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ORIGINAL RESEARCH REPORT

Aortic aneurysm: A life-threatening condition in a low-resource nation

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ABSTRACT

Background: Aortic aneurysm is said to be uncommon in the black population; however, with the modification in lifestyle of the dark-skinned people, and improved diagnostic facilities in Sub-Saharan African nations, a surge in its presentation is more likely. If undiagnosed, aortic aneurysm can be catastrophic. We determined the epidemiology pattern and outcome of aortic aneurysm at our institution. **Materials and Methods:** This is a retrospective analysis of patients who presented with aortic aneurysm from 2000 to 2017. A pro forma was designed to analyze the bio data, characteristics of the aneurysms, clinical manifestation, treatment, and outcome. The Crawford, Stanford, and DeBakey criteria were used to classify the aortic aneurysm. The surgical management of the aneurysm was resection and its replacement with synthetic polytetrafluoroethylene prosthesis with antibiotic prophylaxis under general anesthesia. **Results:** A total of 17 patients were recruited, with a mean age of 62.75 ± 20.92 years. A high proportion were above 65 years, i.e., 7 (41.2%), and male gender, i.e., 10 (58.8%). The most common location of aortic aneurysm using Crawford criteria was Type IV followed by Type I, with Stanford criteria being Stanford Type B (13) and with DeBakey being Type III (3). Five operated were fusiform in shape. A higher proportion of patients, i.e., 14 (82.4%), had coexisting hypertension, and a positive history of smoking, i.e., 7 (41.2%). The 30-day mortality was 64.7%, the operative mortality was 35.3%, and three patients (17.6%) were loss to follow-up. A positive history of smoking increased the risk of dead, relative risk 3.375, 95% confidence interval 0.677–5.909, $P = 0.04$. **Conclusion:** Aortic aneurysm, though uncommon, is not a rare disease among cardiovascular disorders in a low-resource environment. The most common shape and location were fusiform and Stanford Type B or DeBakey Type III, respectively. There was associated high 30-day mortality (64.7%).

Key words: Abdominal aortic aneurysm, outcome, pattern

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INTRODUCTION

Aortic aneurysm is described as a constant focal dilation of the aorta with a diameter of at least 50% more than its normal diameter.[1] However, the abdominal aorta is said to have an aneurysm when the distal aorta is dilated to a diameter larger than 3 cm.[2] Aortic aneurysms are divided into thoracic aortic aneurysms (TAAs), thoraco-abdominal aortic aneurysms (TAAAs), and AAAs. TAAs may develop at any of the aortic segments which include the aortic root, ascending aorta, aortic arch, and descending thoracic aorta.[3] Ascending aortic aneurysm may involve the aortic root and annulus and terminate distally at the origin of the innominate artery while descending TAA occurs after the takeoff of the left subclavian artery. Thoraco-abdominal aneurysms involve thoracic aneurysms extending distally to the abdomen.

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AAA can be suprarenal or infrarenal. Crawford,[4] Stanford,[5] and DeBakey[6] at different time classified aortic aneurysm based on the anatomical location.[4-7] Aneurysm can also be classified based on the shape of the bulge or the lesion. Saccular aneurysms are asymmetrical and appear on the one side of the aorta. They are usually caused by injury or a severe aortic ulcer. Fusiform aneurysms are most common and appear as symmetrical bulges around the circumference of the aorta. The AAA expands at a variable rate of 2–4 mm/year until rupture. The saccular aneurysms tend to grow more rapidly than fusiform aneurysms and often rupture and result in compression symptoms.[3,7]

The reported risk factor for the development of an aortic aneurysm includes age over 65 years, male gender, smoking, hypertension, dyslipidemia, coronary artery disease, and positive family history.[3,8] It appears to have a lower incidence in black Africans when compared to Caucasians.[3,9,10] The symptoms of aortic aneurysm are usually nonspecific and varies from dull abdomen or low back aches to severe chest pain, indicating imminent rupture.[8,11,12] The diagnosis of aortic aneurysm is often made as an incidental finding on imaging studies, such as abdominal ultrasonography or computerized tomography (CT); however, it may occasionally be visible on plain radiography if the aneurysm wall is calcified.[1,8,11]

The management of aortic aneurysm depends on the diameter at presentation, rate of growth, location, and presence of symptoms or signs that may suggest impending rupture. The current modality of management includes lifestyle modification, medical treatment (doxycycline, propranolol), open surgery, and endovascular procedures. Open surgery is performed in most low-resource countries.[10,11,13,14] However, endovascular stent grafting for AAAs has become popular in both Europe and the USA.[15] Aortic aneurysm at any segment can cause distal embolization of clot or atheromatous debris that gradually obliterate and thrombosed distal visceral and lower extremity arteries.[6,8] Advancement in imaging technology has greatly assisted in the diagnosis of aortic aneurysms. Computerized axial tomography scan (CT scan) and magnetic resonance angiography provide excellent images adequate for preoperative planning either for open or endovascular procedures. Contemporary data from western population have suggested a measurably notable prevalence of aortic aneurysms; however, reports about this disease in Sub-Saharan Africa are scanty. This retrospective study determined the pathological pattern and outcome of aortic aneurysm at our center.

