From the Society for Clinical Vascular Surgery

Outcomes of thoracic endovascular aortic repair for chronic aortic dissections

Allan M. Conway, MBChB (Hons), MRCS, Khalil Qato, MD, Laurie R. Mondry, BSN, Guillaume J. Stoffels, MS, MA, Gary Giangola, MD, *and* Alfio Carroccio, MD, *New York, NY*

ABSTRACT

Background: Open surgical repair remains the "gold standard" treatment for chronic type B aortic dissection (cTBD) with aneurysm. Thoracic endovascular aortic repair (TEVAR) has gained popularity in recent years for the treatment of thoracic aortic diseases, including cTBD. We assessed the effectiveness of TEVAR in the treatment of cTBD using the Vascular Quality Initiative (VQI) database.

Methods: The VQI registry identified 4713 patients treated with TEVAR from July 2010 to November 2015, including 125 repairs for cTBD. We analyzed TEVAR outcomes in this cohort per the Society for Vascular Surgery reporting standards for TEVAR.

Results: Median age was 65.0 years (interquartile range [IQR], 56.0-72.0 years), and 85 (68.0%) were male. Median aneurysm diameter was 5.5 cm (IQR, 4.8-6.3 cm). Sixty-two (49.6%) patients were asymptomatic on presentation, 57 (45.6%) were symptomatic, and 6 (4.8%) presented with rupture. Median length of stay was 8.0 days (IQR, 4.0-11.0 days). Fluoroscopy time was 17.3 minutes (IQR, 10.5-25.6 minutes). The distal landing zone was aortic zone 4 in 27 (21.6%) and aortic zone 5 and distal in 98 (78.4%) patients. Successful device delivery occurred in 123 (98.4%) patients. Conversion to open repair occurred in one (0.8%) patient. A type IA endoleak was present in 2 (1.6%), type IB endoleak in 2 (1.6%), and type II endoleak in 2 (1.6%) patients. Perioperative complications included stroke in 2 (1.6%), respiratory complications in 6 (4.8%), and spinal cord ischemia symptoms present at discharge in 3 (2.4%) patients. In-hospital mortality occurred in three (2.4%) patients. Reintervention was required in two (1.6%) patients for false lumen perfusion and in two (1.6%) patients for extension of the dissection. Follow-up was available for 43 patients at a median time of 239 days (IQR, 38-377 days). Median change in sac diameter was −0.2 cm (IQR, −0.5 to 0.1 cm). Sac shrinkage of 0.5 cm was noted in 12 (27.9%), with sac growth >0.5 cm in four (9.3%) patients. Extent of stent graft coverage did not affect sac shrinkage ($P =$ .65). Patients with aneurysms ≥5.5 cm compared with <5.5 cm were more likely to demonstrate shrinkage (−0.6 cm vs 0.0 cm; 95% confidence interval, 0.3-11.7; $P = .04$).

Conclusions: TEVAR for cTBD may be performed with acceptable rates of morbidity and mortality. Changes in sac diameter in the midterm are promising. Long-term data are needed to determine whether this approach is durable. (J Vasc Surg 2017;■:1-7.)

Traditionally, patients with aneurysmal degeneration of the aorta due to chronic type B aortic dissection (cTBD) have been repaired with an open surgical approach.[1] Despite recent improvements in outcomes of contemporary data sets, there remains a significant morbidity and mortality from open surgery.[2-4] During recent years, thoracic endovascular aortic repair (TEVAR) has emerged as a treatment option for a multitude of aortic diseases, including cTBD. The aims are to exclude entry tears, to induce thrombosis within the false lumen, to stimulate remodeling of the thoracic aorta, and to prevent aortic growth.[5-8]

In the setting of acute complicated type B aortic dissection, TEVAR has shown favorable outcomes for patients with malperfusion, rupture, chest pain, and aortic enlargement.[9-12] The Investigation of Stent Grafts in Aortic Dissection trial with extended follow-up (INSTEAD-XL) demonstrated reduced aorta-related mortality in patients who underwent TEVAR compared with medical therapy for uncomplicated type B aortic dissection.[6] TEVAR resulted in a predictable regression of the false lumen and expansion of the true lumen. However, the role of TEVAR for complicated cTBD as defined by aortic enlargement, persistence of symptoms despite medical therapy, and rupture remains largely unknown. Concerns about the ability of this technique to decompress the false lumen and to expand the true lumen, given the thickened intimal flap and mature entry tears in the setting of cTBD, have been described. The

From the Department of Surgery, Lenox Hill Hospital, Northwell Health.

Author conflict of interest: none.

Presented at the Forty-fifth Annual Symposium of the Society for Clinical Vascular Surgery, Lake Buena Vista, Fla, March 18-22, 2017.

Correspondence: Allan M. Conway, MBChB (Hons), MRCS, Lenox Hill Hospital, 130 E 77th St, 13 Black Hall, New York, NY 10075 (e-mail: allan.m.conway@doctors.org.uk).

