Thoracic endovascular aortic repair: A single center's 15-year experience

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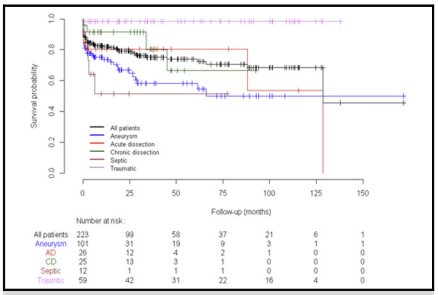
ABSTRACT

Objective: Specific complications of thoracic endovascular aortic repair (TEVAR) exist and long-term data are lacking. The purpose of this study was to evaluate our long-term TEVAR results.

Methods: This is a single-center retrospective study of 223 patients undergoing TEVAR from 1998 to 2013. Indication was aneurysm (45%), traumatic (26%), dissection (23%), and septic (6%).

Results: Patients' mean age was 62.7 ± 17.9 years, 84% of them had an American Society of Anesthesiologists score ≥3, and 42% had an aortic rupture. TEVAR was performed in zone 0 (n = 17), 1 (n = 17), or 2 (n = 59) in 42% of patients. Technical success rate was 96.4%. Overall 30-day mortality was 11.7% (elective aneurysm, 11.6%; emergent aneurysm, 34.3%; acute type B dissection, 14.8%; chronic dissection, 4.2%; septic, 8.3%; and traumatic, 1.7%). Major adverse events included stroke in 4.5%, spinal cord ischemia in 1.8%, and retrograde aortic dissection in 2.7%. Mean follow-up was 43.4 ± 38 months. Estimated aortic complications-free survivals at 12, 36, 60, and 120 months were (% ± standard error) 73% ± 3%, 64% ± 4%, 62% ± 4% and 57% ± 5%, respectively. Multivariate analysis showed that patients treated for a chronic aortic dissection had a significant risk of late reintervention ($P = .001$)

Conclusions: Because of its simplicity and low morbimortality rate, TEVAR has become the first-line approach for thoracic aortic diseases. Mortality outcomes are related to aortic pathology, emergent status, and proximal landing zone. To improve long-term results, rigorous patient selection and follow-up, development of referral centers, and technologic evolution of materials have to be reached. (J Thorac Cardiovasc Surg 2016;151:1595-603)



Product-limit survival estimates curves.

Central Message

We present a single-institution's experience with early and late outcomes of TEVAR across 15 years.

Perspective

Mortality outcomes after thoracic endovascular aortic repair are related to the aortic pathology, elective or emergent status, and proximal landing zone. To improve long-term results, rigorous patient selection and follow-up, development of referral centers, and technologic evolution of materials have to be reached.

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ACQ

Since its first description in 1994,[1] thoracic endovascular aortic repair (TEVAR) has evolved from homemade experimental devices to being the first-line therapy for most thoracic aortic pathologies using commercially available thoracic stent-grafts for anatomically suitable patients.[2,3]

Experience with abdominal aortas showed that the early mortality advantage associated with endovascular repair of abdominal aneurysms was affected by specific reported complications, such as late aortic rupture and endoleaks.[4] Similar long-term durability issues concerning TEVAR have been raised. Furthermore, encouraging results of TEVAR have prompted many authors to use stent-grafts in more challenging anatomical regions using a hybrid approach,[5-8] increasing the risk of TEVAR failure.

Most studies describe early outcomes from TEVAR with relatively short-term follow-up.[9-17] We present the early and late outcomes of our single-institution experience with TEVAR.

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Scanning this QR code will take you to supplemental figures and tables for this article.

Abbreviations and Acronyms

ASA = American Society of Anesthesiologists
CT = celiac trunk
LSA = left subclavian artery
MSOF = multisystem organ failure
RAD = retrograde aortic dissection
SAV = supra-aortic vessels
SCI = spinal cord ischemia
SMA = superior mesenteric artery
TEVAR = thoracic endovascular aortic repair

MATERIALS AND METHODS

Patients

From November 1998 to January 2013, 235 patients were treated in our institution for various thoracic aortic pathologies. Among these patients, 223 had favorable preoperative anatomic conditions to perform TEVAR. They constituted the basis of our study. A retrospective analysis of this series was performed using a prospectively maintained database. Patients were divided into 4 groups (aneurysm, dissection, traumatic, and septic).

