ORIGINAL ARTICLE

Endovascular management of the thoracic aorta by cardiothoracic surgeons

Eliana Yagual-Gutiérrez, MD, Javier Ávalos-Rios, MD, Guillermo Díaz-Quiroz, MD, María del Sol García-Ortegón, MD, and Margarito Morales, MD.

Department of Cardiovascular Surgery, Centro Médico Nacional 20 de Noviembre, ISSSTE. Ciudad de México, MÉXICO.

Background. **Surgery of the thoracic aorta leads to high mortality and morbidity rates. The endovascular technique has enjoyed greater permissiveness for the treatment of penetrating ulcer, intramural hematoma, traumatism of the aorta, chronic dissections. We want to present the result of endovascular management in Stanford B aortic dissection by Cardiothoracic Surgery Service at one center.** ***Materials.*** **We registered the patients with diagnosis of aortic dissection Stanford B, De-Bakey III A, at our institution. Between January 2017 to January 2019, 18 patients underwent an aortic endovascular procedure, and 12 had a compromise after the emergence of the left subclavian artery.** ***Results.*** **Endovascular procedure was performed in (N = 12) through the femoral or iliac artery. The average age of the patients was 57 years, with the minimum and maximum age being 32 and 80 years respectively. The surgical time used was on average 170 min. The stay in the intensive care unit was on average 2 days and the hospital stay on average 5 days. Among the early complications, cerebral edema was observed in 1 patient and another with type II endoleak. Operative mortality at 30-days and 1-year was 0%.** ***Conclusions.*** **The endovascular approach has led to great changes in the therapeutic possibilities that affect the thoracic aorta, the cardiothoracic surgeon with a good learning curve is able to deal with this type of aortic pathology with promising results.**

Key words: **Thoracic aortic dissection; TEVAR; endovascular technique; Stanford B.**

Antecedentes. **La cirugía de la aorta torácica conlleva altas tasas de mortalidad y morbilidad. La técnica endovascular ha gozado de mayor permisividad para el tratamiento de la úlcera penetrante, hematoma intramural, traumatismo de la aorta, disecciones crónicas. Queremos presentar el resultado del manejo endovascular en disección aórtica Stanford B por parte del servicio de Cirugía Cardiotorácica de un centro.** ***Material.*** **Registramos los pacientes con diagnóstico de disección aortica Stanford B, De-Bakey III A, en nuestra insitutción. Entre Enero 2017 a Enero 2019, 18 pacientes fueron sometidos a procedimiento endovascular aórtico, y 12 tuvieron compromiso después de la emergencia de la arteria subclavia izquierda.** ***Resultados.*** **Procedimiento endovascular fue realizado en (N=12) a través de Arteria femoral o iliaca. La edad de los pacientes en promedio fue de 57 años, siendo la mínima y máxima edad 32 y 80 años respectivamente. El tiempo quirúrgico empleado fue en promedio 170 min. La estancia en unidad de cuidados intensivos fue en promedio 2 días y la estancia hospitalaria en promedio 5 días. Entre las complicaciones tempranas se observó en 1 paciente datos de edema cerebral y otro con endofuga tipo II. La mortalidad operatoria a 30 días y a 1 año fue del 0%.** ***Conclusiones.*** **El abordaje endovascular ha dado lugar grandes cambios en las posibilidades terapéuticas que afectan a la aorta torácica, el cirujano Cardiotorácico con una buena curva de aprendizaje es capaz de lidiar este tipo de patología aórtica con resultados prometedores.**

Palabras clave: **Disección aórtica torácica; TEVAR; técnica endovascular; Stanford B.**

Cir Card Mex 2019; 4(4): 102-106

Aortic dissection (AD) is a vascular emergency with a high surgical mortality of 14-16% [1]. The DeBakey classification divides dissections into 3 types, as follows: Type I involves the ascending aorta, aortic arch, and descending aorta; Type II refers to dissections that are confined to the ascending portion of the aorta, and Type III dissections are limited to the descending aorta. On the other hand, Stanford type A includes dissections that involve the ascending aorta, arch and descending thoracic aorta. Stanford type B refers to dissections that involve only the descending aorta (descending thoracic aorta = DeBakey type IIIa, or thoracoabdominal aorta = DeBakey type IIIb). In this setting, this Stanford type B is handled medically or by surgical or

Corresponding author: Dra. Eliana Beatriz Yagual Gutiérrez
email: draelianayagual@gmail.com

endovascular intervention when it is complicated. In recent years, thoracic endovascular aortic repair (TEVAR) has been increasingly used in the treatment of DeBakey type III (Stanford type B) (**Fig. 1**).

