Endovascular repair of a ruptured ascending aortic pseudoaneurysm with concomitant pericardiocentesis

Daniel Oar, BS,[a] Ryan P. Lydon, MD,[b] Patrick Riggs, MD,[b] Cameron Hall, MD,[c] *and* Tania Flink, PhD,[a] *Bradenton, FL and Rochester, NY*

ABSTRACT

Aneurysms and pseudoaneurysms of the ascending thoracic aorta are serious vascular conditions. Open surgical repair is the treatment of choice; however, some patients are deemed unfit for such invasive procedures. Endovascular repair can offer an invaluable and lifesaving treatment option, especially in emergent situations. We describe a case of a successful endovascular repair of a ruptured ascending aortic pseudoaneurysm in an 85-year-old man with cardiac tamponade who was not a candidate for traditional open surgery. Future innovations and applications of endovascular ascending aortic repair could lead to more favorable prognoses in patients with urgent surgical indications. (J Vasc Surg Cases Innov Tech 2025;11:101775.)

Keywords: Ascending aorta; Ascending TEVAR; Pseudoaneurysm; Endovascular techniques; Pericardiocentesis

True ascending aortic aneurysms are life threatening, with mortality rates of 97% to 100% when ruptured and not treated immediately.[1] The use of thoracic endovascular aortic repair (TEVAR) to treat pathologies in the descending thoracic aorta (DTA) is established widely and has overtaken traditional open repair as the gold standard of treatment.[2,3] However, in the ascending aorta (AA), open surgical repair remains the gold standard of treatment for pathologies such as type A aortic dissections, intramural hematomas, aneurysms, and pseudoaneurysms owing to the anatomical and physiological difficulties of the region, as well as the lack of approved endovascular devices.[4-8] Ascending TEVAR poses significant operative challenges owing to the curvature of the aortic arch, powerful hemodynamic forces, and proximity of the aortic valve, coronary ostia, and arch vessels.[4-8] Although open repair of the AA has proved to be highly effective, up to 28% of patients presenting for surgical repair are deemed unfit for open surgery.[5] In these patients, TEVAR can be considered as an alternative, less invasive approach, providing an invaluable treatment option. The development of new technologies in this region is desperately needed to provide the optimal benefits of TEVAR to the AA, especially for patients not candidates for open repair with emergent surgical indications.

This case study presents an emergent TEVAR of a ruptured ascending aortic pseudoaneurysm (AAP) with simultaneous pericardiocentesis in an 85-year-old man, deemed unfit for open repair. Informed consent was received from the patient to publish his case and imaging studies.

CASE REPORT

An 85-year-old man with a history of hyperlipidemia, type 2 diabetes mellitus, Parkinson's disease, stroke, new-onset atrial fibrillation treated with apixaban (Eliquis), EVAR, and percutaneous coronary intervention and stenting presented to the emergency department with complaints of bilateral shoulder pain radiating to the chest and abdomen along with generalized weakness. A computed tomography angiogram revealed a ruptured AAP with a large pericardial effusion (Fig 1, *A* and *B*). Traditionally, AAPs are usually due to previous anastomotic breakdown or are of an infectious etiology. However, this was not the case in this presentation, and the etiology remains unclear. With worsening hemodynamic instability, a bedside echocardiogram was performed demonstrating tamponade physiology secondary to this large effusion. Cardiac surgery was consulted for immediate surgical repair. However, the patient was deemed not a candidate for open repair given his comorbidities and overall frailty. Therefore, vascular surgery was consulted and an endovascular repair with simultaneous pericardiocentesis was proposed. After discussion with all of the involved teams, the patient, and his family, it was decided that this approach gave the patient his only chance of survival.

The patient's neck, chest, and bilateral groins were prepped and draped in the event that open arch debranching was required. Standard percutaneous femoral access was achieved. An exchange length Lunderquist wire (Cook Medical, Bloomington, IN) was advanced into the thoracic aorta and a 24F DrySeal sheath (W. L. Gore & Associates, Newark, DE) was placed. The

From the Department of Vascular Surgery, Lake Erie College of Osteopathic Medicine, Bradenton[a]; the Department of Vascular Surgery[b] and Department of Interventional Cardiology[c] Rochester Regional Health, Rochester.

Correspondence: Daniel Oar, BS, Lake Erie College of Osteopathic Medicine, Bradenton, 11645 Monument Dr, Bradenton, FL 34211 (e-mail: doar91157@med.lecom.edu).

