CASE SERIES

Endovascular aortic repair: Single centre experience of thoracic endovascular aortic repair and endovascular aneurysm repair

Faizan Nihal[1], Talha Kareem[2], Omer Ehsan[3], Muhammad Adeel Ahmed[4], Nazish Ali[5], Zahid Amin[6]

Abstract

This retrospective case series evaluates the experience of endovascular aortic repair procedures at a single centre in Pakistan, focussing on patient selection, procedural feasibility, and associated challenges. The study includes 21 patients (six women and 15 men) who underwent various endovascular interventions: six received endovascular aneurysm repair (EVAR), one underwent fenestrated EVAR (FEVAR), 12 had thoracic endovascular aortic repair (TEVAR), and two underwent interventions for aortic coarctation. Of these procedures, seven were performed in emergency settings, while fourteen were elective.

The results highlight the effectiveness of endovascular techniques in reducing operative mortality and morbidity for aortic aneurysms and dissections. However, limited accessibility in Pakistan due to high costs and scarcity of specialised referral centres restricts widespread implementation. Strengthening vascular services, improving affordability, and increasing awareness among healthcare professionals and patients could enhance the adoption of these life-saving procedures.

Keywords: EVAR, TEVAR, Endovascular repair, Abdominal aortic aneurysm, FEVAR, Vascular interventions, Aortic coarctation.

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Introduction

The field of aortic disease management is undergoing remarkable advancements, allowing for improved care of an increasing number of elderly and high-risk patients.[1] Over the past two decades, mortality following the rupture of an abdominal aortic aneurysm (AAA) has declined by 50%, reflecting progress in early diagnosis, treatment strategies, and overall disease management. Additionally, our understanding of the genetic[2] and environmental factors[3] contributing to AAA has evolved significantly, further refining patient risk assessment and management approaches.

Screening programmes estimate the prevalence of AAA to be between 4% and 8%, with men being disproportionately affected.[4] Given that the risk of rupture is directly correlated with the size of the aneurysm,[5] prophylactic repair is recommended in appropriate cases to prevent catastrophic outcomes. Three major randomised trials comparing endovascular aneurysm repair (EVAR) with open surgical repair have consistently demonstrated that EVAR is associated with lower 30-day operative mortality,[6,7] making it a preferred, minimally invasive alternative. The advantages of EVAR, including reduced hospitalisation, lower morbidity, and improved short-term survival, have contributed to its widespread adoption as a primary treatment modality.

Endovascular aortic procedures, such as angioplasty and stent-grafting, are now commonly utilised for the management of aortic aneurysms, dissections, traumatic transections, and occlusive disease. However, their feasibility in developing countries remains uncertain due to challenges such as financial constraints, limited access to specialised centres, and a shortage of trained vascular specialists.

This study aims to evaluate the criteria for patient selection, considerations in procedural approaches, and the overall feasibility of conducting EVAR and TEVAR in Pakistan. It also seeks to identify the challenges associated with the routine implementation of these procedures in a resource-limited

Table-1: Overview of patients who had EVAR.

Total Patients	6
Mean Age (years)	72.6±6.5
Elective/Emergency	5/1
Aorto-iliac aneurysms	2
Infra renal aneurysms	3
Juxta Renal aneurysms	1
FEVAR	1
Post-Operative Endo leak	3

*EVAR = Endovascular Aneurysm Repair; *FEVAR = Fenestrated Endovascular Aortic Repair

[1-3]Department of Vascular Surgery, Shifa International Hospital, Islamabad, Pakistan [4,5]Department of General Surgery, Shifa International Hospital, Islamabad, Pakistan; [6]Department of Interventional Radiology, Shifa International Hospital, Islamabad, Pakistan.

Correspondence: Muhammad Adeel Ahmed.
e-mail: adeelhashmi4462@gmail.com

ORCID ID: 0000-0002-1617-345X

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Table-2: Overview of patients who underwent TEVAR.

