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INTERMEDIATE

CASE REPORT: CLINICAL CASE

Acute Aortic Syndrome of Ascending Thoracic Aorta

Transcarotid Percutaneous Exclusion of a Ruptured Pseudoaneurysm

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ABSTRACT

Treatment of ascending aorta disease is surgical; however, some series have evaluated the effectiveness of endovascular treatment. We report the case of a patient with a ruptured pseudoaneurysm who underwent endovascular repair via the left common carotid artery. The clinical and neurological evolution was satisfactory during the in-hospital follow-up. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2020;2:2414–8) © 2020 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

A 56-year-old woman was referred to our hospital for sudden chest pain radiating to the back associated with massive hemoptysis. At arrival to the emergency room, the patient was having chest pain, hypotensive with severe anemia (hemoglobin of 6.8 g/dl).

LEARNING OBJECTIVES

- To understand that acute aortic syndromes at the ascending aorta, like a pseudoaneurysm rupture, can be safely and successfully treated with an endovascular approach even using a transcarotid approach in properly selected patients.
- To understand the clinical and tomographic evolution of a pseudoaneurysm in the ascending aorta, its rupture, and its percutaneous treatment results.

PAST MEDICAL HISTORY

A history of breast adenocarcinoma with several prior surgical procedures (radical mastectomy, sternotomy, and partial rib resection with mesh placement in the anterior chest wall) followed by radiotherapy.

DIFFERENTIAL DIAGNOSIS

Due to the sudden onset of pain and massive hemoptysis, the main differential diagnoses were massive pulmonary thromboembolism or thoracic aorta rupture. Secondary differential diagnoses were lung metastases or vasculitis.

INVESTIGATIONS

A thoracic aorta computed tomography angiography (CTA) documented displacement of the rib mesh and

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a pseudoaneurysm of 78 mm of maximum diameter at the ascending aorta (AA) with impending rupture criteria. The size of the pseudoaneurysm neck was 22 mm, with a distance from the neck to right coronary artery of 49 mm, and from the neck to innominate artery of 26 mm. The AA diameter was 31 mm, left subclavian artery of 6 mm, and left common carotid artery of 7 mm (**Figures 1A and 1B**). During the first hours in the intensive care unit, she presented a new episode of hemoptysis, respiratory failure, and hemodynamic instability. A new CTA confirmed the pseudoaneurysm rupture with right hemothorax (**Figures 2A to 2C**).

MANAGEMENT

Emergency endovascular treatment was chosen due to favorable patient anatomy for achieving optimal exclusion. The procedure was performed in the catheterization laboratory under general anesthesia with full heparinization. The vascular access was surgically open and controlled (but without clamping) through the left common carotid artery because it was free of artery disease and the delivery system of the stent-graft was too short to use the femoral artery for vascular access (57 cm). A 0.035-inch, 260-cm-long Amplatz extra-stiff wire guide (Cook Medical, Bloomington, Indiana) at the level of the left ventricle was placed and an aortic extension Endurant II stent-graft (Medtronic, Santa Rosa, California) of 36 mm proximal diameter, 36 mm distal diameter, and 49 mm of total covered length was implanted covering the neck of the pseudoaneurysm (**Figures 3A and 3B**). We chose the mid-point between the coronary artery ostia and the proximal border of the ruptured pseudoaneurysm as the landing zone of the proximal edge of the graft. Once the post-deployment aortography demonstrated an optimal exclusion of pseudoaneurysm (Video 1), the carotid access was surgically closed. Post-procedural CTA showed complete exclusion of the pseudoaneurysm with no evidence of complications (**Figures 4A to 4C**).

ABBREVIATIONS AND ACRONYMS

AA = ascending aorta

CTA = computed tomography angiography

TEVAR = thoracic endovascular aortic repair

DISCUSSION

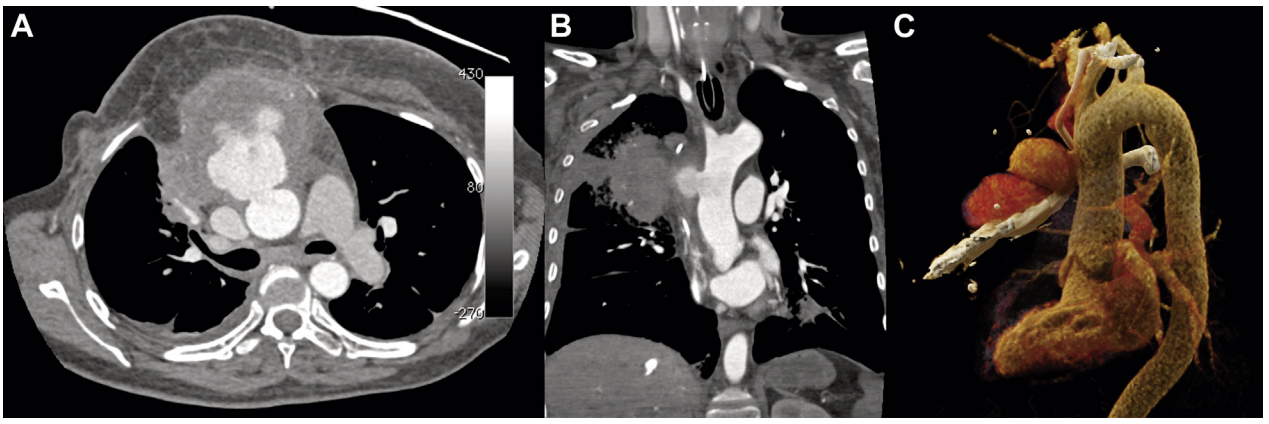
Conventional treatment of ascending aortic pathology is open repair; however, patients with prohibitive or very high risk for surgery, such as patients with previous surgeries, radiotherapy, or multiple comorbidities, are associated with high mortality rates. Open surgery in emergencies reaches 21.5% of mortality (5.9-fold higher compared with elective cases) (1).