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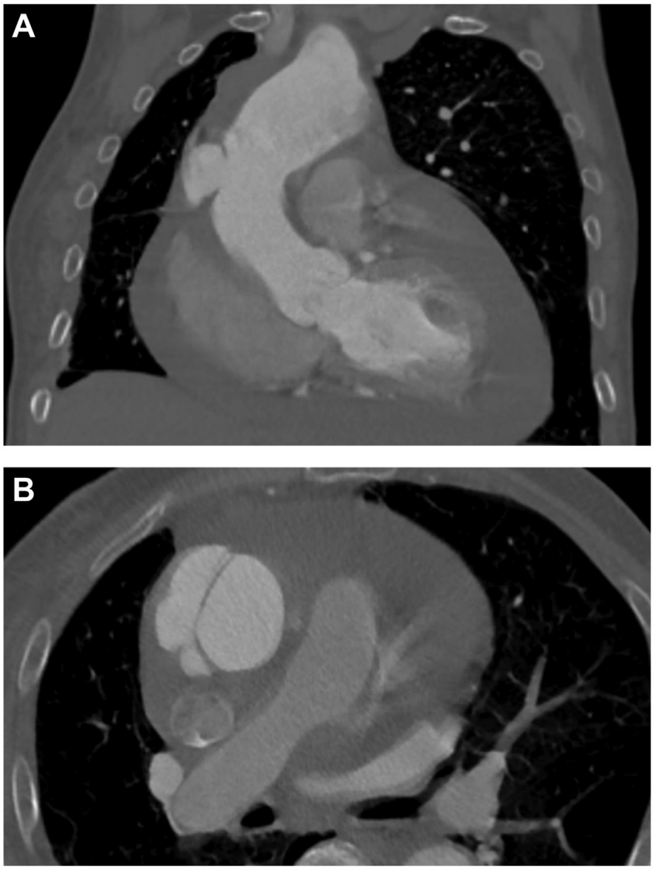

Fig 1. (A) Coronal and **(B)** axial preoperative computed tomography angiogram (CTA) displaying a ruptured pseudoaneurysm in the proximal ascending aorta (AA).

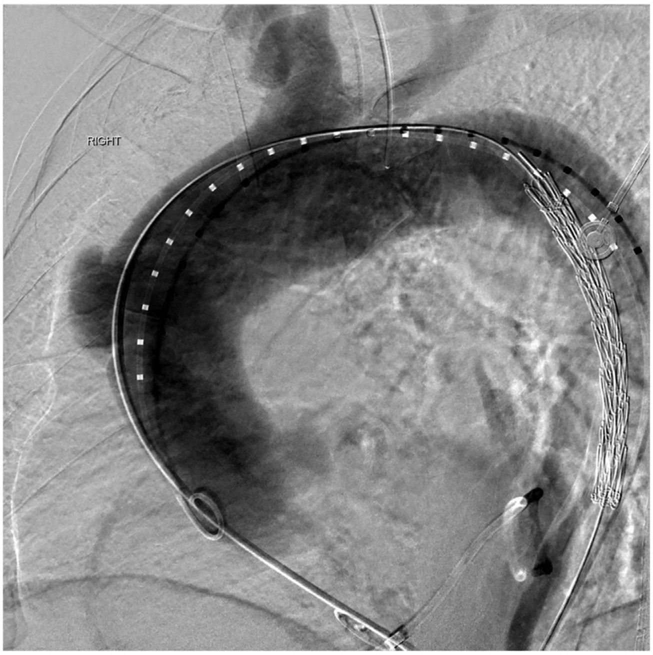

Fig 2. Intraoperative angiography displaying the ruptured pseudoaneurysm.

decision was made to perform the procedure without heparinization. The aortic valve was traversed and access to the left ventricle was gained (Fig 2). Our wire was then exchanged for an exchange length Safari2 wire (Boston Scientific, Marlborough, MA). A 45 mm × 45 mm × 100 mm conformable TAG endograft (W. L. Gore & Associates) was advanced into the AA. Aortography in the correct projection was performed and the coronary arteries, as well as the innominate artery, were marked. To maximize coverage and seal and to help ensure the precise deployment of the proximal piece, the decision was made to place two endografts in a distal-to-proximal fashion. In our experience, landing devices into prosthetic grafts are much more stable and predictable than landing into the native aorta. The first endograft was deployed in the distal AA encroaching on the innominate artery. However, upon removal of the delivery device, the graft was pulled back, thus covering approximately 50% of the innominate. Cerebral and upper extremity perfusion remained adequate on completion imaging and the patient had maintained a palpable right carotid pulse. Therefore, no additional interventions were performed (Fig 3). A second 45 mm × 45 mm × 100 mm conformable TAG endograft (W. L. Gore & Associates) was then deployed more proximally extending the repair to the level of the coronary arteries (Fig 4). Device sizing was based off of preoperative CTA with three-dimensional remodeling. Aggressive oversizing was used to mitigate migration risk.

After endovascular seal of the rupture, ultrasound-guided percutaneous pericardiocentesis with continued autotransfusion of bloody pericardial fluid into the right internal jugular vein was performed; hemodynamics immediately improved and ultimately normalized. Follow-up echocardiogram demonstrated near complete resolution of the pericardial effusion. By postoperative day 3, the drain was removed and the patient was ultimately discharged on postoperative day 5. At 6 months after the procedure he is alive and well (Fig 5).

