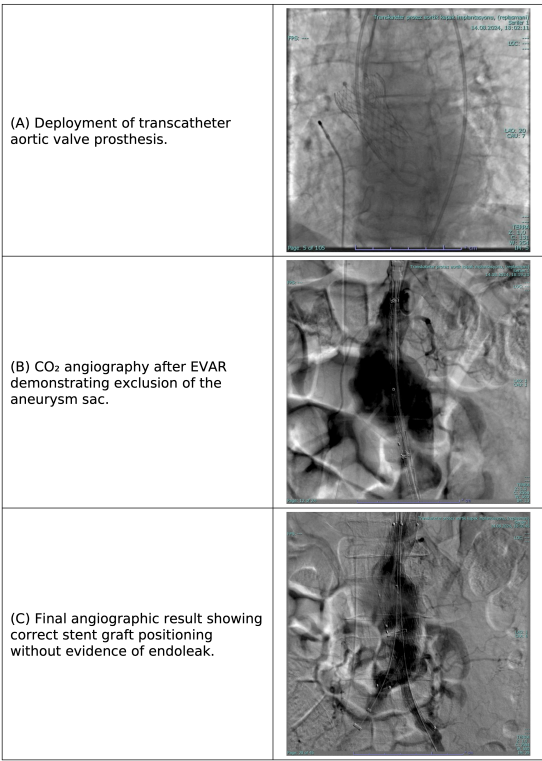


Figure 2. Angiographic images during simultaneous TAVI and EVAR procedure. (A) Deployment of transcatheter aortic valve prosthesis. (B) CO₂ angiography after EVAR demonstrating exclusion of the aneurysm sac. (C) Final angiographic result showing correct stent graft positioning without evidence of endoleak.

Emerging data from multicenter series support the safety of simultaneous TAVI–EVAR, with low perioperative complication rates in experienced centers (Figure 2).⁴

Procedure Sequencing

Some authors recommend performing EVAR before TAVI to avoid potential mechanical displacement of the aortic stent graft by stiff transcatheter valve delivery systems. However, both procedural sequences have been reported in the literature, and the optimal strategy should be individualized based on patient anatomy, vascular access conditions, and operator experience.^{6,7}

Use of CO₂ Angiography

In this patient with chronic kidney disease, CO₂ angiography was beneficial in minimizing contrast-induced nephropathy while maintaining procedural accuracy.⁸

This case contributes to the growing evidence that combined endovascular approaches are feasible in high-risk cohorts and should be considered when open surgery is contraindicated.

Conclusion

Simultaneous TAVI and EVAR can be performed safely in highly selected patients with severe AS and AAA who are unsuitable for open surgery. A multidisciplinary strategy, careful anatomical evaluation, and experienced operators are critical for procedural success. Further multicenter data are needed to strengthen evidence and refine patient selection algorithms.

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