Currently, thoracic endovascular aortic repair (TEVAR) is a class IC indication in patients with complicated type B acute aortic dissection (2). However, at the AA, its role has not been well defined, although small series have demonstrated that

FIGURE 1 Initial Computed Tomography Angiography

(A, B) Baseline angiotomography showing a pseudoaneurysm localized at the ascending thoracic aorta.

FIGURE 2 Ruptured Pseudoaneurysm With Cinematic Rendering Reconstruction

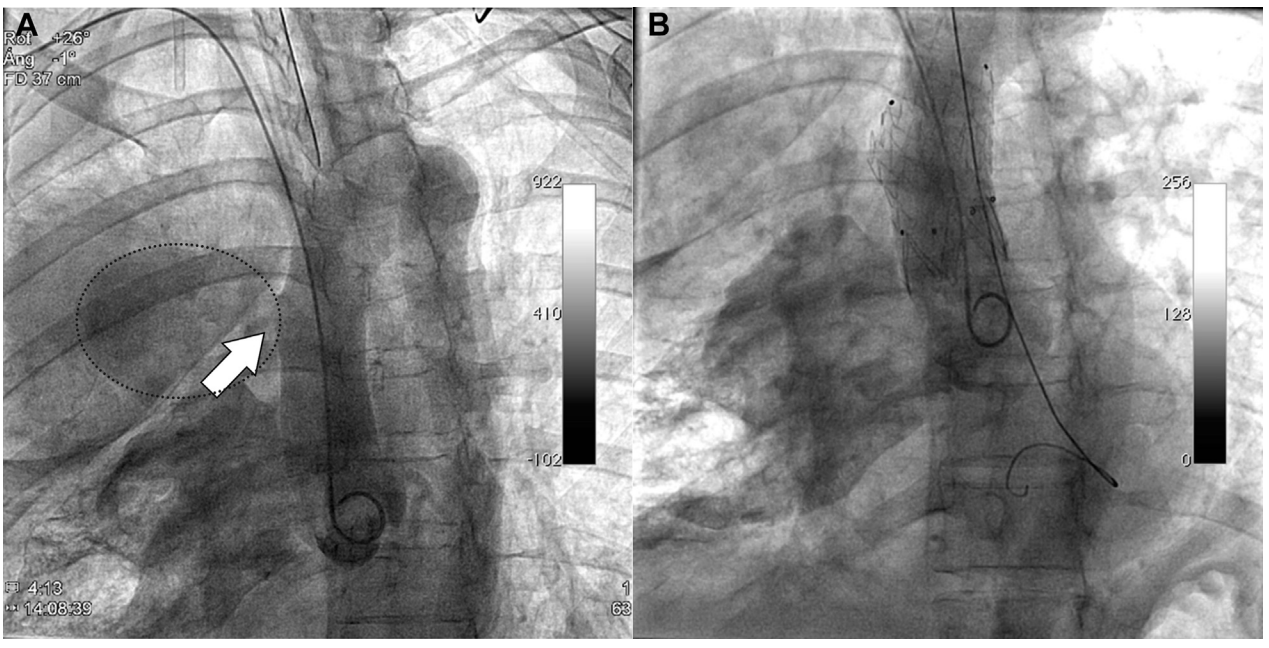


(A, B) Computed tomography showing the ruptured pseudoaneurysm. **(C)** Cinematic rendering of the ruptured pseudoaneurysm.

ascending TEVAR is feasible in patients at high risk for open repair and suitable anatomy (3-6).

