THE ANATOLIAN JOURNAL OF CARDIOLOGY

Official journal of the TURKISH SOCIETY OF CARDIOLOGY

Percutaneous Treatment of Ascending Aortic Pseudoaneurysms: A Case Series

CASE REPORT

INTRODUCTION

Ascending aortic pseudoaneurysm is a rare clinical entity associated with a high mortality potential and most commonly occurs as a late complication of prior cardiac or aortic surgery. These lesions typically originate from areas where aortic wall integrity has been disrupted during surgical manipulation and are most frequently observed along suture lines, cannulation sites, and aortotomy regions. Nevertheless, cases related to traumatic, infectious, or inflammatory etiologies have also been reported, and in a small proportion of patients, no identifiable precipitating factor can be demonstrated.[1,2]

The clinical presentation spans a wide spectrum; depending on the size and anatomical location of the pseudoaneurysm, patients may remain asymptomatic or may present with symptoms such as chest pain, dysphagia, or hoarseness secondary to compression of adjacent mediastinal structures. However, the clinical course of ascending aortic pseudoaneurysms is often unpredictable and may culminate in life-threatening catastrophic complications, including rupture, fistulization to neighboring structures, embolic events, or the development of a chronic infectious focus. This potentially devastating natural history necessitates early diagnosis and an active treatment approach in most cases.[3]

Through this case series, 3 ascending aortic pseudoaneurysm cases with distinct clinical courses and outcomes are presented to contribute to the existing literature.

CASE REPORTS

Clinical, anatomical, and procedural characteristics of the patients are summarized in Tables 1 and 2.

Case 1

A 76-year-old female patient with a history of aortic valve replacement (AVR) 20 years earlier presented to the emergency department with a pulsatile mass on the chest wall (Video 1). Computed tomographic angiography (CTA) revealed a 10 × 7 cm pseudoaneurysm originating from the proximal portion of the aortic arch and extending into the anterior mediastinum, with active contrast enhancement (Figure 1A).

Given the patient's high surgical risk and the anatomical suitability of the lesion, percutaneous closure was planned. The procedure was performed via the right femoral artery. Initial aortography was performed using a pigtail catheter to assess the relationship between the pseudoaneurysm sac and the ascending aorta, as well as the location of the neck. A 7F ASD delivery system was positioned in the ascending aorta. A 6F right Judkins catheter was then advanced through the delivery system to provide telescopic coaxial support, and the pseudoaneurysm sac was selectively cannulated. After a 0.014-inch ChoICE Extra Support Guide Wire was advanced into the pseudoaneurysm sac to provide stable intraluminal support, the delivery system was advanced to the pseudoaneurysm neck (Figure 1B). The position of the delivery system was confirmed by controlled contrast injection.

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Available Online Date: August 11, 2026

Cite this article as: Can F, Melik M, Zeren G, et al. Percutaneous treatment of ascending aortic pseudoaneurysms: a case series. *Anatol J Cardiol.* 2026;XX(X):X-X.

DOI: 10.14744/AnatolJCardiol.2026.6424

Table 1. Clinical and Anatomical Characteristics of the Patients

	Case 1	Case 2	Case 3
Age (years)	76	60	66
Sex	Female	Male	Male
Previous cardiac surgery	AVR + MVR (20 years prior)	CABG ×4 + septal myectomy + AML plication + neochordae (11 months prior)	AVR (2 years prior)
Time from index surgery	20 years	8 months (symptom onset)	2 years
Presentation	Pulsatile chest wall mass	Incidental	Chest pain
Infection present	No	Yes (sternal osteomyelitis)	No
Pseudoaneurysm location	Ascending aorta	Ascending aorta	Ascending aorta
Sac diameter	100 × 70 mm	49 × 41.5 mm	76 × 71 mm
Neck diameter	6 mm	7 mm	Not specified
Associated hematoma	No	Yes (~20 mm)	Rupture present
Hemodynamic instability	No	No	Yes

AVR, aortic valve replacement. MVR, mitral valve replacement. AML, anterior mitral leaflet. CABG, coronary artery bypass grafting

Because the pseudoaneurysm neck measured 6 mm, an 8-mm Amplatzer Septal Occluder device (Abbott) was selected to achieve adequate oversizing and stable anchoring. The device was deployed under fluoroscopic guidance to cover the pseudoaneurysm neck (Figure 1C). Before release, control aortography confirmed stable device positioning and the absence of residual leakage. The device was then released, and final aortography demonstrated complete exclusion of the pseudoaneurysm. Follow-up imaging confirmed sustained complete occlusion throughout the 2-year follow-up period (Figure 1D, 1E).

