Endovascular Aneurysm Repair: Paradigm Shift in a Low Volume Centre

Anthony Gikonyo*, Matu Macharia, Isaac Adembesa, Shrikant Panchal, Dan Gikonyo, Josiah Ruturi and Premanand Ponooth

The Karen Hospital Hospital, Nairobi, Kenya

*Corresponding Author: Anthony Gikonyo, The Karen Hospital Hospital, Nairobi, Kenya.

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Abstract

Aortic aneurysm incidence is increasing in Kenya. Open surgical repair has been the standard of care. We present four cases of endovascular aneurysm repair at a single centre. This technique may be a suitable alternative to open repair, especially in a low volume centre and provide a higher success rate of repair.

Keywords: Aortic Aneurysm; Endovascular Aneurysm Repair; Thoracic Endovascular Aneurysm Repair

Background

Descending thoracic aortic aneurysms, similar to other aneurysms, are often incidentally diagnosed in patients with unrelated complaints. Most individuals with asymptomatic descending thoracic aortic aneurysms may be safely managed with cardiovascular risk factor modification until the aneurysm size reaches 6 cm [1].

Abdominal aortic aneurysm refers to abdominal aortic dilation of 3.0 cm or greater. The main risk factors are age older than 65 years, male sex, and smoking history. Diagnosis may be made by physical examination, an incidental finding on imaging, or ultrasonography. Ruptured abdominal aortic aneurysm is a medical emergency presenting with hypotension, shooting abdominal or back pain, and a pulsatile abdominal mass. Emergent surgical intervention is indicated for a rupture but has a high operative mortality rate [2].

Earlier studies from Southern Africa suggested abdominal aortic aneurysms as uncommon amongst Africans, however recent reports from Africa emphasize an increasing incidence of vascular diseases and its sequelae including abdominal aortic aneurysm [2]. In 1985 Robbs described a series of 494 patients in South Africa presenting with peripheral vascular disease to a single arterial clinic over 2 years claiming that in 82.6% atherosclerosis was responsible. In Zimbabwe between 1974 to 1984 there were 249 cases of aortic aneurysm from 2 clinical centres [4].

Current incidence and prevalence of aortic aneurysm in Kenya is unknown. A retrospective study in Kenya, from 1998 to 2007 at tertiary referral centre that receives 80,000 inpatients per year from the entire East and Central African regions identified two hundred sixty-four (92 male and 172 female patients) files were analysed of patients with confirmed aortic aneurysms. The mean age was 56.15 years. Two hundred twenty-three (84.5%) aneurysms occurred in the abdominal aorta, followed by the descending aorta (7.5%), ascending aorta, (3.8%) and arch (1.9%). In 2.3% of cases, both the abdominal and thoracic aortas were affected. Pain with swelling or a pulsatile mass was the predominant symptom. More than 50% of the cases were diagnosed by means of ultrasonographic analysis. Sixty-one (23.1%) aneurysms were ruptured, and of this group, 44 (72.1%) patients died. Successful open surgical repair was done in 157 (59.5%) patients. Hypertension was the primary risk factor in 137 (51.9%) cases [5].

One hundred and thirty-four autopsy cases of cardiovascular related deaths examined in Kenya, from 2005 to 2009, illustrated cardiovascular causes comprised 13.2% of all autopsy cases, with ruptured aortic aneurysm 11.2% [6]. An earlier study from Uganda from 1968 to 1970, of 1170 necropsies, found 29 cases of aortopathy [7].

Open surgical repair has been the standard approach. Important issues in aortic aneurysm management are the effects of clamping and unclamping the aorta, if prolonged, leading to pulmonary edema, intracranial hypertension, ischemic damage- renal, spinal cord or extremities [3].

The first endovascular repair of an abdominal aortic aneurysm (EVAR) was performed by Dr. Juan Parodi in 1990 in Argentina. The first clinical experience with transfemoral insertion of an endovascular bifurcated graft for repair of an abdominal aortic aneurysm was in 1994 by Dr Chuter [8]. In 2003, EVAR surpassed open surgical repair, as the most common technique for repair of aortic aneurysm repair [9]. In 2010, endovascular aneurysm repair, accounted for 78% of all intact abdominal aortic aneurysm repair in the United States [10].

We report our experience of the management of aortic aneurysms using endovascular aneurysm repair stents, EVAR (Endovascular Aneurysm Repair) and TEVAR (Thoracic Endovascular Aneurysm Repair) between January to September 2018.