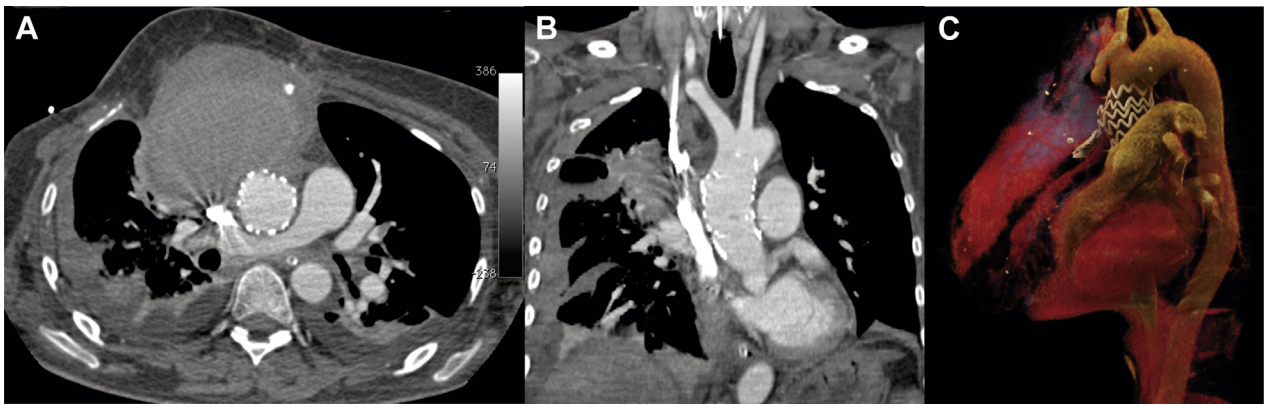
Ascending TEVAR had been most frequently performed to treat type A dissection and pseudoaneurysms with a 30-day mortality of 6.5%, early reintervention of 7.2%, and type I endoleak rate of 10.9% (7). A recently published case series (n = 13) including 3 patients with unruptured pseudoaneurysms reported 15% of operative mortality and 8% stroke rate (8). The long-term survival rates of high-risk patients undergoing ascending TEVAR at 1 and 5 years had been described up to 77% and 73%,

FIGURE 3 Stent Graft Implantation Procedure



(A) Angiography showing the ruptured site **(white arrow)** of the ruptured pseudoaneurysm **(dotted circle)**. **(B)** Stent-graft implantation through the left common carotid artery.

FIGURE 4 Computed Tomography Angiography of the Successfully Excluded Ruptured Pseudoaneurysm



(A, B) Thoracic aorta tomography demonstrating optimal exclusion of ruptured pseudoaneurysm. **(C)** Cinematic rendering of the stent-graft.

respectively, with a late reintervention rate of 32% (4). The feasibility of TEVAR in patients with AA pseudoaneurysm was evaluated by Piffaretti et al. (3). Eight patients underwent TEVAR, 5 had a diagnosis of unruptured pseudoaneurysm of AA. Clinical success was 87.5%. No deaths, myocardial infarction, impaired aortic valve function or neurological events were reported in-hospital phase. At 1 year of follow-up, reduction of the sack diameter was documented in 87.5% of patients (3).

The first report of TEVAR at the AA was through the transseptal route (9). In an ascending TEVAR review by 2016, the transcarotid access was used in 12.7%. The stroke rate was 3.4% and was more frequent in patients with underlying pathology of type A dissection, factors that were assessed and discarded before the procedure. The selection of the transcarotid access must be based on several very important considerations, all of them properly assessed before the procedure in this case, like the absence of obstructive disease in the left common carotid artery and the integrity of the ipsilateral vetebrobasilar system. Another important factor is the length of the stent-graft delivery system (being better to use short distances between the access site and the landing zone with the device used in this case). Finally, the left carotid access allows the best coaxial alignment for a proper stent-graft delivery.

The feasibility of ascending TEVAR is determined by anatomic and technical aspects and device design (5,6). There are a couple of dedicated stent-grafts, the Zenith Ascend TAA Endovascular Graft (Cook Medical) and the Ascending Stent-Graft (ASG) (GORE, Newark, Delaware), that are not yet available in our country. The use of other nondedicated stent-grafts (such as in this case), although perfectly suitable, is considered "off label" in the AA. The desired characteristics for a "perfect" device would have a proximal close-web system with a distal bare spring system, a diameter from 20 mm to 40 mm, with a short proximal tip. From the technicality standpoint, ideally there would be a distal and proximal landing zone of 1 cm and the use of cardiac pacing due to the proximity to the aortic valve apparatus and the aortic pulse that significantly increases the mobility of the AA (5,6,10).

Our case has particular characteristics. It was performed via the left common carotid artery in a patient with ruptured pseudoaneurysm and hemodynamic instability. The severity of the case required a prompt resolution and stabilization of the aorta. The potential advantage of the carotid access is that the procedure time is reduced with a better coaxiality and stability of the device at the sinotubular junction. The carotid access could be considered in patients with great hemodynamic compromise, and very high risk of death.

FOLLOW-UP

Three days later, she underwent surgery to drain the right hemothorax by thoracoscopy. The subsequent evolution was favorable, with neurological integrity and hemodynamic stability. She was discharged from the hospital 6 days later.

CONCLUSIONS

Ascending TEVAR is considered the final frontier in the endovascular treatment of the aorta. The proximity of vital and mobile structures makes this procedure a challenge. We believe that in the subset of patients with pseudoaneurysm it is more feasible to achieve an adequate exclusion mainly in the absence of dissection. The use of the left common carotid artery as vascular access may facilitate the stent-graft implantation and reduce the procedural time in patients with major complications and prohibitive risk for open repair.

AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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KEY WORDS aortic disease, endovascular procedure, ruptured aortic aneurysm

APPENDIX For a supplemental video, please see the online version of this paper.