All patients underwent a preoperative computed tomography scan to assess the feasibility of TEVAR. As a prerequisite for successful stent-graft placement, a proximal landing zone of healthy and nondissected aorta (or graft) of at least 20 mm and a diameter <40 mm were deemed necessary. Our criteria for oversizing have changed with time. At the beginning of our experience, the goal of TEVAR was to achieve lesion exclusion and we used a 20% oversizing for all the different diseases. Furthermore, at the beginning of our experience, the range of stent-graft diameter available was limited when compared with the broad range of stent-graft diameters currently available. However, complications related to excessive oversizing such as stent-graft collapse and RAD have prompted us to change our surgical strategy. Oversizing is currently moderate (maximum, 15%) and depends on the disease: 10% to 15% for traumatic transection and degenerative aneurysm, 10% for chronic aortic dissection, and 5% for acute aortic dissection.

According to the classification proposed by Fillinger and colleagues[18] patients were divided into 5 groups based to the proximal landing zone (Figure E1).

Study protocols were in accordance with the Declaration of Helsinki and were approved by the Montpellier Institutional Review Board.

Procedure

In case of pathologies involving the aortic arch, successful stent-graft placement required supra-aortic vessel (SAV) debranching before stent-graft deployment to achieve a suitable proximal landing zone. Technical details of SAV debranching have been described in previous publications.[7,8,19] In case of staged procedure, 1 week was observed between debranching and TEVAR. Prophylactic use of cerebrospinal fluid drainage to prevent spinal cord ischemia (SCI) was not used.

In cases where overstenting of the origin of the left subclavian artery (LSA) was necessary, revascularization was systematic in elective cases and in emergent patients without unstable hemodynamic status at the time of treatment.

In a few cases, overstenting of the celiac aorta was deemed necessary. Visceral debranching was performed via a prosthetic bypass from the aorta or iliac artery to the celiac trunk (CT), superior mesenteric artery (SMA), and/or renal arteries.

After achieving suitable landing zones, endograft deployment was performed. Technical details on endograft deployment have been described in previous publications.[7,8,19] After deployment, stent-graft modeling with a low-pressure balloon was performed, except in dissection cases.

Outcome criteria were defined according to the Reporting Standards for Thoracic Endovascular Aortic Repair.[18] Technical success required successful introduction and successful deployment of the device in the absence of surgical conversion to open repair, death ≤24 hours, type I or III endoleaks as evidenced by procedural angiography, or graft obstruction. Follow-up included clinical examination and computed tomography scans during hospital stay, at 1 month, 6 months, and yearly thereafter.

Statistics

Primary research concerned all patients and pathology outcomes. Pathology-specific mortality analyses were presented as secondary objectives without adjusted *P* value for multiple comparisons.

Descriptive data were summarized as mean ± standard deviation or median with interquartile range according to the normality of the distribution, assessed with the Shapiro-Wilk test and compared with Mann-Whitney *U* or *t* test. Categorical data were expressed as number and percentages and compared with a χ^2 analysis.

Early outcome data were analyzed using logistic regression after calibration using the Hosmer-Lemeshow goodness-of-fit test. Late outcome is a time-related data point and was analyzed using a Cox regression model. Every variable associated with a *P* value below .20 in the univariate analysis was entered into multivariate models. A stepwise procedure was used to obtain the final multivariate model.

Survival status was assessed by the Kaplan-Meier method and compared between groups with the log-rank test.

Statistical analysis was performed using R Software version 3.1.0 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

We performed 223 thoracic aortic stent-grafting procedures from November 1998 to January 2013. The number of patients treated in each calendar year is reported in Figure E2. A total of 280 endografts were deployed (Table E1). There was no evidence for propensity for certain types of grafts for certain pathologies or zones. Patient demographic data are described in Table E2.

Distribution of pathologies treated included aneurysm group (n = 101; 45%), traumatic transections (n = 59; 26%), acute and chronic dissections (n = 51; 23%), and septic pathologies (n = 12; 5%). Procedure was emergent in 121 patients (54%), including 93 aortic ruptures (42%); 102 (46%) procedures were elective.

In the aneurysm group, there were 87 degenerative aneurysms, 9 anastomotic pseudoaneurysms, and 5 penetrating ulcers. Thirty-two procedures were emergent, including 24 aortic ruptures.

In the dissection group, there were 25 chronic dissections (including 1 aortic rupture) and 26 type B acute dissections with 8 aortic ruptures, 5 malperfusions, 7 patients with best medical treatment having rapid aortic expansion, and 6 uncomplicated patients included in the Acute Dissection: Stent Graft or Best Medical Therapy (ADSORB) study.[20]

In the traumatic group, diagnosis of aortic disruption was achieved at initial admission for 50 patients. Thirty-three (56%) had TEVAR procedure during the first 24 hours. The delay between the time of aortic disruption and endovascular treatment was <5 days for 82% of patients with a mean interval of 4.1 ± 8.8 days. For 6 patients, treatment was delayed due to septic state or major cerebral lesions.