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20 Tevars in 10 Months: Our Early Experiences and Learning Points as the Emerging Referral Center for TEVAR

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Abstract **Review Article**

Thoracic Endovascular Aortic Repair (TEVAR) is becoming increasingly adopted minimally invasive approach for managing thoracic aorta pathologies. We present the early outcomes of our first 20 TEVAR cases performed over a 10-month period in our centre. The mean age of patients is 39.15 ± 15.17 years old with predominantly male patients (85.0%). The most common indication was BTAI (80.0%), followed by type B aortic dissection (TBAD) (10.0%) and pseudoaneurysm (10.0%). 14 patients underwent TEVAR Zone 2 implantation; 5 patients underwent TEVAR Zone 3 implantations, and 1 patient with Zone 1 implantation. Mean intensive care unit (ICU) stay was 2.26 ± 1.28 days. There were no cases of spinal cord ischemia, type I or III endoleaks, no new dissections, no aortic thrombosis, no aneurysm expansion at 6 weeks computed tomography (CT) follow-up. There was one case of aortic rupture of which was converted to open surgical repair on cardiopulmonary bypass (CPB) who was discharged home later. Freedom from surgical reintervention was 100.0% at 6 months. One patient had stent migration partially occluding the left subclavian artery, and eventually had a stroke and succumbed to sepsis secondary to perforated gallbladder empyema. Early imaging follow-up showed satisfactory graft positioning and exclusion of the pathology in all patients. Left common carotid to left subclavian artery bypass can be done with a single supraclavicular incision. We switched to reinforced polytetrafluoroethylene (PTFE) grafts for better resistance against kinking. High-risk cases or cases with challenging anatomy should involve cardiothoracic team to ensure rescue capability with cardiopulmonary bypass. Early multi-disciplinary team involvement can ensure good surgical outcomes. Our early experience demonstrates that TEVAR provides good short-term outcomes even in early adoption phase. District outreach programme to raise awareness and aortic dissection network are crucial steps to improve timely management of thoracic aortic diseases.

Keyword: TEVAR; thoracic aorta; aortic dissection; aortic aneurysm; learning points; early experiences.

INTRODUCTION

Thoracic endovascular aortic repair (TEVAR) is becoming an increasingly adopted minimally invasive approach for managing thoracic aorta pathologies. The recent European Society of Cardiology (ESC) guideline recommends considering TEVAR for uncomplicated cases of aortic aneurysm, type B aortic dissection (TBAD) and blunt traumatic aortic injury (BTAI) (Mazzolai *et al.,*2024). Conventional open surgeries for aortic diseases are often associated with high morbidity and mortality rates, including complications such as spinal cord ischaemia, kidney injuries, and bowel ischaemia (Tan *et al.,*2019; Nor Elina *et al.,*2013). Endovascular repair offers an alternative with lower rates of complications and shorter operating time (Nor Elina *et al.,*2013).

Between September 2024 to July 2025, our centre has successfully performed 20 TEVAR cases within the span of 10 months. We present the early outcomes, as well as some of the learning points that we've accrued along the way.

EARLY RESULTS

From our first 20 cases of TEVARs, the mean age of the patients is 39.15 ± 15.17 years old. Our patients are predominantly male (17, 85.0%). The most common indication for TEVAR is BTAI, consisting of 80% of the total cases followed by an equal number of cases of TBAD and aortic aneurysm with 2 cases (10.0%) each.

Most of our patients underwent Zone 2 TEVAR implantation (14, 70.0%) with left subclavian-left carotid artery bypass done in the same setting. 5 patients (25.0%) underwent Zone 3 implantation, while 1 patient (5.0%)

underwent Zone 1 implantation with concurrent carotid-carotid-left subclavian artery bypass done. Of the 15 cases with neck bypass performed, earlier cases were done with non-reinforced polytetrafluoroethylene (PTFE) graft, while for more recent cases we've migrated to using reinforced PTFE grafts.

Figure 1: Patient demographics from our first 20 TEVAR cases (BTAI: blunt traumatic aortic injury, TBAD: type-B aortic dissection, PTFE: polytetrafluoroethylene)

	N = 20
Age (Years)	39.15 ± 15.17
Gender	
Male	17 (85.0%)
Female	3 (15.0%)
Diagnosis	
BTAI	16 (80.0%)
TBAD	2 (10.0%)
Aortic aneurysm	2 (10.0%)
Implantation zones	
Zone 1	1 (5.0%)
Zone 2	14 (70.0%)
Zone 3	5 (25.0%)
Neck bypass done	
Yes	15 (75.0%)
No	5 (25.0%)
Conduit for neck bypass	
PTFE (non-reinforced)	10 (66.7%)
PTFE (reinforced)	5 (33.3%)

Our mean intensive care unit (ICU) stay is 2.26 ± 1.28 days. We recorded no endoleak, spinal cord ischaemia, bowel ischaemia, new aortic dissections, aortic thrombosis or aortic aneurysm expansion at 6 weeks computed tomography (CT) follow up. Early imaging follow-up showed satisfactory graft positioning and exclusion of the pathology in all patients. Freedom from surgical intervention at 6-months is 100.0%.

