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A case report of successful endovascular repair of a giant 15 cm diameter asymptomatic thoracic aortic aneurysm

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ABSTRACT

INTRODUCTION: Giant thoracic aortic aneurysms (TAA) are extremely uncommon, and there are only a few cases reported in the literature. Most patients presented with symptoms before the size of the aneurysm reached a magnitude >10 cm, and most of the reported cases were treated with open repair.
PRESENTATION OF CASE: Here we report a 15 cm asymptomatic thoracic aortic aneurysm of a 72-year-old male patient, treated successfully with thoracic endovascular aortic repair (TEVAR). The patient was discharged asymptomatic on postoperative day 2.
DISCUSSION: Only 20 case reports of giant TAAs were found in the literature, and this is the biggest TAA reported treated with TEVAR. This procedure is a promising treatment as morbidity and mortality is lower when compared with open aortic repair (OAR).
CONCLUSION: Even though there is limited documented experience, use of TEVAR seems a safe and promising option in the treatment of giant thoracic aneurysms as presented in this case.

1. Introduction

Thoracic aortic aneurysm (TAA) is defined as a loss of parallelism of the aortic walls, resulting in saccular, fusiform, or diffuse dilation, 1.5 times greater than the superjacent aorta [1]. Giant TAA is considered when widening exceeds 10 cm in diameter [2]. Thoracic aneurysms affect 10 of every 100,000 elderly adults, and are less common than their abdominal counterparts [3,4].

We present a case of a 72-year-old male presenting a 15 cm asymptomatic TAA, successfully treated by TEVAR. A review of the literature is also presented.

The work has been reported in line with the SCARE criteria [5].

2. Presentation of case

A 72-year-old male with no past history of smoking, and with medical history of hypertension, dyslipidemia and benign prostate hyperplasia treated with angiotensin-converting-enzyme inhibitor, atorvastatin, tamsulosin, and finasteride respectively, presented with a giant descending thoracic aortic aneurysm. Diagnosis was incidentally found after a CT-scan was performed for polycystic kidney disease. Tomography revealed an unruptured aortic aneurysm, affecting the distal part of the aortic arch and the descending aorta, with a maximum diameter of 15.6 cm (Fig. 1A, B). The patient didn't have any mass effect manifestation such as dyspnea, cough, chest pain, or any other symptom. At that time, the patient underwent a laparoscopic left nephrectomy, which went unremarkable, at a small town 1000 miles away from our teaching hospital.

The patient arrived to our hospital two months after the kidney surgery. He had a complete cardiac assessment with no abnormalities in cardiac function, and serum creatinine of 0.9 mg/dl. No contraindications for surgery were presented, and TEVAR was performed. An open approach to the right common femoral artery was done under general anesthesia. A Medtronic-Valiant 34-30-200 thoracic endograft (Santa Rosa, CA Medtronic) was placed distally to the left subclavian artery and a Medtronic-Valiant 30-30-200 thoracic endograft (Santa Rosa, CA Medtronic) was positioned proximally to the origin of the celiac trunk, with 5 cm overlapping. No blood pressure reduction during deployment was needed, nor CSF drainage. An angiogram showed complete exclusion of the aneurysm without endoleaks (Fig. 2).

Patient recovered satisfactorily and was discharged on postoperative day two. No complications were seen in the CT angiography at four-month follow-up (Fig. 3). At 24-month follow up the patient is doing well without complications.

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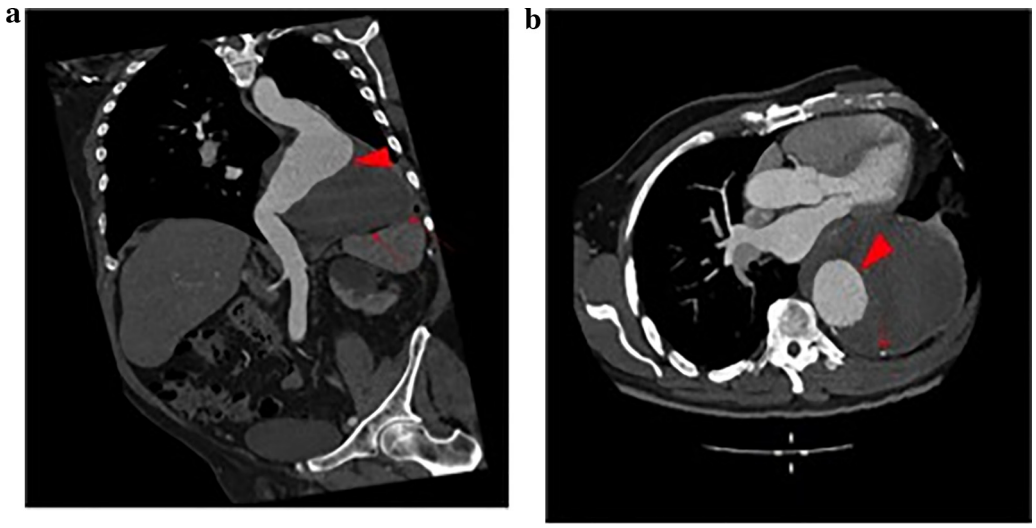

