Prevalence and Epidemiological Pattern of Abdominal Aortic Aneurysms in Africa: A Systematic Review

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Abstract

Introduction: The incidence of abdominal aortic aneurysms (AAAs) in high-income countries has been declining in the last three decades. However, in most low-income and middle-income countries especially in Africa, little is known about its burden. The absence of screening services for AAA in African countries makes it difficult to detect and promptly manage AAA before rupture, which has significant implications for mortality. This study sought to systematically assess the prevalence of AAA amongst patients visiting hospitals in Africa and evaluate its epidemiological pattern. **Materials and Methods:** A systematic review was performed on the EMBASE, GLOBAL HEALTH, MEDLINE, and PUBMED databases. The review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses statement standards and protocol registered with PROSPERO (CRD42020162214). A data extraction tool was used to get relevant information from these studies. Quality assessment and risk of bias were performed using the Newcastle Ottawa Scale for cross-sectional studies. Results were summarised in tables, figures, and a forest plot. A narrative synthesis approach of the articles was taken. **Results:** Two hundred and sixty-one studies were identified and after the exclusion of 246, a final 15 were deemed suitable for analysis. A total of 4012 participants were screened for AAA and of these, 129 cases were identified. The prevalence of AAA in these studies ranged from 0.7 to 6.4%. Male participants accounted for 115 (89.1%) of the cases. There was a wide age range (31–72 years) reflective of both its possible infective and degenerative aetiology. AAA was reported to be associated with hypertension, smoking, advanced age, coronary artery disease, and HIV infection. There was no association between AAA and diabetes. Over 50% of cases were identified incidentally. About one-third (23–54%) of the participants presented aortic rupture with a mortality rate ranging between 65 and 72%. **Conclusions:** AAA prevalence in Africa is probably higher than the current thinking as there is no baseline data to compare with. Aetiologically, AAA was shown to be associated with hypertension, smoking, coronary artery disease, and possibly infectious pathologies like HIV. Large epidemiological studies would help better characterise AAA in this setting. Lastly, efforts targeting the reduction of the risk factors for AAA would go a long way in reducing the burden of AAA.

Keywords: *Abdominal aortic aneurysms, Africa, low-income and middle-income countries, prevalence*

Abstract

Introduction: L'incidence des Anévrismes Aortiques Abdominaux (AAA) dans les pays à hauts revenus est en déclin depuis les trois dernières décennies. En revanche, dans la plupart des pays à faibles et moyens revenus, particulièrement en Afrique, le fardeau représenté est peu connu. L'absence de service de dépistage des AAA dans les pays africains en rend la détection difficile ainsi que la gestion immédiate avant rupture, ce qui a des répercussions importantes sur la mortalité. Cette étude cherche à évaluer systématiquement la prévalence des AAA parmi les patients qui visitent les hôpitaux en Afrique et à évaluer son profil épidémiologique. **Procédés:** Une revue systématique a été réalisée sur les bases de données EMBASE, GLOBAL HEALTH, MEDLINE et PUBMED. La revue a été menée conformément aux normes et au protocole des Éléments de Rapport Préférés pour les Examens Systématiques et les Méta-Analyses (Preferred Reporting Items for Systematic Reviews and Meta-analyses) enregistrés auprès de PROSPERO (CRD42020162214). Un outil d'extraction de données a été utilisé afin d'obtenir des informations pertinentes de ces études. L'évaluation de la qualité et le risque de partialité a été effectuée au moyen de l'Échelle de Newcastle Ottawa pour les études transversales. Les résultats ont été récapitulés dans des tableaux, des graphiques et un "graphique en forêt" (forest plot). Une approche de synthèse narrative des articles a été adoptée. **Résultats:** Deux cent soixante et une (261) études ont été identifiées et après exclusion de 246, les 15 dernières ont été jugées appropriées pour l'analyse. Un total de 4012 participants ont été dépistés

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pour des AAA et, parmi ceux-ci, 129 cas ont été identifiés. La prévalence des AAA de ces études s'étendait de 0.7% à 6.4%. Les hommes représentent 115 (89.1%) des cas. Il a été noté une grande amplitude d'âges (31–72 ans) représentative de sa possible étiologie infectieuse comme dégénérative. Les AAA ont été rapportés en association avec l'hypertension, le tabagisme, l'âge avancé, la maladie coronarienne et la séropositivité. Il n'y a pas eu d'association entre les AAA et le diabète. Plus de 50% des cas ont été incidemment identifiés. Environ un tiers (23–54%) a été présenté en tant que rupture aortique avec un taux de mortalité compris entre 65% et 72%.

