7 Thoracic Aortic Aneurysms in Brazil

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Thoracic aortic aneurysms (TAA) are true aneurysms located at the segments of the thoracic aorta [1, 2]. Ascending aortic aneurysms arise anywhere from the aortic valve to the innominate artery and affects 60 % of these patients. Aortic arch aneurysms, seen in 10 % of the patients, include any thoracic aneurysm that involves the brachiocephalic vessels. Descending aortic aneurysms are those distal to the left subclavian artery and are present in 40 % of these. Thoracoabdominal aneurysms, accounting for 10 %, involve any extension of the thoracic aorta, including the visceral segment. These categories help to stratify the approach to management.

Occur most commonly in the sixth and seventh decade of life and affect males approximately two times more commonly than females [3, 4].

It is generally accepted that the aneurysm diameter that indicates surgical TAA intervention should be larger than 6.5 cm [5] for the general population and 6.0 cm for patients with connective tissue disorders or with positive family history for aortic rupture or dissection [6]. Saccular configuration, symptomatic and the ruptured aneurysms also dictates intervention. The size recommendations are somewhat variable because no randomized trials exist to guide the decision-making process.

In Brazil, during the years 2008–2013, 3109 public health system users underwent surgical treatment of TAA. The median number of patients who underwent conventional or endovascular surgery were 86 and 443 respectively a year. It is observed a marked reduction in the number of conventional surgery over time and, conversely, increasing the number of endovascular surgery (http://www2.datasus.gov.br) (see Fig. 7.1).

Comparing the extremes of the period analyzed, it was observed that there was an increase of 1.2 % in the number of procedures performed by conventional means and increase of 48.72 % in endovascular procedures performed (http://www2.datasus.gov.br). In the United States between 2004 and 2007 there was an increase in the total number of procedures performed, with slight decrease in the frequency of procedures by the conventional method and sharp increase in the frequency of procedures by the endovascular method [7].

Though, considering the Brazilian population (more than 200 million people), we observe that the number of operated patients are very small.

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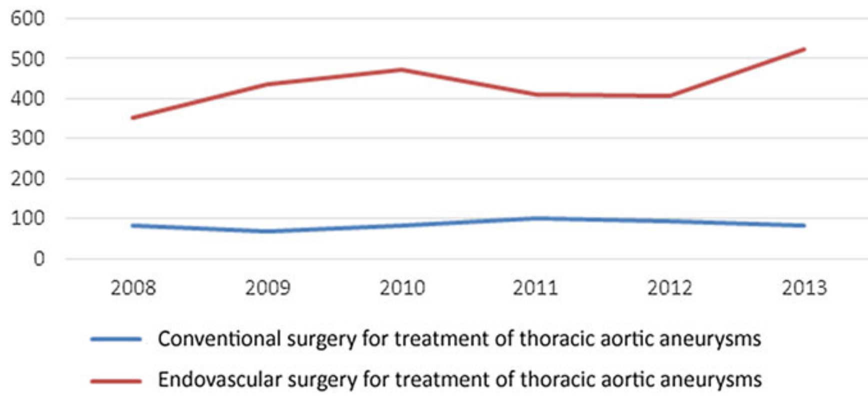


Fig. 7.1 Frequency of endovascular and conventional surgeries to treat thoracic aneurysm in Brazil, 2008–2013

So, we could assume that there are still many people dying from ruptured thoracic aneurysms.

The median number days of hospitalization of the patients undergoing conventional or endovascular surgery for TAA were 13 and 11 days in Brazil respectively (http://www2.datasus.gov.br). The mortality was 35.8 % for the conventional surgery and 8.76 % for endovascular surgery group (see Fig. 7.2). These mortality rates are significantly higher when compared to US and UK trials [8].

In Brazil, one can justify the high mortality observed, compared with American and European data, due to the fact that there is no specialized centers for thoracic aortic aneurysm. Some hospitals with small number of cases operate fewer patients and get worse results. Therefore, one could suggest that patients with TAAs would benefit from treatment at a high-volume center [8].

The UK implemented specialized centers, with an available vascular surgeon and a trained and focused multidisciplinary team, in order to concentrate therapy and generate high surgical volumes facilities, aiming at improved results. There is evidence that such changes achieved the desired result as the mortality rate of AAA intervention in England and Wales fell to 2.4 %, between 2008 and 2010 [9].

Similar to what occurred in the UK, the Brazilian health system should adopt policies to overcome their current rates. It should be proposed the development of reference centers, with well trained and specialized medical staff and a multidisciplinary team, besides adequate infrastructure. This would make possible concentrate the treatment in some hospitals, generating best surveillance and care of the Brazilian TAA's patients, as well high volume centers, in a way to take the Brazilian results close to the American and European's.