Fig. 1. a) Coronal MPR CT image obtained with intravenous contrast in arterial phase shows a sacular aneurism of the descending aorta, with the presence of an intramural thrombus (arrows). There is no extravasation of the contrast media from the true lumen (arrowhead). b) Axial MPR image shows calcification of the aortic wall (arrowhead). The true lumen (arrowhead) measures 7.4 cm; the aneurysm measured in the perpendicular plane has a diameter of 15.6 cm.

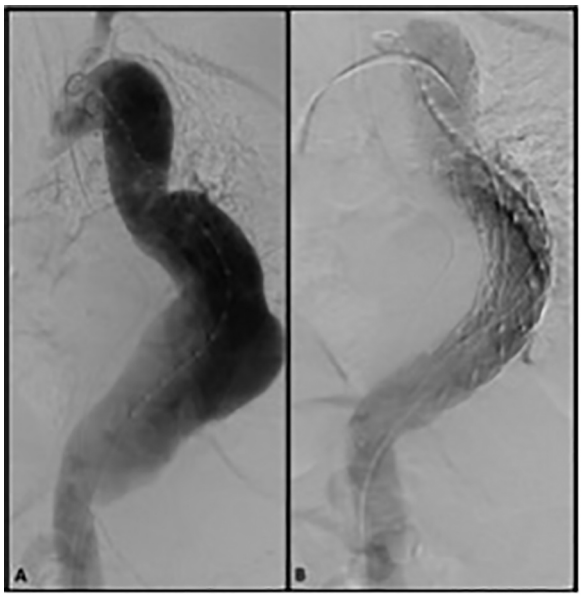

Fig. 2. TEVAR (A) Invasive angiography depicts the thoracic aneurism before repair. There is no extravasation of the contrast. (B) Invasive angiography posterior the placement of two endoprothesis. There are no endoleaks.

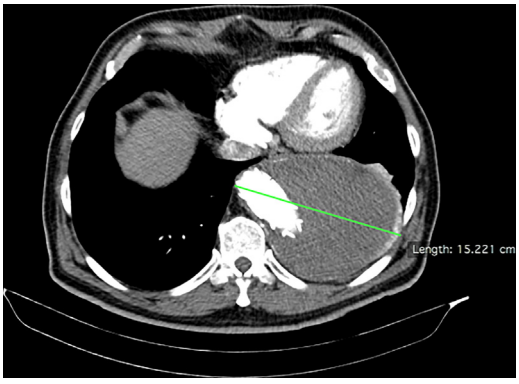

Fig. 3. CT angiogram at a four-month follow up. The endoprothesis is well positioned with no endoleaks.

3. Discussion

Most TAAs occur in the ascending aorta followed by the descending thoracic aorta, and the aortic arch. The average age at the time of diagnosis is around the 60–70 years range [4,6,7]. Women with degenerative TAA have greater aneurysm growth rates than men, independently of body size or other clinical variables [7].

Pathophysiology of TAA formation involves the process of cystic medial necrosis, where focal degeneration of the elastic and muscle tissue within the tunica media of the aortic wall occurs. The aortic wall subsequently weakens and dilates as a result of the high pressure of intraluminal blood flow [6]. This definition differentiates an aneurysm from a false aneurysm, with the latter being a perivascular pulsatile hematoma secondary to a vessel injury often seen after endovascular procedures. A third type of aneurysm is the mycotic counterpart, which is defined by the presence of two or more of the following features: sepsis, positive blood culture, positive culture from the aneurysmal wall, or a characteristic radiological appearance [8]. Another type of aneurysm is the one following an acute event of aortic dissection.

In this case, the patient was diagnosed with hypertension 30 years before intervention, which constitutes the main risk factor predisposing for TAAs, aortic dissection and rupture, accounting for 50–60% of deaths. Patients with aneurysms greater than 10 cm have a 5-year survival of 15% [2,4,7]. In retrospect, our patient's aneurysm should have been repaired first before performing the nephrectomy due to the high risk of rupture that it presented.