The editors and reviewers of this article have no relevant financial relationships to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

0741-5214

https://doi.org/10.1016/j.jvs.2017.08.098

long-term durability of stent grafts in this setting also remains largely unknown.[13-16] Although acceptable perioperative outcomes have been achieved, there remains a paucity of data for TEVAR for complicated cTBD.

The aim of this study was to provide short-term and midterm results of patients who underwent TEVAR for cTBD. Specifically, results of perioperative outcomes, secondary interventions, mortality, and change in aortic sac diameter are described.

METHODS

A retrospective cohort study was performed using the Vascular Quality Initiative (VQI) registry. This study was approved by the Institutional Review Board of Northwell Health (15-378), and the need for consent of individual patients was waived. Using the VQI registry, all patients who underwent TEVAR for thoracic aortic disease were identified. A total of 4713 patients were identified from July 2010 to November 2015. Of these, 125 repairs were performed for cTBD, as recorded in the VQI registry. The VQI defines chronic dissection as >30 days.

Characteristics of the patients, morphology of the aortic dissection, operative details, perioperative outcome, and reinterventions were obtained from the registry, which is recorded prospectively. Measurements of the maximum aortic diameter were recorded on preoperative computed tomography (CT) imaging. Zones of entry tear were recorded per the Society for Vascular Surgery reporting standards for TEVAR.[17] The same reporting measures were used to identify extent of aortic stent graft coverage. Subjects were then divided into two groups, depending on the extent of coverage. Group A included subjects with stent graft coverage extending to zone 4. Group B included those with coverage extending to zone 5 and distal. Successful device delivery was defined as deployment of the stent graft in the planned thoracic aorta. Technical success was defined as satisfactory closure of the primary entry tear, endograft deployment without type I or type III endoleak, and absence of conversion or death within 24 hours. Clinical success included the absence of death, type I or type III endoleak, aneurysm expansion, rupture, or conversion to open repair. Early and midterm outcomes were defined according to reporting criteria as within 30 days of the index procedure and from 30 days to 5 years after the intervention, respectively.

Early mortality was defined as all-cause mortality occurring within 30 days from the reference TEVAR procedure, and late mortality was defined as death occurring after that period. Follow-up was obtained from the VQI registry. Where available, postoperative sac diameter was measured and change in sac diameter was recorded. Sac shrinkage was defined as a reduction in diameter of >0.5 cm; sac growth was defined as an increase in diameter of >0.5 cm.

ARTICLE HIGHLIGHTS

- **Type of Research:** Retrospective analysis of prospectively collected Vascular Quality Initiative (VQI) data
- **Take Home Message:** Thoracic endovascular aortic repair of chronic type B aortic dissections in 125 patients resulted in three deaths (2.4%). Technical success was 98.4%, with two cases of type IA endoleak (1.6%) and type IB endoleak (1.6%). Aneurysm sac shrinkage of at least 5 mm was observed in 12 patients (27.9%) with a median follow-up of 8 months, and extent of stent graft coverage was not associated with aneurysm sac shrinkage.
- **Recommendation:** This study suggests that thoracic endovascular aortic repair for chronic type B dissections can be performed safely with reasonable rates of aneurysm sac shrinkage at a median follow-up of 8 months.

The analysis of the association between stent group and absolute change in aortic diameter was performed, initially using univariable analyses to identify factors that were associated with stent group, which therefore could be confounders in the relationship between stent group and aortic change. In these analyses, the Fisher exact test was used for categorical factors and the Mann-Whitney test was used for continuous factors. A multivariable regression model was then used to assess the association between aortic diameter change and stent group while adjusting for potential confounders identified. The *t*-test was used to compare aortic diameter change between patients with aneurysms ≥5.5 cm and patients with aneurysms <5.5 cm. Unless otherwise specified, a result was considered statistically significant at the $P < .05$ level of significance. All analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC).

RESULTS

Of the 125 subjects with cTBD, median age was 65.0 years (interquartile range [IQR], 56.0-72.0 years), and 85 (68.0%) were male. Demographics of the patients and prior aortic interventions are summarized in Table I. Anatomic characteristics of the aneurysms are delineated in Table II. Median aneurysm diameter was 5.5 cm (IQR, 4.8-6.3 cm). Sixty-two (49.6%) subjects were asymptomatic on presentation, 57 (45.6%) were symptomatic, and six (4.8%) presented with rupture. Indication for TEVAR was pain in 53 (42.4%) subjects, refractory hypertension in 12 (9.6%), malperfusion in 5 (4.0%), rapid expansion in 16 (12.8%), aneurysm in 79 (63.2%), rupture in 8 (6.4%), and uncomplicated in 11 (8.8%) subjects.

Perioperative details are summarized in Table III. Median length of stay was 8.0 days (IQR, 4.0-11.0 days). The distal landing zone was aortic zone 4 in 27 (21.6%) and aortic zone 5 and distal in 98 (78.4%) subjects.