Brazil also shares the trend, similar to others countries, regarding the preference for endovascular procedure over conventional surgery for treatment of TAA. The main considerations for the TEVAR preference (Thoracic Endovascular Aneurysm Repair) are based on anatomy and comorbidities. There should be an appropriate landing zone (typically >15–20 mm) both proximally and distally to allow adequate sealing and exclusion of the aneurysm from the circulation, as well as appropriately sized arterial access to deliver the stent-graft to its desired location.

Anatomy, after all, is not the only parameter in treatment planning. Age and operative risk assessment also play a significant role in selecting the appropriate treatment modality. The majority of patients, on the other hand, do not have "ideal" anatomy for TEVAR, and the risk/benefit assessment becomes more complex. Many aneurysms impinge on a major arterial

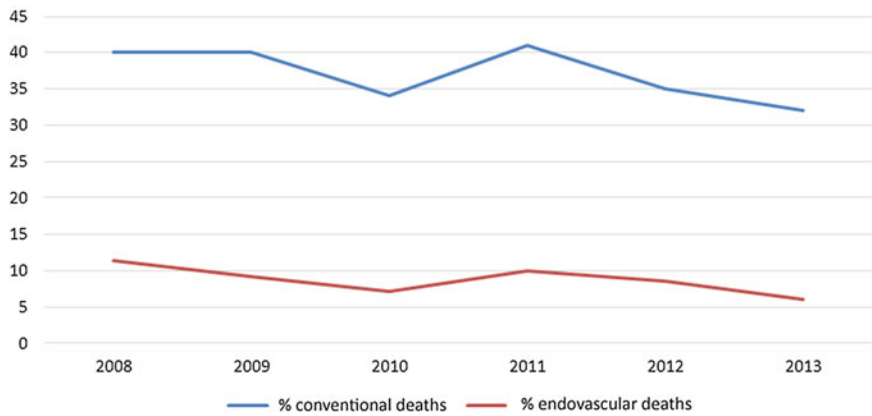


Fig. 7.2 Mortality rate related to conventional and endovascular surgery in Brazil, 2008–2013

branch that must be covered for adequate sealing.

In order to achieve technical success in the exclusion of the aneurysm procedure, there is often the need to overcome the anatomical difficulties, particularly where there is no adequate proximal landing zone, and for this it is necessary transposition or occlusion of large supraortic vessels. Ishimaru et al. [9] proposed a classification according to proximal landing zones.

Aneurysms located in zones 3 and 4 with a good zone of proximal anchor, greater than 1.5–2.0 cm in length, are treated as a regular TEVAR procedure [10].

Any how, many Brazilian patients do not have this ideal anatomy, what would require landing the endograft at zones 1 and 2. The most of these, being considered high-risk patients for conventional surgery, are directed for TEVAR (endovascular first approach).

In the case of landing the endograft in zone 2, it is necessary to cover the left subclavian artery, leading to complications inherent in this procedure, or to go for a hybrid procedure. The most common solution is a carotid-subclavian arterial bypass.

This approach is no different from others parts of the world.

Nevertheless, we have performed around 35 patients with left subclavian artery chimney in order to avoid the carotid subclavian artery by-pass. Anyhow, it was found a short term postoperative 11 % proximal endoleak rate, especially in aneurysms related to chronic dissections. Therefore, this approach was abandoned.

When the dilatation reaches the origin of the left carotid artery, Zone 1, there is a need for covering the subclavian and the left common carotid artery as well. To ensure cerebral blood circulation, we perform a carotid-carotid by-pass. The left subclavian artery may be or may be not revascularized with a carotid-subclavian bypass.

Some years ago, after an unintended occlusion of the left carotid artery, a stent was delivered to this artery using a chimney technique. The patient recovered well, with no neurologic defects and no leaks. So we decided to use this technique in others high risk patients with lesions reaching zone 1 (see Fig. 7.3). We performed five more cases without stroke or endoleaks.

In lesions of Zone 0, when the whole aortic arch is involved, a complete transposition of the aortic arch and supraortic vessels are mandatory. Typically, one performs an aortic-bifurcated bypass in order to revascularize the brachiocephalic artery and the left carotid artery. Sometimes the left carotid branch is taken to the left subclavian artery too. Other times, a carotid-subclavian artery bypass is the solution. It is carried through a median sternotomy. A healthy ascending aorta is needed. Afterwards, a TEVAR endograft is delivered with the proximal landing zone at the

Fig. 7.3 Photography of a CAT scan showing a left carotid artery chimney

ascending aorta, distally to the aortic bypass to ensure the aneurysm exclusion.

On the other hand, there are some patients with aortic arch aneurysms and high operative risk with several comorbidities, which we should avoid sternotomy due to high risk of morbidity and mortality. In such cases, we perform a carotid-carotid bypass graft. Through the right carotid access, a endograft AAA limb extension is placed at the ascending aorta, with the proximal landing zone above the sinus-tubular junction and the distal landing zone at the proximal portion of the brachiocephalic artery. Subsequently, a thoracic endograft is deployed covering the distal ascending aorta, the whole aortic arch and the proximal part of the descending aorta. The cerebral circulation is maintained by the chimney limb extension, deployed over the brachiocephalic artery and through the carotid-carotid by-pass graft (see Fig. 7.4). We have performed seven cases. No strokes or endoleaks were reported [11].