DISCUSSION

To date, TEVAR has proved to be a feasible albeit limited option for repairs in the AA with relatively favorable outcomes.[5,7,9,10] However, data concerning the use of TEVAR in ruptured AA aneurysms remains scarce.[11] Muetterties et al[7] performed a systematic review of ascending TEVAR and found an all-cause mortality rate of 15.2%, along with 3.4% conversion to open surgery and 3.4% occurrence of cerebrovascular complications. The most common complication in this study was type I endoleak, occurring in 18.6% of patients. Despite these encouraging outcomes, open repair continues to be the gold standard for treatment in the AA.[4-8]

A major limiting factor is that, currently, there are no US Food and Drug Administration-approved devices for use specifically in the AA, resulting in most cases being performed using standard thoracic endografts or abdominal aortic devices.[7] The unique anatomical challenges of the

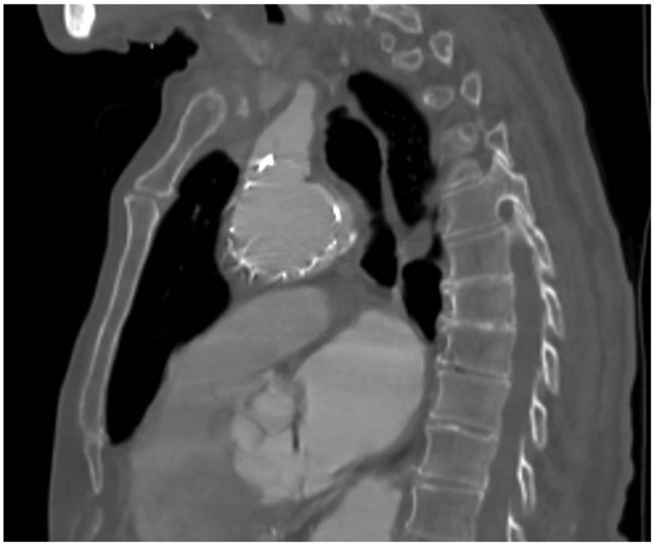

Fig 3. Two-week follow-up computed tomography angiogram (CTA) demonstrating adequate patency of the innominate artery.

Fig 4. Intraoperative angiography displaying endograft deployment to the level of the coronary arteries.

region make using thoracic and abdominal devices technically challenging and exclude many patients as candidates for endovascular repair. The distance of the pathology from the coronary arteries proximally and innominate artery distally are crucial factors to consider.[4-8] The shortest commercially available endograft for use in the DTA is 100 mm long while the average length of the AA is between 50 and 80 mm, making these off-label grafts too long and unsuitable for many

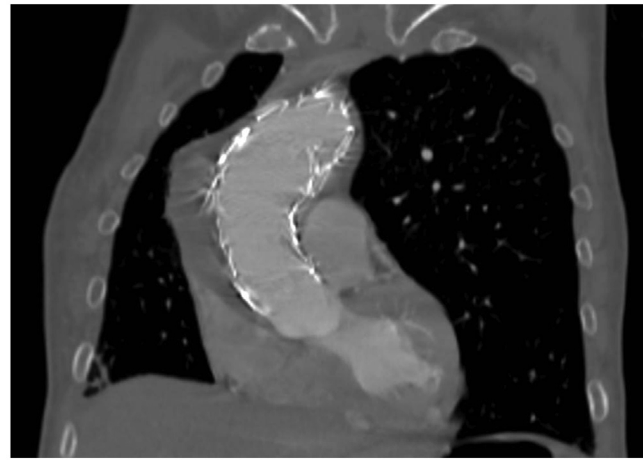

Fig 5. Six month follow-up computed tomography angiogram (CTA).

patients.[4,6-8] It has been reported that more than 10% of endovascular cases in the AA are being performed using custom made endografts for specific patient dimensions.[7,12] However, in emergent cases such as ours, this solution is not feasible.

In this case, our patient presented with favorable anatomy that allowed two DTA off-the-shelf endografts to be deployed without sacrificing significant perfusion to the coronary or arch vessels. Once rupture seal was obtained, decompressing the pericardium became possible, which reversed the hemodynamic instability from tamponade.

CONCLUSIONS

We report a rare case of an emergent endovascular repair of a ruptured AAP with concomitant pericardiocentesis in a hemodynamically unstable patient with cardiac tamponade. This case highlights the use of ascending TEVAR as an alternative treatment option for patients deemed unfit for open repair, even in emergent situations when prognosis seems poor. The decision to use ascending TEVAR must be discussed and made by an advanced aortic team with specific patient anatomical and physiological considerations in mind. With the future development of devices designed for use in the AA, a standardized endovascular treatment approach can be established to ensure optimal clinical outcomes.

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DISCLOSURES

None.

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