We recorded one mortality which was non-related to TEVAR. This is a case of stent migration at 1 month post-operatively, causing poor flow to the left subclavian artery. Patient unfortunately developed cerebrovascular event and during the same hospital stay, he eventually succumbed to sepsis due to a perforated gallbladder empyema.

There was also another case of BTAI where the patient developed acute rupture of the dissection while performing TEVAR implantation. The patient was quickly put on cardiopulmonary bypass (CPB) and surgery was converted to open repair. Patient was successfully discharged post-operatively.

Figure 2: Early outcomes from our first 20 TEVAR cases (ICU: intensive care unit)

	N = 20
ICU stay (days)	2.26 ± 1.28
Patient outcome	
Alive	19 (95.0%)
Dead	1 (5.0%)
Other complications	
Cerebrovascular accident	1 (5.0%)
Stent migration	1 (5.0%)
Endoleak	0 (0.0%)
Spinal cord ischaemia	0 (0.0%)
Bowel ischaemia	0 (0.0%)
New aortic dissections	0 (0.0%)
Aortic thrombosis	0 (0.0%)
Aortic aneurysm expansion	0 (0.0%)

LEARNING POINTS

Surgical access for neck bypass

TEVAR grafts require a minimum of 20mm long proximal landing site to avoid endoleak and stent migration (Nation *et al.,*2015). If the site of dissection, transection or aneurysm is in close proximity to the arch branches of the aorta, a neck bypass (either carotid – carotid – left subclavian or left carotid – subclavian

bypass) may be necessary. In our centre all Zone 2 TEVAR implantations were done with concurrent left subclavian to left common carotid artery bypass.

In earlier cases, two separate incisions were made to expose both the arteries: a supraclavicular incision to expose the subclavian artery, and another incision parallel to the left sternocleidomastoid muscle (SCM) to expose the left common carotid artery. We eventually migrated to the method of using only a supraclavicular incision just lateral to the clavicular head. Decent exposure of the left common carotid artery can be achieved by mobilising the platysma and subcutaneous tissue (Han *et al.,*2016).

Neck bypass is an indispensable skill that makes Zones 1 and 2 TEVAR implants possible. These have been shown to have good early and long-term outcomes for the treatment of TBAD and aortic aneurysms (Kudo *et al.,*2025). Newer fenestrated grafts may eliminate the need for neck bypass in future TEVAR cases without sacrificing the perfusion to the vessels (Nation *et al.,*2015).

Choice of conduit

Studies have shown that polytetrafluoroethylene (PTFE) grafts are better conduit choice compared to Dacron grafts and saphenous vein grafts (Law *et al.,*1995; Veldenz *et al.,*2005). In our centre earlier neck bypasses were performed using non-reinforced PTFE grafts. For the most recent 5 cases we've opted to use reinforced PTFE grafts as they provide better resistance to compression and flexion forces (Magee *et al.,*1992). The shift was made in the hopes that the graft will be more resilient to accidental kinks during the patients' normal neck movements. Further studies comparing the long-term patency between the non-reinforced and reinforced grafts may provide us with a better insight into the choice of conduit.

Importance of cardiac surgery involvement

In one of our cases a patient was referred to us for BTAI secondary to a motor-vehicle accident. While performing TEVAR implantation the dissected aorta ruptured, followed by sudden and rapid loss of blood pressure. Immediate sternotomy with femoral cannulation for CPB was done. Operation was converted to open replacement of the aorta with interposition graft. Patient was subsequently discharged home.

Immediate rupture of the aorta is a rare but potentially fatal complication of TEVAR (Zipfel *et al.,*2007). The ability to rapidly convert to open surgery and timely establishment of CPB could result in the life or death of the patient. In BTAI with challenging anatomy, we are of the opinion that involvement of the cardiothoracic team in the TEVAR is crucial to ensure immediate rescue capability. For high-risk cases or challenging anatomy cases, consider having a CPB machine on standby to shorten the time required to put patient on bypass.

Multi-disciplinary team approach

Early multi-disciplinary team (MDT) discussion even at the pre-planning stage can ensure good outcomes for the surgery. Discussion with radiology and vascular teams could identify vascular access and the potential challenges and how to avoid them. In challenging or high-risk cases early discussion with the anaesthetists and perfusionists can be considered to standby a CPB machine in the event of the devastating rupture of the aorta.

MDT extends to the referring hospitals or health facilities as well. Running parallel to our TEVAR programme are other initiatives such as our district outreach programme and aortic dissection network. These programmes aim to educate the public and district healthcare personnel in identifying aortic diseases early and to refer them to the hospitals with aortic surgery capabilities in a timely manner. By reducing the delay from diagnosing the patient to getting the patient on the operating table we hope to improve the overall outcome of patients with aortic diseases.

Conclusion

Our early experience demonstrates that TEVAR provides good short-term outcomes even in the early adoption phase. District outreach programme to raise awareness and aortic dissection network are crucial steps to improve timely management of thoracic aortic diseases.

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