Total Patients	12
Mean Age (years)	62.5 (±10.1)
Elective/Emergency	5/7
TAI Grade 3 injury	2
TAI Grade 2 injury	5
Stanford type B dissection	1
Saccular descending aortic aneurysm	3
Mycotic descending aortic aneurysm	1
Endo-leak	None

*TEVAR = Thoracic Endovascular Aortic Repair; *TAI = Traumatic Aortic Injury

setting. Informed consent was obtained from all patients prior to their inclusion in this case series, in compliance with hospital policies and ethical guidelines.

Case Series

Methods and Materials: This retrospective case series was conducted at the Vascular Surgery Department of University Hospital Islamabad, analysing patients who underwent endovascular aortic procedures between January 2018 and December 2022. The study included 21 patients who received endovascular interventions for various aortic pathologies, including abdominal aortic aneurysm (AAA), thoracic aortic aneurysm, aortic dissection, and aortic coarctation.

Selection criteria included those patient with suitable anatomical characteristics for endovascular repair, high surgical risk for open repair, or emergency presentations requiring immediate intervention. Data was collected on patient demographics, clinical presentations, peri-operative details, procedural outcomes, and post-operative complications.

The procedures were performed by a multidisciplinary team comprising vascular surgeons and interventional radiologists. Standardised protocols were followed for pre-operative assessment, stent graft selection, and procedural execution. Post-operative follow-up was conducted at one and six months using clinical evaluations and imaging studies to assess outcomes and complications.

Results

Among the 21 patients, 15 (71.4%) were males and 6 (28.6%) were females, with a mean age 68.4±8.2 years. The most common indication for intervention was aneurysmal disease, followed by aortic dissection and traumatic aortic injuries. Seven (33.3%) patients underwent emergency procedures, while 14 (66.7%) had elective interventions.

Procedural Details

- EVAR (Endovascular Aneurysm Repair): Performed in six patients with infrarenal abdominal aortic aneurysms. The mean aneurysm size was 9.4±0.6cm (range: 8.2–10.6 cm). One patient underwent fenestrated EVAR (FEVAR) due to the involvement of visceral arteries.
- TEVAR (Thoracic Endovascular Aneurysm Repair): Conducted in 12 patients for thoracic aortic pathologies, including thoracic aneurysms (n=3), aortic dissection (n=3), and traumatic aortic injuries (n=6).
- Aortic Coarctation: Two patients with congenital aortic

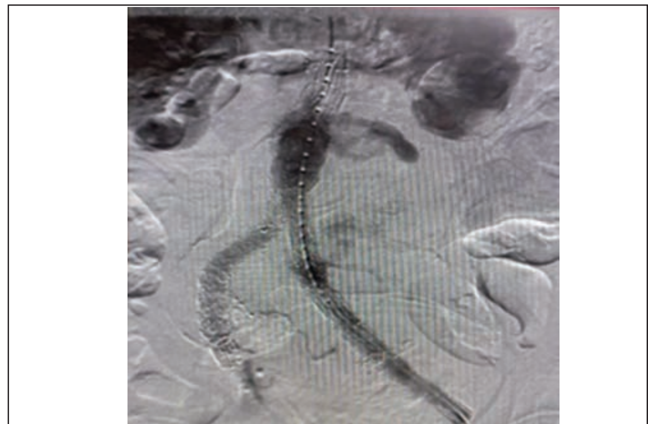

Figure-1: EVAR performed at our hospital.

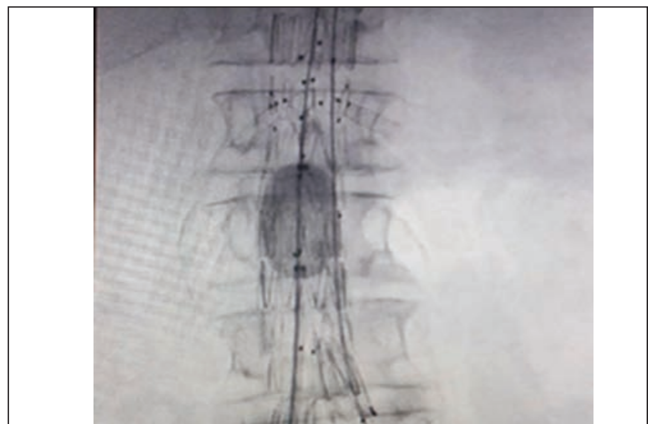

Figure-2: FEVAR with stenting of renal arteries and SMA.