MATERIALS AND METHODS

This retrospective case series included 17 patients with CT diagnosis with aortic aneurysm from June 2001 till June 2017. The study was conducted in a hospital-based setting in Lagos, Nigeria. The following data were retrieved from patient's case note; patient's age and sex, location and diameter of the aneurysm, associated risk factors, treatment, and outcome. The data collected were input into the Statistical Programme for Social Sciences (SPSS) version 21.0 for windows computer program (SPSS Inc., Chicago, IL, USA), and were analyzed.

Definitions

The aneurysm resections were described as elective when a planned procedure was performed, or urgent when rapid expansion in the size of aneurysm or the sudden onset of symptoms with a tender aneurysm on palpation necessitated operation, but at which, nevertheless, the aneurysm was intact. Aneurysmal rupture defined as leakage associated with a frank retroperitoneal or intraperitoneal hemorrhage.[16] The 30-day mortality is defined as death that occurred during or following aneurysm resection at any time during the initial hospital admission and in the first 30-day period after operation.[16]

Classification on anatomical location

Crawford in 1986 described TAAA based on the anatomical extent of the aneurysm.

Type I involves a greater proportion of the descending thoracic aorta from the origin of the left subclavian to the suprarenal abdominal aorta. Type II is the most extensive, extending from the subclavian to the aortoiliac bifurcation. Type III involves the distal thoracic aorta to the diaphragm. Type IV is limited to the abdominal aorta below the diaphragm.[4] Safi's group modified the classification by adding Type V, which extends from the distal thoracic aorta including the celiac and superior mesenteric origins but does not involve the renal arteries.[5] DeBakey classification divides dissections into:

Type I involves ascending and descending aorta (= Stanford A). Type II involves ascending aorta only (= Stanford A). Type III involves descending aorta only, commencing after the origin of the left subclavian artery (= Stanford B).[6]

Operative techniques

Open repair laparotomy was adopted for all the infrarenal AAAs using transperitoneal approach under general anesthesia relaxant technique according to the patients need. The ligament of Treitz was divided and the retroperitoneal duodenum segments were mobilized and retracted. The aneurysm sac was opened with evacuation of clots, bleeding lumbar vessels were tied off, and preclotted 20-mm polytetrafluoroethylene (PTFE) graft was laid and sutured end to end with prolene 3/0 sutures on atraumatic needle. The clamps were released

thereafter; some bleeding points at the anastomotic sites were sutured and distal embolectomy with Fogarty catheter of size 3 Fr before final closure of the distal anastomosis. The aneurysmal sac was wrapped around the graft; peritoneal cavity was generously lavaged with normal saline with a drain inserted followed with wound closure. All the patients had friendly infrarenal neck for clamping. Anticoagulation with unfractionated heparin was commenced before proximal and distal clamping. The level of anticoagulation was assessed with activated clotting time. Glyceryl trinitrate (GTN) was used to reduce the blood pressure during aortic clamping. Only one patient had intra-arterial blood pressure monitoring. At the end of surgery, the patient was transferred to the intensive care unit for critical care and elective mechanical ventilation for 48 h.

Intraoperative finding

All patients had fusiform aneurysm involving the aorta with no involvement of the common iliac arteries. Three aneurysmal sac contained clots and thrombosed inferior mesenteric arteries. In one patient, there was retroperitoneal clot with no detectable area of aneurysmal leak.

RESULTS

A total of 17 patients were recruited, with a mean age of 62.75 ± 20.92 years. A high proportion of patients were above 65 years, i.e., 7 (41.2%), and males, i.e., 10 (58.8%). The mean age in male was 59.70 ± 6.64 years compared with their female counterpart 76.00 ± 4.29 years, $P = 0.4$. The median diameter of an aneurysm was 6.7 cm (25^{th}–75^{th} percentile 6.23–7.35 cm). The most common location of aortic aneurysm using Crawford criteria was Type IV followed by Type I, with Stanford criteria being Stanford Type B (13) and with DeBakey being Type III (3) [Table 1 and Figure 1].

There were 9 (52.9%) ruptured aortic aneurysm during study; 1 (5.9%) at presentation, and 8 (47.1%) while on admission awaiting surgical intervention. Aortic dissection and aortic calcification were observed in one patient each, respectively (5.9%).

