

A Review of the Endovascular Management of Thoracic Aortic Pathology



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Background	Thoracic endovascular aortic repair (TEVAR) has recently gained popularity, but there is ongoing debate surrounding its safety and efficacy. We present 13 years of TEVAR experience at our institution.
Methods	Data from procedures performed between September 2000 and October 2013 were sourced. Eighty-one TEVARs were performed in 72 patients for various disorders of the thoracic aorta.
Results	The mean duration of follow-up was 62 months (range, 2–140 months). One-month, one-year, and five-year survival rates were 93%, 88%, and 63%, respectively. Five mortalities occurred within 30 days of operation (7%), three of which were related to vascular complications. There were 12 episodes of postoperative endoleak (12.5%). The left subclavian artery was covered without revascularisation in nine cases resulting in two episodes of subclavian steal syndrome and one episode of left arm claudication. Three patients had perioperative strokes, and one patient spinal cord ischaemia.
Conclusions	We demonstrated low rates of reintervention after TEVAR and a low risk of complications, particularly neurological. We therefore advocate an endovascular approach for thoracic pathology involving the aortic arch and descending aorta, particularly in elderly patients. Coverage of the LSCA is often necessary, but where possible, prophylactic revascularisation should be performed.
Keywords	Endovascular • Thoracic aorta • Aneurysm • Dissection • Endoleak • Subclavian artery

Introduction

In 1994, Dake et al. published the first series of thoracic endovascular aortic repairs (TEVAR) [1]. TEVAR offers a less invasive alternative to the traditional open thoracic aortic repair, providing a new option to patients who were previously deemed unsuitable for open operation. In the late 1990s, the development of aortic arch debranching in combination with endovascular grafting further broadened the scope of TEVAR to enable endovascular treatment of aortic arch, or near-arch pathology [2].

TEVAR has rapidly gained popularity, but there is ongoing debate surrounding its safety and efficacy. Whilst a wealth of data have suggested that TEVAR is superior to open repair

with respect to early mortality and major complications, including spinal cord ischaemia, postoperative bleeding, and renal impairment, no randomised controlled trials that compare TEVAR with open repair have been performed to date [3]. In addition, a long-term survival benefit of TEVAR is yet to be demonstrated [4,5].

Little has been reported on the Australian experience with TEVAR. We aimed to present 13 years of experience with TEVAR at the Royal North Shore Hospital (RNSH).

Materials and Methods

Ethics approval of this study was obtained from the RNSH ethics committee.

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Data were sourced from private and public hospital medical records, medical imaging reports, and correspondence from general practitioners and other specialists. The most recent patient status with respect to quality of life was ascertained by liaising with general practitioners. Where relevant, the date of death was sourced from the Ryerson index [6].

Between September 2000 and October 2013, 81 endovascular procedures were performed in 72 patients for various disorders of the thoracic aorta at RNSH public and private hospitals. Nine repeat endovascular procedures were performed for postoperative endoleak. Three ascending aortic replacements for type A aortic dissections were performed prior to TEVAR. The endoluminal approach alone was used for 48 primary procedures. In 24 cases, the procedures were performed in a hybrid manner. In 14 of the 24 cases, debranching and stenting were performed as part of the same procedure, whereas in 10 cases, these were performed as separate procedures.

The series consisted of 49 men and 23 women, with a mean age at operation of 70 years (range, 17–89 years).

The indications for operation included 37 atherosclerotic aneurysms (26 elective and 11 emergency presentations); nine traumatic disruptions of the thoracic aorta; six penetrating aortic ulcers; five false aneurysms, one of which was mycotic; five chronic type B dissections with either persistent pain or ongoing expansion of the false lumen; three acute type B dissections with significant pseudocoarctation; three chronic sequelae of previously treated type A dissections; one acute type A dissection in a 92-year-old woman; one coarctation of the aorta; and one case of an infected sinus related to a previous open ascending aorta repair.