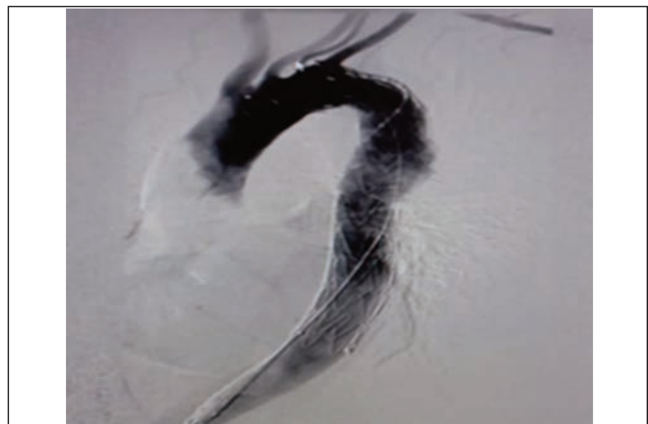

Figure-3: Elective TEVAR.

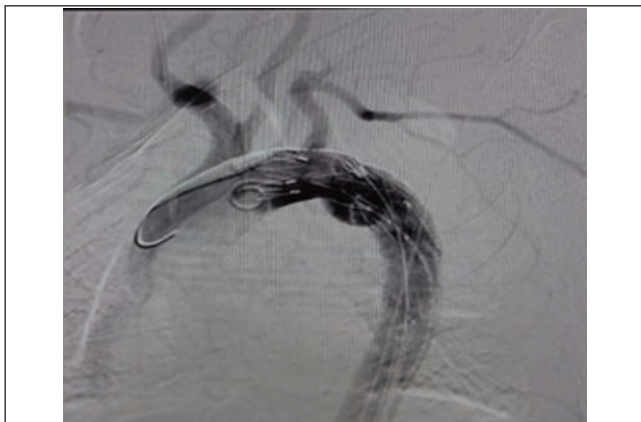

Figure-4: TEVAR for traumatic aortic injury.

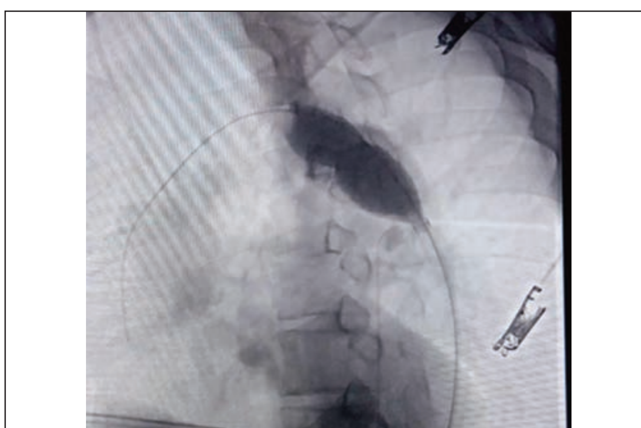

Figure-5: Aortic stenting with endovascular balloon dilation.

coarctation were treated using stent grafts and balloon dilatation.

Perioperative Morbidity and Mortality

- The 30-day mortality rate was 4.7% (1/21 patients), occurring in an emergency TEVAR case with traumatic aortic rupture.
- Complications occurred in 19.0% (4/21) of cases, including two type II endo-leaks post-EVAR requiring embolisation, one iliac limb occlusion managed with a secondary procedure, and one access-related complication requiring vascular repair.
- No major neurologic complications (paraplegia) or conversion to open surgery were reported.