Case 2

Eight months after the index surgery, the patient developed sternal discharge and was treated with antibiotic therapy. During follow-up, the patient underwent reoperation, and 2 infected sternal wires were removed. While the patient was receiving treatment for sternal osteomyelitis, imaging revealed an ascending aortic pseudoaneurysm measuring 49 × 41.5 mm, with a neck diameter of 7 mm (Figure 1F). Owing to the high surgical risk, the case was evaluated by the Heart Team, and percutaneous closure was planned because the pseudoaneurysm anatomy was considered suitable.

Table 2. Procedural Results and Follow-up

	Case 1	Case 2	Case 3
Device used	8 mm ASD occluder	8 mm ASD occluder	—
Technical success (angiography)	Complete exclusion	Complete exclusion	—
Early CT (≤1 week)	Mild residual leak	No extravasation	—
Mid-term CT	Complete thrombosis (2 years follow-up)	Complete occlusion (3 months)	—
Late recurrence	No	Yes (14 months)	—
Clinical status at last follow-up	Alive	Died following redo surgical repair	Death before intervention

ASD, Atrial septal defect; CT, computed tomography.

Under fluoroscopic and transesophageal echocardiographic (TEE) guidance, vascular access was obtained via the right femoral artery. A 7F ASD delivery system was advanced over Amplatz Super Stiff guidewire into the ascending aorta and positioned close to the pseudoaneurysm neck (Video 2). After removal of the dilator, a 6F right Judkins catheter was advanced through the lumen of the parked delivery system using a telescopic coaxial technique. The pseudoaneurysm sac was selectively cannulated under fluoroscopic guidance, and the position of the catheter tip within the sac was confirmed by controlled contrast injection.

Following successful cannulation, a 0.014-inch ChoICE Extra Support Guide Wire (Boston Scientific) was advanced through the 6F right Judkins catheter into the pseudoaneurysm sac, where a loop was formed to ensure adequate wire stability. After sufficient intraluminal support had been achieved, the 7F ASD delivery system was advanced in a controlled manner over the 6F right Judkins catheter to the level of the pseudoaneurysm neck while maintaining coaxial alignment (Video 3).

Because the pseudoaneurysm neck measured approximately 7 mm on preprocedural imaging, an 8-mm Amplatzer Septal Occluder device (Abbott) was selected to achieve adequate oversizing and secure anchoring. After confirmation of the delivery system position by contrast injection (Video 4), the device was successfully deployed across the pseudoaneurysm neck under combined fluoroscopic and TEE guidance (Video 5). Final angiography and TEE demonstrated complete exclusion of the pseudoaneurysm, with no residual flow or device-related complications (Video 6).

Follow-up computed tomography performed 1 week after the intervention showed no evidence of active contrast extravasation and demonstrated thrombosis of the pseudoaneurysm sac. At the 3-month follow-up, computed tomography confirmed complete closure of the pseudoaneurysm sac, with a reduction in its size (Figure 1G). However,