Results

Thirty-one patients presented with chest or thoracic back pain, and an additional nine with post-traumatic chest pain. Twenty-four cases were detected incidentally. Two cases presented with acute haemoptysis; two, with a new cerebrovascular accident in conjunction with chest pain; and two, with syncope and chest pain. Two presentations were attributable to aneurysmal compression of surrounding structures: one case presented with shortness of breath due to bronchial compression; and the other with dysphonia related to compression of the recurrent laryngeal nerve. One patient presented with poorly controlled hypertension and was found to have a juxtaductal coarctation of the aorta. Four patients were haemodynamically unstable at presentation.

For the purposes of this study, the ascending aorta was defined as extending from the aortic root to the origin right brachiocephalic artery; the aortic arch, as extending from the right brachiocephalic artery to the attachment of the ligamentum arteriosum; and the descending aorta as the segment of the aorta distal to this. Disease was most commonly localised to the proximal descending aorta (32 cases) and aortic arch (15 cases). In 11 cases disease spanned the thoracoabdominal aorta (Crawford classification: three, type 1; one, type 2; three, type 3; none, type 4; four, type 5) [19]. In

eight cases, the disease was localised to the distal descending thoracic aorta; and in six cases, the disease was confined to the mid descending thoracic aorta. The mean aneurysm size at operation was 63 mm (21 [saccular] to 90 mm).

The mean patient follow-up duration was 62 months (range, 2–140 months). One-month, one-year, and five-year survival rates were 93%, 88%, and 63% respectively.

The following stent grafts were used: Valiant/Talent (37 cases), Zenith (17 cases), Gore (13 cases), Talent (eight cases), Cook (three cases), Relay (two cases), Aneurx (one case), and Palmaz (one case). Stent size varied in diameter from 26 to 42 mm. The median stent width was 34 mm. Smaller widths were predominantly utilised in the distal thoracic aorta, and larger widths, in the proximal descending thoracic aorta.

Relevant patient comorbidities included hypertension (40 cases), chronic kidney disease defined by an estimated glomerular filtration rate < 60 mL/min (15 cases), ischaemic heart disease (14 cases), chronic obstructive pulmonary disease (10 cases), obesity (seven cases), and diabetes (six cases).

A preoperative spinal drain was inserted in 23 patients for spinal cord protection. The decision to insert a drain was based on the risk of spinal cord ischaemia predicted by the extent of aortic coverage required, a history of previous abdominal aortic aneurysm (AAA) repair, and whether or not the left subclavian artery (LSCA) was to be covered.

One patient required urgent conversion to an open procedure for a complication related to vascular access. The patient recovered well and later underwent an uncomplicated TEVAR.

Thirty-Day Mortality

Five mortalities occurred within 30 days of operation, three of which were related to vascular complications. Early death occurred in three patients who underwent elective operation and in two patients who presented as emergencies.

A 73-year-old woman died after an extensive bowel infarction secondary to hypoperfusion after a hybrid repair of a thoracoabdominal aneurysm. An 80-year-old woman died of ischaemic bowel related to hypoperfusion following hybrid repair of a large type 1b endoleak. A 79-year-old man died from pneumonia after a TEVAR eroded into his oesophagus.

Another two patients died of extravascular complications. A 21-year-old man presented with a traumatic aortic tear after a motor vehicle accident. A TEVAR was performed with successful exclusion of the defect, but the patient died one week later due to head injuries. An 80-year-old man with multiple comorbidities presented with a large thoracoabdominal aneurysm at risk of imminent rupture. He was unsuitable for an open procedure because of respiratory disease. An endoluminal repair with a custom-made fenestrated graft was performed. The patient could not be extubated and died from type 2 respiratory failure secondary to pneumonia.

Endoleak

Table 1 summarises 12 episodes of postoperative endoleak. Two type 2 endoleaks were small enough to be managed conservatively and closed without intervention after

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