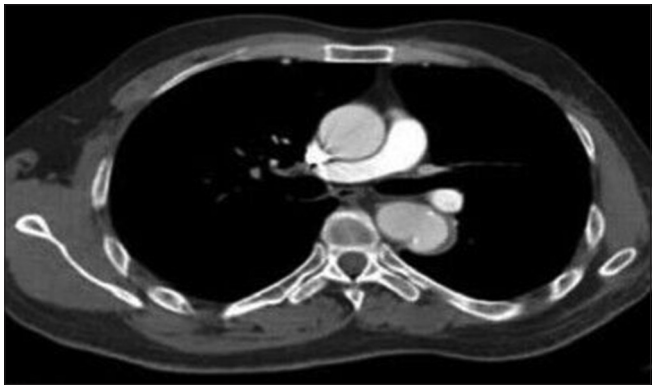

Figure 1: Abdominal aortic aneurysm

The most frequent presenting complaint was pain, i.e., 8 (47.1%), either as dull abdominal aches, i.e., 7 (41.2%) or throbbing chest pain, i.e., 1 (5.9%), followed by incidental finding in 5 (29.4%) patients; other symptoms included dysphagia hoarseness of voice and hematemesis in 1 (5.9%) patient each, respectively.

A higher proportion of patients 14 (82.4%) had coexisting hypertension, and a positive history of smoking, i.e., 8 (47.1%), while only one patient (5.8%) had associated Marfan syndrome.

Five patients (29.4%) had corrective surgery; others were managed conservatively with propanolol while awaiting surgical intervention. The 30-day mortality was 64.7%, the operative mortality was 35.3%, and three patients (17.6%) were loss to follow-up.

A positive history of smoking increased the risk of dead, relative risk 3.375, 95% confidence interval 0.677–5.909, $P = 0.04$ [Table 2].

DISCUSSION

Aortic aneurysm described as a constant focal dilatation of the aorta in its courses is not an uncommon presentation at our institution, and it was accompanied by a high mortality

Table 1: The classification of aortic aneurysm using Crawford, Stanford, and DeBakey criteria

Classification of aortic aneurysm					
Crawford (*n*=17)		Stanford (*n*=17)		DeBakey (*n*=17)	
Type	Frequency	Type	Frequency	Type	Frequency
I	2	A	4	1	2
II	1	B	13	II	2
III	1			II	13
IV	12				
V	1				

Table 2: Univariate analysis of determinants of 30 days mortality in patients with abdominal aortic aneurysm

Variables	OR	95% CI	*P* (Fisher's exact)
Age>65 years	0.29	0.04-2.32	0.25
Sex	0.88	0.11-7.11	0.66
Smoking	0.08	0.006-0.94	0.04
Alcohol	1.000	0.48-2.08	0.60
Hypertension	1.38	0.96-1.98	0.52
Rupture aneurysm	5.5	1.57-19.27	0.02*
Aneurysm size >6.5 cm	1.2	0.16-8.79	0.91
Intervention (surgery)	0.38	0.04-2.99	0.46

Values are OR, 95% CI, and *P* value (Fisher's exact). *Indicate level of significant. OR=Odd ratio, CI=Confidence interval

rate. Other scholars, however, have suggested that it is rare in the black patient[3,9] and sparse in Nigeria, with 3–5 infrarenal aortic aneurysm over a 10-year period,[10,17] It has been suggested that the low occurrence in the black Africans may not be due to a rare occurrence, but probably due to inadequate report of cases, and comatose health infrastructure in the continent.[10,13,14] However, with the changing lifestyle among black Africans, and improved diagnostic facilities, a surge in presentation is most likely.[10,14]

We observed that the mean age at presentation was around 67 years; however, three patients (17.7%) presented before the age of 40 years, and this is contrary to previous reports that the median age was between 44.5 and 56.15 years and that 21% of black Africans presented before the age of 40 years.[2,4] It has been reported that aneurysms occur 10–15 years earlier in black Africans than in Caucasians 66.3–75 years.[3,14] Bengtsson *et al*.[18] calculated the average age and sex-specific frequency of AAA based on a necropsy study of 45835 autopsies over 30 years. They observed that the frequency of AAA in men was 4.3% (two times higher than in women). In, addition, the frequency increased rapidly after the age of 55 in men, reaching a peak prevalence of 5.9% at 80–85 years, and then decreased. However, the rise in frequency started 15 years later in women than in their male counterpart, after the age of 70, reaching 4.5% in those above the age of 90 years.[18] The heterogeneity in age at presentation was attributed to varying etiology, in the elderly patient usually due to atherosclerotic changes,[1,3,13] while in the younger population, tuberculous arthritis, bacterial infection, HIV infection, trauma, and connective tissue disease were implicated.[3,9,12] This was illustrated in our study, where a 28-year-old male patient with Marfan syndrome presented with aortic aneurysm. There are, however, conflicting reports on the gender distribution,[19] while some scholars have reported a male preponderance,[9,11,17] and some suggested female preponderances;[8,19] on the contrary, a study conducted in South Africa reported that there was no gender bias.[3] The protective effect of estrogen and the negative effect of testosterone on the aorta have been proposed as a reason for the observed gender variation in those studies.[11,19] Other reasons for the heterogeneity in gender predominance included geographical location,[8,9,19] ethnicity,[9,19] and presence of comorbid conditions.[3,9]