In most clinical trials and clinical practice, acute AD is considered if TEVAR is performed within 14 days from the onset of symptoms and chronic if TEVAR was performed after 14 days from the onset.

TEVAR goal chronic and acute AD type B is to close the dissection tear leading to the occlusion of the false lumen giving rise to the remodeling of the thoracic aorta [2-3]. Thoracic endovascular aortic repair (TEVAR) has become the preferred approach for treatment of thoracic aortic pathology since the approval of the first endograft device by the U.S. Food and Drug Administration (FDA) in 2005. The term "uncomplicated Type B aortic dissection" (UTBAD) was first proposed by Trimarchi et al, who described it as uncomplicated AD without hemodynamic instability, or malperfusion syndrome. Historically, the standard of care for UTBAD has been medical management because of favorable one-year survival rates compared with open replacement of the descending thoracic aorta. Mortality rate is around 10% [4-6]. Despite the initial success by means of optimal medical management for UTBAD, aortic wall degeneration, aneurysm formation of the dissected aorta, it remains as a clinical challenge [7]. In this context, prophylactic endovascular therapy as TEVAR for UTBAD in addition to optimal medical treatment is associated with improved 5-year aorta-specific survival and delayed disease progression [8].

Minimally invasive surgery has enough evolved nowadays. Endovascular management for Stanford Type B is amenable to be performed by this way by Cardiothoracic Surgeons. We sought to showcase our initial surgical experience in this kind of pathology at out institution.

.

MATERIAL

This is a retrospective, observational study gathering all comers with primary diagnosis as AD Stanford type B, DeBakey Type IIIa, at our institution from January 2017 through January 2019. Eighteen patients underwent any aortic endovascular procedure, but just 12 being involved beyond (distal) the branching-off the left subclavian artery. At the preoperative evaluation, CT with 3D reconstruction of the whole aorta as well as supraaortic vessels and femoral arteries were obtained (**Fig. 2**). In addition, an echocardiographic scanning for aortic valve function and status was also conducted in all cases.

We used PTFE endovascular prostheses composed by nitinol stent frame, flexible and 20-30% oversizing. Stent placement in the thoracic aorta was performed by retrograde ap-