Methods and Materials

The heart team consists primarily of the cardiothoracic/vascular surgeon, cardiologist, cardiac anaesthetist, cardiac nurses in theatre and cardiac catheterization laboratory, perfusionists and technicians. This team reviewed all the cases referred for endovascular repair and decided on suitability of procedure. There were 2 elective cases and 2 emergent cases, all had CT aortograms except for one patient with ruptured abdominal aortic aneurysm who was diagnosed on abdominal ultrasound. CT aortograms were analysed using the 3 Mensio software to ensure adequate 20mm landing zones distal to left subclavian or renal arteries, proper sizing of grafts and adequate distance form celiac artery and both internal iliac arteries. Medtronic Valiant Thoracic and Endurant II Stent Abdominal graft ere used. Access was via cutdown of both femoral arteries. Certain cases required 5Fr pigtail catheter inserted from either left or right radial artery to confirm landing zone and anatomy of aneurysm or dissection. A stiff Amplatz wire delivered from the femoral artery using 5Fr JR4 or pigtail catheter initially placed with Terumo exchange wire. The position of the vessels marked on screen with an erasable marker to assist with stent deployment. Contralateral limb of EVAR Endurant II Stent cannulated with either Cobra, JR4 or AR2 diagnostic catheters. Confirmation of being in lumen of stent with rotation of pigtail and angiogram. Procedures performed under general anaesthesia.

Case

Case One

50-year-old female woken up by sudden onset of abdominal pain with history of hypertension. A diagnosis of ruptured Abdominal Aortic Aneurysm (AAA) was made on ultrasound, and transferred for definitive management. Successful EVAR deployed within 3 hours of hospital admission. Post discharge complicated by recurrent abdominal pain with no evidence of endoleak.
Case Two

51-year-old male with intermittent chest pain past few years, worse on presentation, with history of dyslipidaemia. Chest x-ray showed widened mediastinum, CT Aortogram confirmed descending aortic aneurysm with possible dissection. Post discharge complicated by recurrent fevers managed with antibiotics.

![Figure 2: CT Aortogram of TEVAR for descending aortic dissection.](image)

Case Three

47-year-old male with vague abdominal discomfort, bilateral leg weakness and history of hypertension and tobacco abuse. Diagnosis of aneurysm on CT angiogram. Preoperative preparation complicated by alcohol and nicotine detoxication prior to EVAR. Post-operative care complicated by groin wound, healed after one month.

![Figure 3: CT aortogram pre and post endovascular aneurysm repair of abdominal aortic aneurysm.](image)
Case Four

51-year-old male presented with chest pain, onset one year ago. History significant for trauma in 2006. CT aortogram showed a descending aortic aneurysm. Elective TEVAR was successful, and postoperative period uneventful.

**Figure 4:** CT aortogram of thoracic aortic aneurysm, pre and post endovascular aneurysm repair.

Discussion

Aneurysm repair is indicated for patients with aneurysm greater than 5.5 cm in diameter. Majority of patients will qualify for both procedures, however certain anatomical criteria are required for successful endovascular repair and if these are not met then an open procedure or hybrid procedure is indicated. Adequate iliac/femoral access that is compatible with vascular access techniques is mandatory. Thoracic aneurysm repair requires non-aneurysmal aortic diameter in the range of 18 - 42 mm, and non-aneurysmal aortic proximal and distal neck lengths ≥ 20 mm, which avoid the left subclavian artery proximally and celiac axis distally. Abdominal aneurysm repair, devices and/or accessories, proximal neck length of ≥ 10 mm, infrarenal neck angulation of ≤ 60°, aortic neck diameters with a range of 19

to 32 mm, distal fixation length(s) of ≥ 15 mm, iliac diameters with a range of 8 to 25 mm and morphology suitable for aneurysm repair. Contraindications, are conditions that threaten to infect the graft. Patients with known sensitivities or allergies to the device materials.

The EVAR trial demonstrated that in patients with large AAAs, treatment by EVAR reduced the 30-day operative mortality by two-thirds compared with open repair [11]. This was further affirmed by the DREAM trialists, where endovascular repair was preferable to open repair in patients who had an abdominal aortic aneurysm that was at least 5 cm in diameter [12]. Long term data from 12 years of follow-up, showed there were no survival differences between patients who underwent open or endovascular abdominal aortic aneurysm repair [13]. The OVER trial with follow-up to 9 years, showed survival, quality of life, costs, and cost-effectiveness did not differ between elective open and endovascular repair of AAA [14].

Compared to open repair, endovascular repair has shown a decreased operative mortality rate and shorter hospital stay. There is however an indication that more repeat procedures are required with endovascular repair and long term durability data is limited. Furthermore long term surveillance and regular imaging of the graft are required.

Our nascent experience of endovascular aneurysm repair is in keeping with the initial mortality benefit highlighted by the trials. The above patients, based on prior statistics, would have a 60% operative success rate. Furthermore, the learning curve for endovascular repair, allowed a quicker transfer of skills from proctor to trainee team, to independently perform these procedures safely with an acceptable 30-day mortality rate.

**Conclusion**

In a low volume centre endovascular repair may be a preferable approach with 30 day outcomes similar to high volume open repair centres. The heart team is an essential part of the multidisciplinary management of these patients. Collaboration within the cardiac catheterisation laboratory between the cardiologist, cardiovascular surgeon and cardiac anaesthetist to perform these procedures is essential and provides an alternative and safe approach to open repair.

**Bibliography**