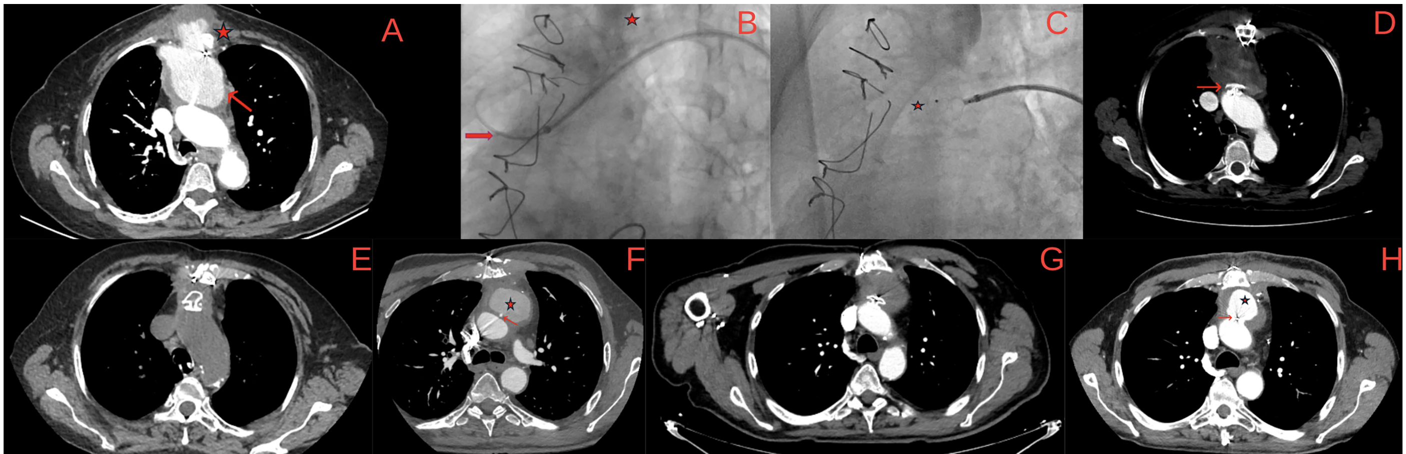

Figure 1. (A) Pre-procedural computed tomography angiography (CTA) demonstrating a 10 × 7 cm pseudoaneurysm arising from the ascending aorta and extending into the anterior mediastinum toward the chest wall with active contrast opacification, with the pseudoaneurysm sac indicated by an arrow and the pulsatile anterior chest wall mass marked with an asterisk. (B) Fluoroscopic image obtained after selective cannulation of the pseudoaneurysm neck with a 6F right Judkins catheter advanced through the 7F ASD delivery system. The 6F right Judkins catheter is indicated by the arrow, and the looped 0.014-inch ChoICE Extra Support guidewire positioned within the pseudoaneurysm sac for stable intraluminal support is indicated by the asterisk. The 7F ASD delivery system was advanced over the wire toward the pseudoaneurysm neck. (C) Fluoroscopic image showing deployment of the 8-mm Amplatzer Septal Occluder device across the pseudoaneurysm neck. The device is indicated by the asterisk. (D) Early post-procedural CTA showing appropriate positioning of the septal occluder device at the pseudoaneurysm neck (arrow) with minimal residual contrast opacification within the sac. (E) Non-contrast CT obtained at 2-year follow-up demonstrating marked reduction in pseudoaneurysm size with complete thrombosis and the occluder device remaining in situ. (F) Pre-procedural CTA demonstrating a 49 × 41.5 mm ascending aortic pseudoaneurysm located at the 2 o'clock position adjacent to the ascending aorta, with the pseudoaneurysm neck indicated by an arrow and the pseudoaneurysm sac marked with an asterisk. An associated hematoma measuring approximately 20 mm is also observed. (G) Early post-procedural CTA demonstrating appropriate device positioning with complete thrombosis of the pseudoaneurysm sac. (H) Fourteen-month follow-up CTA demonstrating recurrent contrast opacification of the pseudoaneurysm sac, with the septal occluder device indicated by an arrow and the recurrent pseudoaneurysm sac marked with an asterisk.

14 months later, the patient re-presented with recurrent discharge from the sternal incision site. Although computed tomography showed that the device remained in a stable position, a recurrent pseudoaneurysm with a maximum diameter of 37 mm, associated with an aortocutaneous fistula, was detected adjacent to the device (Figure 1H). After re-evaluation by the Heart Team, redo surgery was performed; however, the patient died in the early postoperative period.

Case 3

A ruptured ascending aortic pseudoaneurysm followed a catastrophic clinical course. Rapid hemodynamic deterioration occurred shortly after diagnostic imaging, precluding definitive intervention and resulting in cardiovascular collapse.

DISCUSSION

The management of postoperative ascending aortic pseudoaneurysm remains clinically challenging due to its unpredictable course and the absence of a standardized treatment algorithm. In clinical practice, most cases require an invasive approach, and the treatment strategy is primarily determined by surgical risk, the anatomical characteristics of the pseudoaneurysm, and the patient's overall clinical condition. Although surgical repair has long been established as an effective and definitive treatment modality, the need for redo sternotomy and cardiopulmonary bypass significantly complicates decision-making, particularly in high-risk patients.

The case series illustrates the heterogeneous clinical spectrum of postoperative ascending aortic pseudoaneurysms and the variability in treatment response. In the first case, percutaneous closure was both technically and clinically successful, and the patient remained stable during follow-up with a marked reduction in pseudoaneurysm size on serial imaging. In the second case, despite initial technical success and early radiological improvement, recurrence was observed at 14-month follow-up. In the third case, although intervention was planned, the patient experienced rapid hemodynamic deterioration and died, underscoring the potentially fulminant nature of this condition.

Percutaneous closure of ascending aortic pseudoaneurysms has emerged as an important alternative therapeutic option in carefully selected patients with suitable anatomical characteristics and prohibitively high surgical risk. The success of this approach depends on meticulous pre-procedural imaging, appropriate device sizing according to pseudoaneurysm neck diameter, and careful assessment of device stability during the procedure.