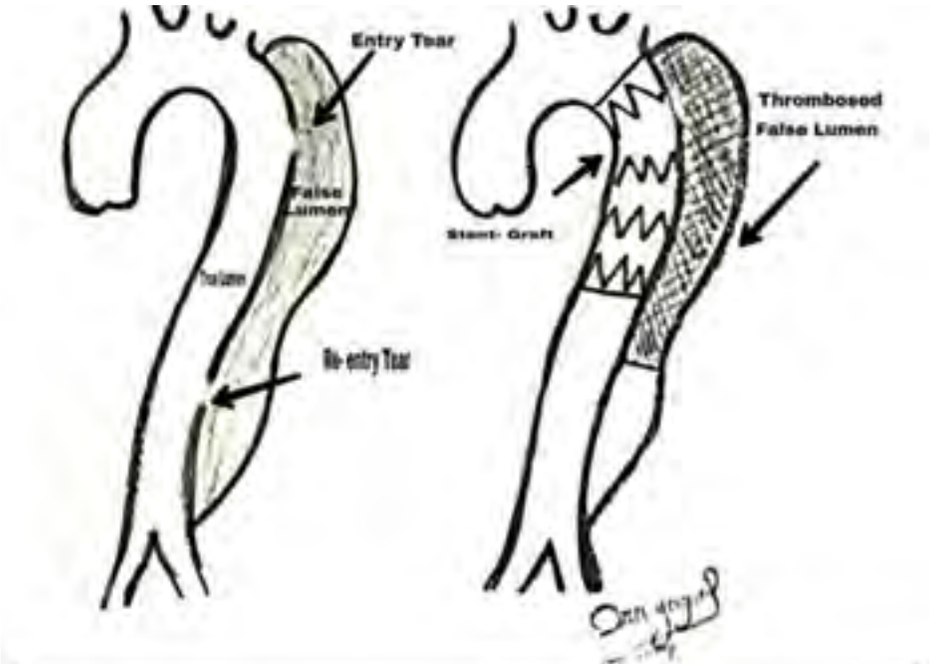

Figure 1. Illustration showing typical findings in the aortic dissection Type B with flow through the false lumen resulting from a priximal tear (left). Endovascular graft into the descending aorta sealing the entrance orifice to the false lumen, resulting in the reconstruction of the true lumen and false lumen thrombosis (right).

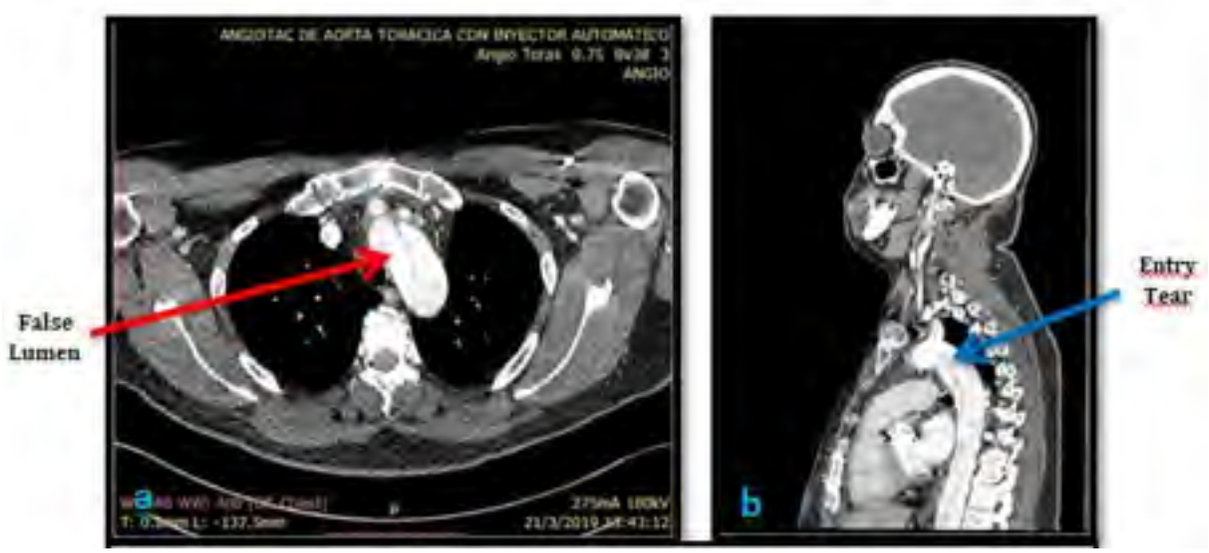

Figure 2. CT scan of the chest with contrast; a) Axial view with the evidence of the false lumen of the disection (red arrow); b) Sagital view in which is seen the entry tear (blue arrow).

proach through the femoral or iliac artery under fluoroscopic guidance (**Fig. 3**). As a matter of course in our institution, CT scan was obtained in all cases 6 months after TEVAR. Two or more surgeons reviewed as peers each and every of the obtained images (**Fig. 4**). Surgical success was reported when preoperative symptoms and clinical condition disappeared after TEVAR. Before proceeding, the informed consent form was signed in all cases by patients, who were fully informed about all possible complications after TEVAR, especially possible conversion to conventional open aortic surgery. Micro-