Follow-up was completed in 17 (81%) patients, with a mean duration of 18 months. Two patients were lost to follow-up. At six months, all followed-up patients had patent stent grafts without evidence of endo-leak or graft migration.

Discussion

The UK EVAR trials[8,9] (EVAR 1 and EVAR 2) remain the most significant sources of evidence supporting the use of EVAR. In the EVAR 1 trial,[8] 30-day mortality data demonstrated a substantial advantage for EVAR (1.7%) compared to open surgery (4.7%). However, by four years, the all-cause mortality for both the procedures became identical (28%), with a slight difference in aneurysm-related mortality favouring EVAR (4% vs. 7%). EVAR 2 was designed to assess the role of EVAR in patients deemed unfit for open surgery.[6] This study reported a higher 30-day operative mortality rate of 7.3% for EVAR compared to EVAR 1 and observed no significant survival benefit in patients who were unable to undergo open surgical repair. Additionally, EVAR was noted to be costly and did not improve long-term survival in this subset of patients. More recently, the US OVER (Veteran Affairs Open vs. Endovascular Repair) trial 9 demonstrated a lower 30-day mortality rate for EVAR (0.5%) when compared to open repair (3.0%).[9]

Despite the well-documented benefits of EVAR in reducing early mortality, the situation in Pakistan presents unique challenges. Currently, there is no nationwide AAA screening programme, leading to the detection of most AAAs at an advanced stage, primarily in older patients. Since AAA repair is often considered a preventive procedure for asymptomatic individuals, conveying the urgency, cost implications, and associated risks to the patients remains a significant challenge. Moreover, the availability of endovascular equipment is restricted to only a few specialised centres. Even when the necessary tools are accessible, the supply of stent grafts remains limited, and there is a severe shortage of trained endovascular surgeons. This not only reduces the number of procedures performed but also hinders the training of new vascular specialists.

The financial burden of EVAR in Pakistan is another major barrier to its widespread adoption. Stent grafts alone cost between 1.5 to 1.8 million rupees, and the total expense for an endovascular procedure, including hospital and equipment charges, amounts to 2.5 to 03 million rupees. In contrast, open surgical repair, including ICU stay and operation theatre costs, is significantly lower at around one million rupees. This stark cost difference is a key factor influencing patients to opt for open surgery instead of the endovascular approach.

Post-operative surveillance is another critical issue. Current guidelines[10] recommend a six-month CT scan after EVAR, followed by annual follow-ups for 10 to 15 years to monitor for potential re-interventions.[10] However, long-term follow-up data in the present cohort is lacking. Out of all the patients treated, four were lost to follow-up, and the remaining have only returned for a single evaluation within the past three years. A key reason for this poor follow-up rate is the scarcity of vascular clinics across Pakistan,

making it difficult for patients to return for routine post-operative assessments.

This case series underscores the infrequent use of EVAR at this institution, highlighting the need for improved referral pathways and awareness among both physicians and patients. To address these challenges, vascular units across Pakistan should focus on awareness campaigns targetting both internists and potential patients to encourage timely referrals. Additionally, expanding the availability of stent grafts, endovascular grafts, and hybrid operating theatres is essential to increase procedural volumes. A significant step forward would be the inclusion of endovascular aortic procedures under Pakistan's Medicare programme (Sehat Card). If successfully implemented, this could drastically reduce procedure costs, increase the number of EVAR and TEVAR cases, improve training opportunities for local surgeons, and enhance the availability of necessary equipment, ultimately leading to better patient outcomes and wider adoption of minimally invasive aortic repair techniques.

Conclusion

This study underscores the feasibility of EVAR and TEVAR in Pakistan but highlights significant financial, logistical, and follow-up challenges. Comparative data from other LMICs reinforce the fact that cost, infrastructure, and referral networks remain the key barriers to widespread adoption. To improve access, policy interventions, cost-reduction strategies, and better surveillance programmes are urgently needed.

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