Conclusions: La prévalence des AAA en Afrique est probablement supérieure à l'état actuel de la réflexion étant donné qu'il n'y a pas de données de référence auxquelles la comparer. Étiologiquement, les AAA ont démontré être associés à l'hypertension, au tabagisme, à la maladie coronarienne et éventuellement aux pathologies infectieuses comme le VIH. Des études épidémiologiques de grande envergure permettraient de mieux déterminer les AAA dans un tel cadre. Enfin, les efforts visant à réduire les facteurs de risque pour les AAA contribueraient grandement à réduire le fardeau des AAA.

Mots clés: *Afrique, anévrismes abdominaux aortiques, pays à faibles et moyens revenus, prévalence*

Introduction

The Lancet Commission on Global Surgery highlighted surgery as a neglected component of health systems with over 30% of the global disease burden attributable to surgical conditions.[1] Abdominal aortic aneurysm (AAA) is one of the main vascular surgical conditions that pose a significant health challenge globally.[2] Although the burden of AAA in high-income countries has significantly decreased over the last three decades,[3-5] low-income and middle-income countries still struggle with a rising burden, with epidemiological studies indicating an increase in the incidence and prevalence of AAA due to an ageing population, increase in smoking and a rising burden of hypertension and coronary heart disease.[6,7] AAA poses a significant mortality threat if not identified early because of rupture with a mortality rate as high as 65–80% even in high-income countries.[8,9]

The challenge presented by AAA in Africa is growing, with modelled projections indicating a rise in Disability-Adjusted Life Years by 35% from 1990 to 2017.[10] Although this may partly be explained by the increase in population, other plausible explanations include an increasing burden of noncommunicable diseases, and that AAA affects a much younger population (10–15 years younger) than in the western countries.[11-13] There are no national screening programs in African countries for the early detection of AAA, which worsens prognoses. Further, the continent carries over 70% of the global burden of HIV as well as other infections such as *Streptococcus*, Tuberculosis, and Schistosomiasis that have all also been associated with increased risk of developing AAA.[14-18] These challenges coupled with weak health systems across the continent may explain the growing AAA burden.[19]

Very little is known about the actual prevalence of AAA in the African continent. Major global systematic reviews and meta-analyses on AAA commonly exclude Africa.[20-22] Since no African country currently has a national screening program for AAA, most of the cases are detected either as an incidental finding on imaging for nonaneurysmal indications or when they present with symptoms consistent with a large aneurysm at high risk of rupture.[7,23] In addition, deaths primarily attributable to AAA may not be captured in available data because of a general cultural aversion towards autopsies.[6,7] Even with early identification of AAA, gold standard care may not be possible as this requires consistent and costly follow-up measuring of aortic diameter growth, which may be unaffordable for the average patient in this setting.

A better understanding of the prevalence of AAA in Africa is required as this will provide an insight into the burden of this disease and also inform screening and risk prevention policies. This is especially pressing with the increasing burden of risk factors for AAA from both noncommunicable and communicable diseases. To date, no systematic review has been undertaken on prevalence, epidemiological patterns, and the management of AAA in Africa.

Objectives of the study

The primary objective of this study was to determine the prevalence of AAA among patients visiting hospitals in Africa. The secondary objectives were to assess the epidemiological patterns and risk factors for AAA as reported in the studies conducted in the region thus far to help characterise the nature of the disease in Africa and provide a baseline for further work in the field.

Materials and Methods

Design

This was a systematic review of studies on the prevalence and epidemiological pattern of AAA among patients visiting hospitals in Africa. The objectives, outcome measures, inclusion and exclusion criteria as well as methods of analysis were summarised in a protocol and registered with Prospective Register of Systematic Reviews in Healthcare and Social Care PROSPERO (CRD42020162214) before the formal review commenced.

Search strategy

Several databases were searched for relevant studies and these included MEDLINE, EMBASE, Global Health, and PubMed. The studies from the individual databases were collated and duplicates were eliminated. These studies were further taken through the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) protocol analysis to identify the studies most suitable to answer the

question. References of all the relevant studies were also reviewed for additional potentially useful articles. Both free and controlled texts were used for the terms to ensure that the search was as comprehensive as possible. Key terms used in the search included "aortic aneurysms," "intimal medial mucoid degeneration," "abdominal aneurysm," "aorto-abdominal aneurysm," "Africa," "Sub-Saharan developing country," "prevalence," and "low-and-middle income country." We also included the names of each of the 54 African countries in our search terms.

Eligibility criteria

Because of a paucity of studies on the subject at hand in Africa, few exclusion requirements were applied. However, only those studies that provided clear and adequate information on their methods were included. A summary table of the inclusion and exclusion criteria is provided in Table 1.