In these cases, procedural planning was primarily guided by CTA. Computed tomographic angiography enabled comprehensive evaluation of critical anatomical details, including pseudoaneurysm neck diameter, neck length, sac morphology, and the relationship of the orifice to the surrounding aortic tissue and adjacent vital structures. During the procedure, fluoroscopy and TEE played complementary roles in real-time device guidance and procedural assessment. The contribution of TEE was multifaceted, allowing confirmation of entry into the pseudoaneurysm sac, assessment of device position and stability, detection of residual flow, and evaluation of the relationship between the device, the aortic wall, and adjacent cardiac structures. In particular, TEE served a complementary and critical role in confirming CTA-based neck measurements and assessing residual shunting after device deployment. This multimodal imaging approach facilitated accurate decision-making regarding device selection and sizing.[4]

During the device sizing process, a mildly oversized occluder device was selected relative to the measured neck diameter in order to ensure stable anchoring and minimize residual flow. Avoiding excessive protrusion of the device into the aortic lumen was considered a fundamental principle during device selection.[5]

Optimal device selection in ascending aortic pseudoaneurysms is not standardized; therefore, the decision-making process should be individualized according to pseudoaneurysm neck diameter, morphology, sac configuration, localization, relationship with adjacent anatomical structures, landing zone suitability, and the ability to safely advance and stabilize the selected device and its delivery system within the ascending aorta.[6] Various endovascular treatment modalities, including septal occluders, vascular plugs, coil embolization, and covered stent-grafts, have been described in the literature. Previous systematic data have demonstrated that Amplatzer septal occluder devices were the most frequently used devices in endovascularly treated cases, followed by vascular plugs and muscular ventricular septal defect (VSD) occluders.[1]

In the treated cases, the presence of a discrete pseudoaneurysm neck with a relatively large sac favored the use of a double-disc occluder system. Atrial septal defect (ASD) occluders were preferred because their broad and symmetric discs allow stable apposition on both sides of the neck, thereby enabling effective sac exclusion while minimizing the risk of device migration in the high-flow, pulsatile environment of the ascending aorta.[6] In contrast, vascular plugs rely primarily on cylindrical intraluminal apposition, which may represent a theoretical disadvantage in short-necked, high-flow pseudoaneurysms because of the potential risk of incomplete sealing, device migration, or late recanalization. Similarly, the bulkier waist configuration of muscular VSD occluders and the asymmetric/tubular design of patent ductus arteriosus (PDA) occluders were considered less suitable for fragile postoperative ascending aortic tissue and wide-sac, short-neck anatomy.

Although covered stent-graft implantation may represent another potential treatment option, it was not preferred in the patients because of ascending aortic localization, inadequate proximal and distal landing zones, aortic curvature, and proximity to the coronary ostia and/or graft anastomoses. These anatomical limitations may complicate safe stent-graft deployment and preservation of adjacent structures; therefore, in patients with favorable neck morphology, an off-label occluder-based closure strategy was considered more appropriate.[6,7]

In this context, procedural technique and system stability represent critical determinants of procedural safety. In the cases, aggressive manipulation within the pseudoaneurysm sac was avoided; stiff guidewires were not used within the sac, and soft-tipped extra-support guidewires were preferred to provide controlled support. This strategy was adopted to minimize the risk of perforation, dissection, or sac rupture in the high-flow and structurally fragile environment of the ascending aorta. In cases of inadequate support, microcatheter use may provide additional coaxial stability and facilitate more controlled and safer advancement, particularly during selective cannulation of the pseudoaneurysm neck.

Nevertheless, despite initially successful closure in the second patient, recurrence developed during 1-year follow-up. Similarly, the recurrence experience reported by Tang et al[4] in a postoperative ascending aortic pseudoaneurysm case and the clinical course described by Gormley et al[8] in a patient with ascending aortic pseudoaneurysm secondary to sternal osteomyelitis suggest that, in pseudoaneurysms with an infectious etiology, a percutaneous approach should often be considered a bridge to surgery rather than definitive therapy. Therefore, dynamic reassessment of treatment strategies remains essential in this subgroup of patients.

CONCLUSION

The management of postoperative ascending aortic pseudoaneurysms requires comprehensive evaluation of etiology, anatomical morphology, and clinical stability. Within a Heart Team–based, individualized treatment framework, percutaneous therapy may offer a safe and feasible alternative in patients with favorable anatomy and high surgical risk when performed with careful technical execution.

Artificial Intelligence Usage Statement: The authors declare that no artificial intelligence (AI)–assisted technologies were used in the preparation of this manuscript.

Informed Consent: Written informed consent was obtained from the patients.

Declaration of Interests: Can Yücel Karabay is an Associate Editor of The Anatolian Journal of Cardiology. The other authors have no conflicts of interest to declare.

Funding: The authors declare that this study received no financial support.

Video 1: Pulsatile anterior chest wall mass in Case 1 due to ascending aortic pseudoaneurysm.

Video 2: Advancement of the 7F ASD delivery system with dilator from the right femoral artery.

Video 3: Advancement of the 7F delivery system over a coaxially stabilized guidewire—catheter rail to the pseudoaneurysm neck.

Video 4: Contrast injection through the delivery system confirming intrapseudoaneurysmal position.

Video 5: Unsheathing and deployment of the septal occluder device through the delivery system.

Video 6: Contrast injection demonstrating final device position and assessment for residual leak.

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