Signs and symptoms that might present with a TAA include a diastolic murmur or, less often, patients may present with congestive heart failure. On the other hand, giant TAAs may suffer a local mass effect, such as compression of the trachea or mainstem bronchus, provoking fatigue, nausea, cough, dyspnea, wheezing, chest pain, or recurrent pneumonitis [1,6,9]. Additionally, typical symptoms of aortic rupture include the abrupt onset of severe pain in the chest, neck, back, and/or abdomen [6]. Aortoesophageal fistulaes (AEsFs), which have also been described as complications in giant TAA, are classified as being either primary or secondary. The first are the results of intrinsic disease, such as TAA, esophageal cancer, mediastinal tubercular infections, or incurred injury from foreign body ingestion, trauma or caustic erosions as from lye consumption, whereas the latter are communications between the esophagus and the repaired aorta. Chiari's triad for this fatal disor-

Table 1
Aortic giant thoracic aneurysms reported in the english literature (>10 cm in transverse diameter).

Age (yrs), Sex	Reference	Size (transverse diameter), Location	Presentation	Comorbidities and risk factors	Type of repair	Outcome
75, F	Refaat et al.	10 cm, ascending	Dyspnea and impaired consciousness	None	Non-surgical.	Recovers short-term. unknown long-term
63, M	Wang et al.	10.3 cm aortic arch	Cough, hoarseness and dyspnea for more than 1 week	None	Non-surgical	Dies same day
61, M	Enriquéz-Puga et al.	11.3 cm, ascending (root)	Dyspnea and chest pain	aortic prosthesis	Open repair. Bentall procedure,	Discharged POD 8
28, M	Göncü et al.	16 cm, ascending	asymptomatic	aortic valve prosthesis	Open repair. Hemashiel woven graft 34 mm	Discharge POD 10
70, M	Philippakis	10cm	back pain	Hypertensive	TEVAR. Medtronic Valiant Captvia 36 mm × 200 mm	Discharged POD 3
76, F	Lamrani et al.	11 cm, decending	Dyspnea, cardiac insufficiency	Renal failure and cardiac insufficiency	Non-surgical	Unknown
75, M	Garrido et al.	15 cm, arch	Cardio-vocal syndrome: dysphonia, dysphagia, dyspnea, chest pain	smoker, hypertensive, CKD, COPD	Open repair	Unknown
77, F	Jmaa-Hela et al.	13.97 cm, ascending (root)	Dyspnea	None	Open repair Bentall procedure	Dies same day
78, F	J.Adekanmi et al.	10.2 cm, ascending	Dyspnea	Hypertension, aortic valve calcification,	Non-surgical	Dies 12 days after evaluation
33, M	Shah et al.	13 cm, ascending	Asymptomatic	Marfan syndrome	Open repair, Bentall procedure.	Discharged POD 7
76, M	Tomey et al.	11.5 cm, ascending	Dyspnea, presyncope; aortitis and atherosclerosis	Syphilis.	Open repair	Dies in OR
76, M	Rajab et al.	11.4 cm ascending	Dyspnea and leg swelling.	Syphilis	Open repair	Unknown
39, M	Topcuoglu et al.	15 cm, descending	lumbalgia, nausea, fatigue	Hypertension, aortic coarctation	Open repair, dacron graft 16 mm	Discharged POD 8
85, F	Kampitakis et al.	14.8 cm, descending	dypsnea, dysphagia,	Hypertension, rheumatoid arthritis	Non-surgical	Unknown
88, F	Okura et al.	10.5 cm, ascending	Asymptomatic.	None	Non-surgical	Dies 3 months later of pulmonary embolism
66, M	Fatimi et al.	11 cm, ascending	Dyspnea	aortic valve regurgitation, mitral valve regurgitant	Open repair	Discharged POD 8
64, M	Pietrzyk et al.	10.5 cm, ascending and aortic arch.	Dyspnea	NYHA III, permanent AF, CKD, DM2, AAA repair 10 years earlier	Open repair	Dies same day.
72, M	Moutakiallah et al.	11 cm, ascending	Dyspnea, ortopnea, SVCS	Heart failure	Open repair	Discharged POD 21
82, F	Ceresa et al.	11 cm, ascending and aortic arch	Acute chest pain	Hypertension, Diabetes	Open repair, tubular graft 30 mm	Discharged POD 14
Unknown	Sansone et al.	13 cm, ascending	Asymptomatic	Past history of aortic valve replacement	Open repair, dacron graft 34 mm	Unknown

SVCS: Superior Vena Cava Syndrome. POD: Post Operative Day. AF: atrial fibrillation. AAA: Aortic Abdominal Aneurysm. CKD: Chronic Kidney Disease. DM2: Diabetes Mellitus Type II.

der is composed of (1) midthoracic pain, (2) a sentinel hemorrhage event, and (3) delayed exsanguination after a symptom-free hiatus. Overall mortality with nonsurgical therapy is total, with surgical intervention mortality ranges from 30% to 80% [10,11].