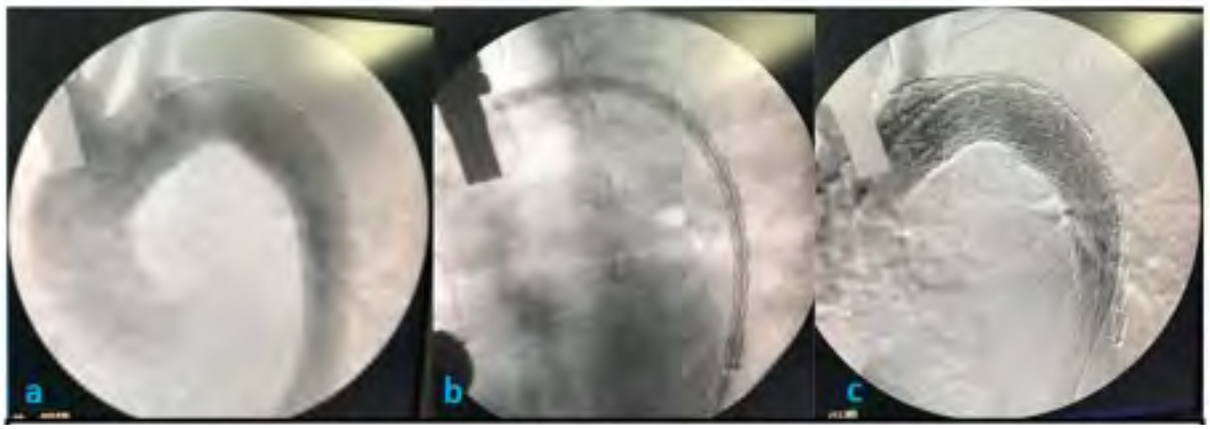

Figure 3. Angiographic control of the TEVAR; a) Pick catheter - tail at the level of the true lumen; b) Introduction of the coated- endoprosthesis; c) Placement of the endoprosthesis while excluding the left subclavian artery, and correction of the disected area.

soft Excel 2010 and SSPS 25 were utilized for statistical analysis.

RESULTS

From January 2017 to January 2019, eighteen patients underwent TEVAR through a femoral or iliac arterial approach with a commercially available device. Six cases undergoing other aortic arch surgical procedure else were ruled out. All patients had UTBAD. Mean age was 57 years, range from 32 to 80 years (**Table 1**). Right femoral approach was used in 7 cases, while right iliac artery in 5. Seventy five percent of patients required endoprosthesis release. Surgical time was 170

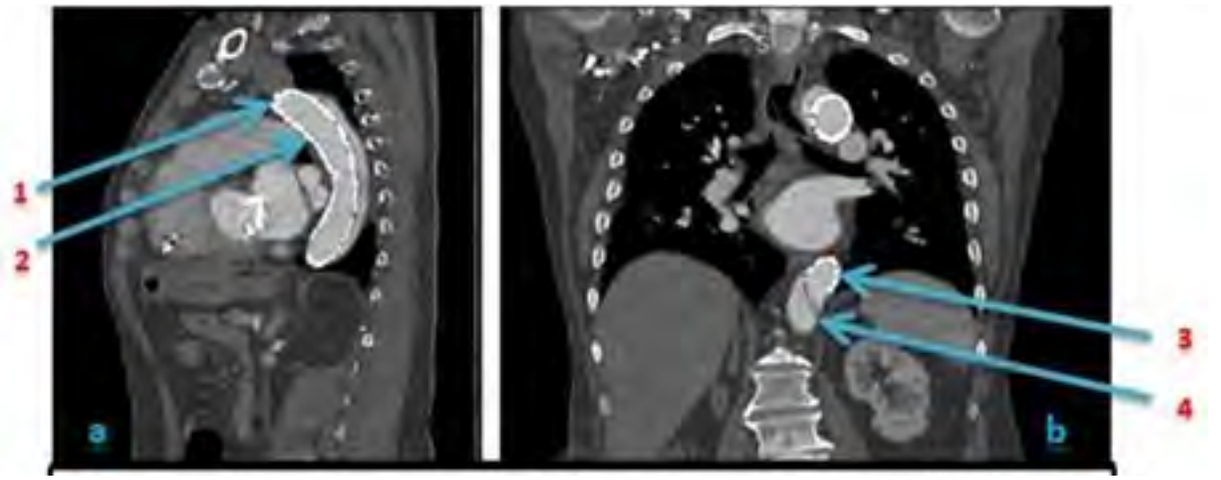

Figure 4. CT scan of the chest with contrast for evaluation after TEVAR; a) Sagital view, b) Coronal view. 1= Proximal end of the stent, 2= Middle of the stent, 3= Distal end of the stent, 4= Distal disected area with no reentry.

min in average. Length of stay at ICU was 2 days. In-hospital stay was 5 days. Among complications, one case of cerebral edema coming from femoral approach, and other with endo-leak Type II coming from the iliac approach (p=0.25). Operative mortality (1 month) and at 1-year follow-up was 0% (**Table 2**).