Article selection and data extraction

Two independent reviewers (E.N. and J.W.) undertook the search and selection of the articles. Reasons for exclusion of studies were also reviewed by both reviewers and mutually agreed on. Any disagreements between the two reviewers were discussed and if no consensus was achieved, then one-third researcher was asked to adjudicate (R.L.). An established data extraction tool was used to collect relevant information from the studies. This included author name, study design, country of study, population screened, sample size, setting, study objectives, and prevalence of AAA, and of comorbidities/risk factors.

Assessment of risk of bias

The risk of bias and the quality of evidence of the cross-sectional studies were evaluated using the Newcastle-Ottawa scale.[24] This scale was adopted from the original design for cohort studies.[25] Each study was assessed on three key aspects: selection of study groups, comparability in design and analysis, and outcome.

Stars awarded in each section were reflective of the quality of the study. The maximum score was 10. The quality of the retrospective case series was assessed using a scale developed from Pierson,[26] Bradford Hill, and Newcastle Ottawa modifications. The scale has 4 domains: selection, ascertainment, causality, and reporting. There were eight leading questions from these domains but questions 4, 5, and

6 were excluded as they are specific for adverse drug reaction retrospective case series.[27]

Data synthesis

The key outcomes of interest were the prevalence and epidemiological pattern of AAA in Africa. Prevalence was defined as the number of cases of AAA divided by the number of participants screened, expressed as a percentage.

Individual prevalence from the studies was summarised in a table with their confidence intervals. There was further assessment of the suitability of data pooling and further meta-analysis based on the quality of the reviewed literature. Results were presented in tables and a forest plot. A narrative synthesis approach was taken to describe the epidemiological pattern including the age and sex distribution, types of aortic aneurysms, risk factors as well as the management options reported in the studies.

Results

Literature search results

Two hundred and sixty-one studies were obtained from white literature search and an additional five were retrieved through grey literature search. After removing duplicates, 245 studies remained. Of these, 220 were excluded for irrelevance or incorrect article type (letters, editorials, or case reports). A further eight studies were excluded because they measured the wrong outcome or did not provide adequate information on their methodology. In the final analysis, 15 (5.7%) of the total searched studies were deemed fit for analysis. Seven cross-sectional studies specifically addressed the question of AAA prevalence in their countries and eight retrospective case series addressed the epidemiological pattern and management approaches to AAA. The PRISMA flow diagram of the studies screened, assessed, and included in the study with reasons is presented in Figure 1. A summary of the studies included in the final analysis is presented in Table 2. Only 10 of the 54 African countries had studied the prevalence and/or epidemiological pattern of AAA. These countries are sparsely distributed in the continent as shown on the map in Figure 2 with six countries from Sub-Saharan Africa.

Results of risk of bias assessment

Quality assessment was performed for cross-sectional and retrospective case series. Three cross-sectional studies scored 7/10 and above.[28-30] Three studies scored 6/10[31-33] and one scored 4/10.[34] Of the retrospective case series, three studies

Table 1: Inclusion and exclusion criteria	
Inclusion and exclusion criteria	
Inclusion	**Exclusion**
■ Screening date from 1990 to 2019	■ Editorials
■ All sex	■ Case reports
■ All ethnic groups	■ Letters
■ All languages	■ Studies conducted before 1990
	■ Animal studies

scored 5/5,[13,16,35] three of them scored 4/5,[36-38] and two scored 3/5.[39,40] The summary of the quality assessment results is presented in Tables 3 and 4.

Outcome synthesis

Prevalence of aortic aneurysms in Africa

Seven studies reported on the prevalence of AAA.[28-34] A total of 4012 participants were screened and of these, 129 were found to have AAA. Of the seven studies, four were from North Africa, a predominantly Arab population, and the remaining three from Sub-Saharan Africa, composed predominantly of the black African population. The prevalence of AAA ranged from 0.7% to 6.4%. A forest plot of the event rates (prevalence of AAA) is presented in Figure 3. No further statistical analysis was performed due to the extensive methodological, clinical, and statistical heterogeneity amongst the studies.

Of the studies included in the review, two were from Egypt.[28,29] Shalaan *et al.* in 2015 screened 1048 patients who were above 50 years old visiting Alexandria Main University Hospital for nonaneurysmal presentations. In this study, 974 (92.9%) had normal aortic size, 18 (1.7%) had aortic dilatation (25–29 mm), and 56 had AAA giving a prevalence of 5.3%.[28]

Similarly, Shaker *et al.* in 2018 screened 1000 patients in Kasr Al-Ainy Hospital. The mean aortic suprarenal diameter (mm) was 18.6 (3.2) and 15 (1.5%) had AAA.[29]

There were two studies on AAA prevalence from Algeria.[30,31] Bouferrouk *et al.*[31] in 2016 reported a prevalence of 6.4% among 674 patients having echocardiography for suspected cardiac disease. Ouarab *et al.*[30] in a different part of Algeria 2 years later in 2018 reported a prevalence of 2.2% amongst patients reporting to the hospital for nonaneurysmal reasons.