And last, but not least, in high risk patients with lesion located exclusively at the ascending aorta, we performed the endovascular treatment of the zone 0 [11]. It was used a regular TEVAR device through a femoral approach, with the nose cone of the graft crossing the aortic valve (see Fig. 7.5).

From 2007 to 2012, 69 patients presented to our center in Belo Horizonte, Brazil, with acute type A aortic syndrome or its chronic complications. Of the 69 patients, seven high-risk patients were submitted to endovascular repair: four had penetrating ulcers, two had acute dissections, and one had chronic dissection with an aneurysm.

The anatomic inclusion criteria were as follows:

1. Presence of distinct proximal and distal landing zones
2. Absence of aortic valve insufficiency or pericardial effusion
3. Site of the entry tear of the acute aortic syndrome in the middle and distal third of the ascending aorta (all above the sinotubular junction)
4. Absence of signs of ischemia of the supra-aortic branchs
5. Absence of ventricular arrhythmia
6. Absence of a connective tissue disorder
7. Adequate femoral and iliac arteries

The proximal landing zone was, on average, 21 mm above the aortic valve. Three patients required intraoperative cervical debranching due to a lesion in the distal third of the ascending aorta, compromising the supra-aortic branches. The distal landing zone was at zone 0 in four patients, zone 2 in one patient, and in zone 4 in two patients.

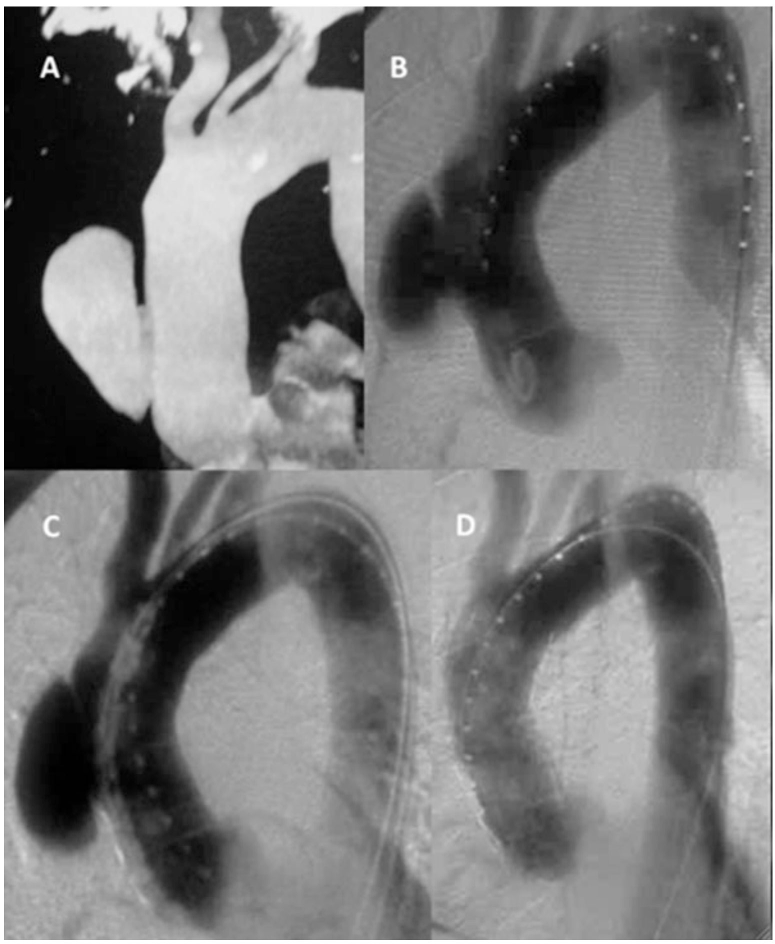
The regular length of the ascending aorta ranges from 5 to 8 cm. Nonetheless, in the diseased aorta, its extension ranges from 10 to 13 cm, allowing the deployment of a non dedicated tubular graft (10 cm in length).

The technical success rate was 87 %, with one intraoperative death from acute aortic valve insufficiency.

The mean follow-up was 26.3 months. Two repeat dissections developed an average of 2 months after treatment. Both presented with acute dissection that was treated with additional open surgery and both patients survived. Thereafter, no patient had presented again with an acute aortic syndrome or other referable symptoms.

Fig. 7.4 Postoperative photography of a CAT scan showing a endograft AAA limb extension placed at the ascending aorta and the endogratf covering the aortic arch. Photography also show the carotid-carotid arterial bypass

Fig. 7.5 Photography of intraoperative angiogram showing aneurysm located exclusively at the ascending aorta (Zone 0), treated with a thoracic endoprosthesis. Note the proximal landing zone at the sinus-tubular junction



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