We observed that pain (8, 47.1%) and incidental finding (29.4%) constituted a high proportion of symptom. Other included dysphagia, hoarseness in voice, hematemesis, and aortic rupture. The pain was mainly dull abdominal aches in 41.2% and throbbing chest pain in 5.9%. The presence of severe chest pain has been shown to signal imminent rupture.[8] Two patients in our study presented with complications involving the esophagus, dysphagia, and hematemesis. These are rare complications of thoracic aneurysm which is secondary to compression and erosion of the esophagus by a large aneurysm, and such occurrence is usually fatal. It is therefore not surprising that the patient with hematemesis eventually died from massive hemorrhage while that with dysphagia was lost to follow-up. A detailed history and thorough investigations would be appropriate in such atypical presentation.

We have demonstrated that aortic aneurysm was more common in the infrarenal aorta, with a high risk of occurrence in hypertensive and smokers. This is the general consensus on the characteristic of aortic aneurysm.[9,11,17] The risk factors observed with aortic aneurysm in our study included hypertension, smoking, and Marfan syndrome. This is agreement with previous studies,[3,9,10] however; other reported comorbid conditions included trauma (gunshot injury) and bacterial and HIV infections, especially in patients with femoral artery and other peripheral artery aneurysm.[3,8,13]

We observed that the diameter of an aortic aneurysm ranged from 5.5 to 8.2 cm, and this diameter was lower than a range of 8.0–15.0 cm in patients with infrarenal aortic aneurysm in an earlier study conducted in our country.[8,9] One patient in our study presented with a ruptured aneurysm; this was contrary to observation in previous studies with relatively large diameter of aneurysm.[8,9] The reason for this is unknown to the authors; however, they suggested that such huge aneurysms are sitting on a time bomb.[9] It is therefore not surprising that four patients in our cohort eventually ruptured and died while awaiting surgical intervention. Other scholars have, however, reported that the risk of aneurysmal rupture and death increases with increase in the size of the aneurysm.[20] An abdominal aorta typically enlarges at a rate of 2–8 mm/year.[20]

Five patients had surgical intervention with 40% operative mortality; this is higher than an operative mortality of 9.5% reported in Enugu.[13] The overall mortality of 64.7% is high; however, this is within the range of 26.1%–72.1% reported in other studies in the continent.[8,12,13] A positive history of smoking increased the risk of dead in our study. In our study, four patients died on the ward while awaiting surgical intervention. Variable confounding factors such as unavailability of PTFE graft, vasodilators such as GTN or sodium nitroprusside, intensive care bed space, and financial constraints were contributory. The high mortality rate observed in studies conducted in Sub-Saharan African countries; we attributed to delay in presentation and intervention due to comatose health infrastructures, and the unavailability of grafts, which are imported at presentation from Europe and America.[12,13] In countries with comatose infrastructure, continuous in-service training and upgrading of health care facilities will go a long way in reducing the morbidity and mortality associated with aortic aneurysm. To avert such preventable mortality, the United State Preventive Services Task Force recommended routine ultrasonography screening for

adults in the age range of 55–75 years.[9] The screening of men aged 65–75 years with a positive history of smoking has been reported to reduce AAA-specific mortality by 43% with an absolute risk reduction of 0.12%.[9]

Open repair laparotomy with transperitoneal approach was used in our patients with infrarenal aneurysm. This operative technique with inlay graft replacement is the most popular approach to the abdominal aorta.[21] The retroperitoneal approach, even though less widely used, was reported by many authors to be associated with reduced postoperative morbidity (such as ileus and pneumonia) and with shortened hospital stay.[21] However, endovascular aneurysm repair can be used when the facility is available and in high-risk patients.[15] This was, however, unavailable at our institution during the years in review. Five patients had surgical intervention with 40% operative mortality; this is higher than operative mortality of 9.5% reported in Enugu.[13] With the use of the Stanford classification of aortic dissection, we were only able to group 4 out of 17. Other limitation includes the retrospective nature which militates against the availability of images for and detailed data. Hence, we were unable to present some illustrations, and we could not determine confounding variables associated with the risk of developing aortic aneurysm and the outcome of aortic aneurysm.

CONCLUSION

We have demonstrated that aortic aneurysm is an emerging cardiovascular disorder in the black African, and there is need for a high index of suspicion even in a seemingly bizarre complaint.

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Conflicts of interest
There are no conflicts of interest.

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