DISCUSSION

TEVAR represents a therapeutic concept for type B aortic dissection. It has led us into a new non-open chest treatment for this type of pathology. Indeed, TEVAR in addition to optimal medical treatment is associated with improved 5-year aorta-specific survival and delayed disease progression [8]. At present, it is very clear that open chest surgery has become in a lesser degree the selected treatment just for cases with chronic dissection aneurysms. It is also worth highlighting the clinical surveillance is fundamental for all cases, more broadly. However, TEVAR remains nowadays as the golden standard for all UTABD [9].

In short, the entire cardiovascular system can be approached by percutaneous interventions. Success will largely depend on being familiar with high-definition images, surgical skills, access approaches, and new and better commercially available devices [10].

Table 1. Preoperative characteristics

Variable	N/%
Number of cases	12
Age (years)	57 (32-80)
Gender (male)	58%
Systemic hypertension	83%
CRF/Creatinine (>1.5 mg/dL)	8%
Marfan Syndrome	16%

** CRF: Chronic renal failure*

Table 2. Early clinical results

Variable	N (%)
Renal failure	0
Cerebral edema	1 (8%)
Endoleak	1 (8%)
Retrograde aortic disection Type A	0
Stent-induced new reentry	0
Length of stay in ICU (days)	2
In-hospital stay (days)	5
Operative mortality (30 days)	0
Mortality at 1-year follow-up	0

** CRF: Chronic renal failure*

FUNDING: None

DISCLOSURE: The authors have no conflicts of interest to disclose.

REFERENCES

1. Roselli EE. Thoracic endovascular aortic repair versus open surgery for type-B chronic dissection. J Thorac Cardiovasc Surg 2015;149(2 Suppl):S163-7.
2. Zhou W, Yu W, Wang Y, et al. Assessing Aortic Remodeling after Thoracic Endovascular Aortic Repair (TEVAR) in DeBakey IIIb Aortic Dissection: A Retrospective Study. Ann Thorac Cardiovasc Surg 2019; 25: 46–55.
3. Miura S, Kurimoto Y, Maruyama R. et al. Thoracic Endovascular Aortic Repair on Zone 2 Landing for Type B Aortic Dissection. Annals of Vascular Surgery (2019). DOI: 10.1016/j.avsg.2019.02.017

4. Krol E, Panneton JM. Uncomplicated Acute Type B Aortic Dissection: Selection Guidelines for TEVAR. Ann Vasc Dis 2017;10(3). pii: ra.17-00061. doi: 10.3400/avd.ra.17-00061.
5. Trimarchi S, Tolenaar JL, Tsai TT. Influence of clinical presentation on the outcome of acute B aortic dissection: evidences from IRAD. J Cardiovasc Surg (Torino). 2012 Apr; 53(2):161-8.
6. Tetsuro U, Mitsuaki S. Thoracic Endovascular Aortic Repair for Acute Aortic Dissection. Ann Vasc Dis 2018 Dec 25; 11(4): 464–472.
7. Durham CA, Cambria RP, Wang LJ., Et al. La historia natural de la disección aórtica aguda tipo B tratada médicamente. J Vasc Surg 2015; 61: 1192-9.
8. Nienaber CA, Kische S, Rousseau H, et al. Endovascular repair of type B aortic dissection: long-term results of the randomized investigation of stent grafts in aortic dissection trial. Circ Cardiovasc Interv. 2013 Aug;6(4):407-16.
9. Schepens MAAM. Type B aortic dissection: new perspectives. J Vis Surg 2018; 4:75. doi: 10.21037/jovs.2018.03.16.
10. Roselli EE. Evolution of Endovascular Treatment for Complex Thoracic Aortic Disease. Ann Vasc Dis 2008; 1: 20–27.