Our patient was diagnosed during evaluation for polycystic kidney disease. It is known that most patients with TAA are asymptomatic and diagnosis is made incidentally during image studies for additional reasons [1,2,6,9]. Contrast enhanced CT scan and MR angiography are the preferred image methods to assess aneurysms, being both the gold standard for diagnosis [1,6].

Patients with aneurysms smaller than 6 cm are generally not candidates for surgery, unless they have symptoms or they present comorbidities, therefore they may be treated medically. Elective surgery may be carried out at a size of 5.5 cm for ascending and 6.5 cm for descending aortic aneurysms, repair is also suggested for patients with documented aneurysm growth of >1 cm per year. Propranolol has shown significantly slower rate of aortic dilatation, fewer aortic events, and lower mortality than treatment with non β -blocker therapy [6,9].

TEVAR has been successfully performed under both general anesthesia (GA) and regional anesthesia (RA). The advantage of RA is that it allows the patient to remain awake, avoid tracheal intubation, and provide postoperative pain relief. Factors favoring GA include a endovascular repair with planned fenestrated or branched endografts, expecting a long technique duration; a need for debranching procedures or for aortic/iliac artery access and planned hemodynamic manipulations to create a immobile field during stent placement [12].

The most feared nonfatal complication in TAA's repair is postoperative paraplegia secondary to interruption of the blood supply to the spinal cord [6]. The incidence of spinal cord ischemia (SCI) after TEVAR is generally less when compared to open aneurysm repair (OAR) but still occurs with a reported incidence of 0%–13%; this is because blood flow to the spinal cord via distal aortic branches is not compromised during TEVAR because there is no aortic cross-clamping [13].

Cerebrospinal fluid drainage (CFD) has proven that its useful in preventing SCI [14]. For many years, we performed this preoperative measure in cases with long endovascular coverage, until systematic reviews failed to show that CFD prevents SCI in TEVAR [15]. Furthermore, many complications related to CFD have been reported [16,17]. Now, our strategy is more selective, and we only perform preoperative CFD in patients with high risk of developing SCI [18].

Only 20 case reports of giant TAAs were found in the literature and detailed in Table 1. The average age was of 67.5 years (28–88). The mean diameter of aneurysm was 12 cm (10–16 cm). Sixteen (80%) patients reported symptoms. Thirteen (65%) of the patients were treated with open approach, and six (30%) patients were not operated on and only one (5%) of the patients was successfully treated with TEVAR. This case to our knowledge is the largest thoracic aneurysm treated with TEVAR.

4. Conclusion

TEVAR is an emergent therapy to successfully treat TAAs. Morbidity and mortality has been reportedly decreasing by this surgical approach. Even though there is limited documented experience, use of TEVAR seems a safe and promising option in the treatment of giant thoracic aneurysms as presented in this case. There is still a lot of work to do regarding minimally invasive vascular procedures, since this may play an important role on the future of vascular surgery.

Conflicts of interest

None.

Funding

None.

Ethical approval

Ethical approval has been exempted by our institution, Tecnologico de Monterrey.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Alejandro Fabiani: He is a senior vascular surgeon. He is the one who performed the surgery. He wrote the presentation of case, and helped with the final edition.

Eduardo Flores Villalba: He is a surgery professor. He helped organized the manuscript, and helped with the final edition.

Gerardo Lozano Balderas: He is a vascular attending. He checked the manuscript and helped with the outline of the paper.

Mauricio Gonzalez- Urquijo: He is a second year general surgery resident. He was the leader of the work, he design the case report. He recollected data, and wrote the manuscript.

Luis Gerardo Tellez: He is a senior radiology resident. He helped obtain the images and descriptions of them. He helped write the manuscript.

Victor Dominguez: He is a senior medican student. He conducted a systematic review of cases reports of TAa >10 cm, and contributed with the table summarizing each one of them.

Registration of research studies

NA.

Guarantor

Mauricio González-Urquijo.

Provenance and peer review

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