Nseka *et al.*[34] conducted a screening study in Uganda in 2014 to establish the prevalence of AAA amongst hypertensive patients. This study reported a prevalence of 1.5% from the 353 patients who were screened. A similar study was conducted in South Africa by Rothberg *et al.*[33] in 2007 on the feasibility and affordability of an age-targeted screening for AAA found a prevalence of 5.3% in men over the age of 60 years. Of all these studies; however, the lowest prevalence was reported in Seychelles by Yerly *et al.* in 2012 where a prevalence of 0.7% and ectatic dilatation of the aorta (25 mm–29 mm) of 2% was reported among 353 participants above 60 years old.[32]
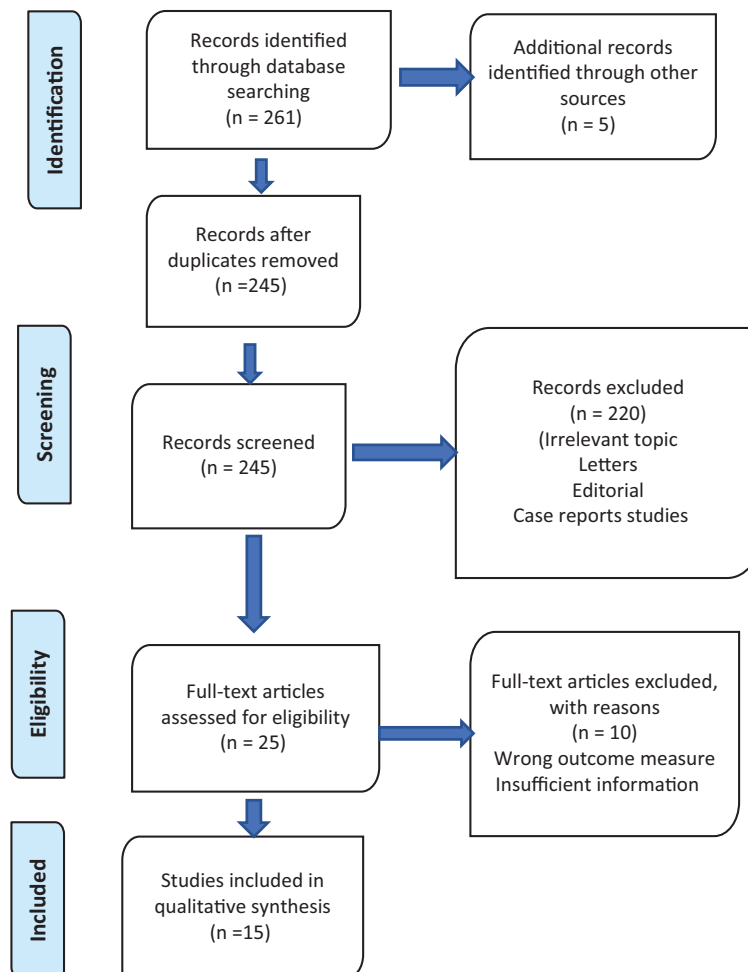

Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-analyses flowchart

<p align="center">Table 2: Summary of the studies included in the review</p>

Study title	Author and year	Study design	Country	Age (mean)	Population	Sample size	Prevalence% (95% CI)	Sex (cases of AAA)
1. Screening of the aneurysm of the abdominal aorta during the echo-cardiography: experience of an Algerian centre	Bouferrouk *et al.* (2016)[31]	Cross-sectional	Algeria	–	≥60 years	674	6.4 (4.5, 8.25)	M-452(29) F-222(2)
2. Screening for abdominal aortic aneurysms and analysis of the associated risk factors in a general population	Shalaan *et al.* (2015[28]	Cross-sectional	Egypt	–	≥50 years	1048	5.3 (3.94, 6.66)	M-630(53) F-418(3)
3. Low prevalence of abdominal aortic aneurysm in the Seychelles population of age 50–65 years	Yerly *et al.* (2012)[32]	Cross-sectional	Seychelles	55.4 ± 6.3	50-65 years	353	0.7 (–0.17, 1.57)	M-151(1) F-178(0)
4. Screening for abdominal aortic aneurysm – a pilot study in six medical schemes	Rothberg *et al.* (2007)[33]	Cross-sectional	South Africa	62.7 ± 4.2	60-65 years	207	5.3 (2.25, 8.35)	M-207(11) F-0(0)
5. Prevalence of aortic aneurysms at abdominal ultrasound and associated findings among hypertensive adults (≥50 years) at Mulago Hospital	Nseko *et al.* (2014)[34]	Cross-sectional study	Uganda	–	≥50 years Hypertensive patients	130	1.5 (–0.59, 3.59)	M-94(1) F-36(0)
6. Prevalence and risk factors of subrenal abdominal aortic aneurysm in an Algerian population aged over 60	Ouarab *et al.* (2018)[30]	Cross-sectional	Algeria	–	≥60 years	600	2.2 (1.03, 3.37)	M-424(11) F-176(2)
7. Frequency of abdominal aortic aneurysm in persons who have been examined with ultrasound at Kasr Al-Ainy Hospitals: a single-centre pilot study	Shaker *et al.* (2019)[29]	Cross-sectional	Egypt	57.97 ± 7.68	All patients ≥50 years	1000	1.5 (0.75, 2.25)	M-468(11) F-532(4)
8. Pattern of aortic aneurysms in an African country	Ogeng'o *et al.* (2010)[13]	Retrospective case series	Kenya	56.15 ± 22.1	All patients	254	NA	

Table 2: Continued

Study title	Author and year	Study design	Country	Age (mean)	Population	Sample size	Prevalence% (95% CI)	Sex (cases of AAA)
9. Pattern of Vascular Diseases at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia	Seyuom *et al.* (2019)[39]	Prospective Case series	Ethiopia	39.5 ± 10.2	All patients	384	NA	
10. A study of extracranial aneurysms at UNTH in Enugu, Nigeria	Eze *et al.* (2010)[41]	Retrospective case series	Nigeria	44.75 ± *6.2*	All patients	26	NA	
11. Aortic aneurysm: A life-threatening condition in a low-resource nation	Ogunleye *et al.* (2019)[35]	Retrospective case series	Nigeria	62.75 ± 20.92	All patients	17	NA	
12. Pattern of Arterial Aneurysms in Acquired Immunodeficiency Disease	Marks *et al.* (1995)[16]	Retrospective case series	Zimbabwe	–	All patients	28	NA	
13. Sudden cardiovascular deaths in adults: Study of 361 autopsy cases	Mesrati *et al.* (2017)[36]	Retrospective case series	Tunisia	55.75	All patients	361	NA	
14. Abdominal aortic aneurysm and the challenges of management in a developing country: A review of three cases	Sule *et al.* (2012)[37]	Retrospective case series	Nigeria	–	All patients	3	NA	
15. Cardiovascular causes of death in an east African country: an autopsy study	Ogeng'o *et al.* (2011)[65]	Retrospective case series	Kenya	–	All patients	134	NA	

The dashes (–) represent missing data, NA = not applicable

Epidemiological pattern and risk factors

Age and sex distribution

The majority of the aneurysms were infrarenal Crawford type IV.[13,28-33,35,40] Of the studies that reported on sex, men accounted for 115 (89%) of the cases. However, one retrospective study by Ogeng'o *et al.*[13] on patterns of AAA in Kenya found a male to female ratio of 1:1.9 among the cases. Further, age distribution varied widely (31–72 years). The mean age of the cases of AAA was 56.4 years.

Risk factors

Several factors were reported to be associated with AAA in these studies. Both Shalaan *et al.* and Shaker *et al.*[28,29] reported a statistically significant association between AAA

and advancing age ($P < 0.001$), male sex ($P < 0.001$), smoking ($P < 0.001$), hypertension ($P < 0.001$), coronary heart disease ($P < 0.001$), and peripheral arteriopathy ($P < 0.001$). However, both Shalaan *et al.* ($P = 0.668$) and Shaker *et al.* ($P = 0.208$) did not show any statistically significant association between diabetes and AAA. Ogeng'o *et al.*[13] found that AAA patients had co-existing hypertension in 51.5% and were smokers in 11.4%. Similarly, Ogunleye *et al.*[35] in Nigeria reported that AAA patients had hypertension in 14 (84.4%), and were smokers in 8 (47.6%), and 1 (5.8%) had Marfan's syndrome. Several retrospective case series also showed hypertension as a comorbidity in those that were diagnosed with AAA.[13,35,41] HIV infection was also associated with AAA as Marks *et al.*[16] reported in a retrospective case series of 28 patients with aneurysms among whom 12 (42.9%) were found to have HIV.
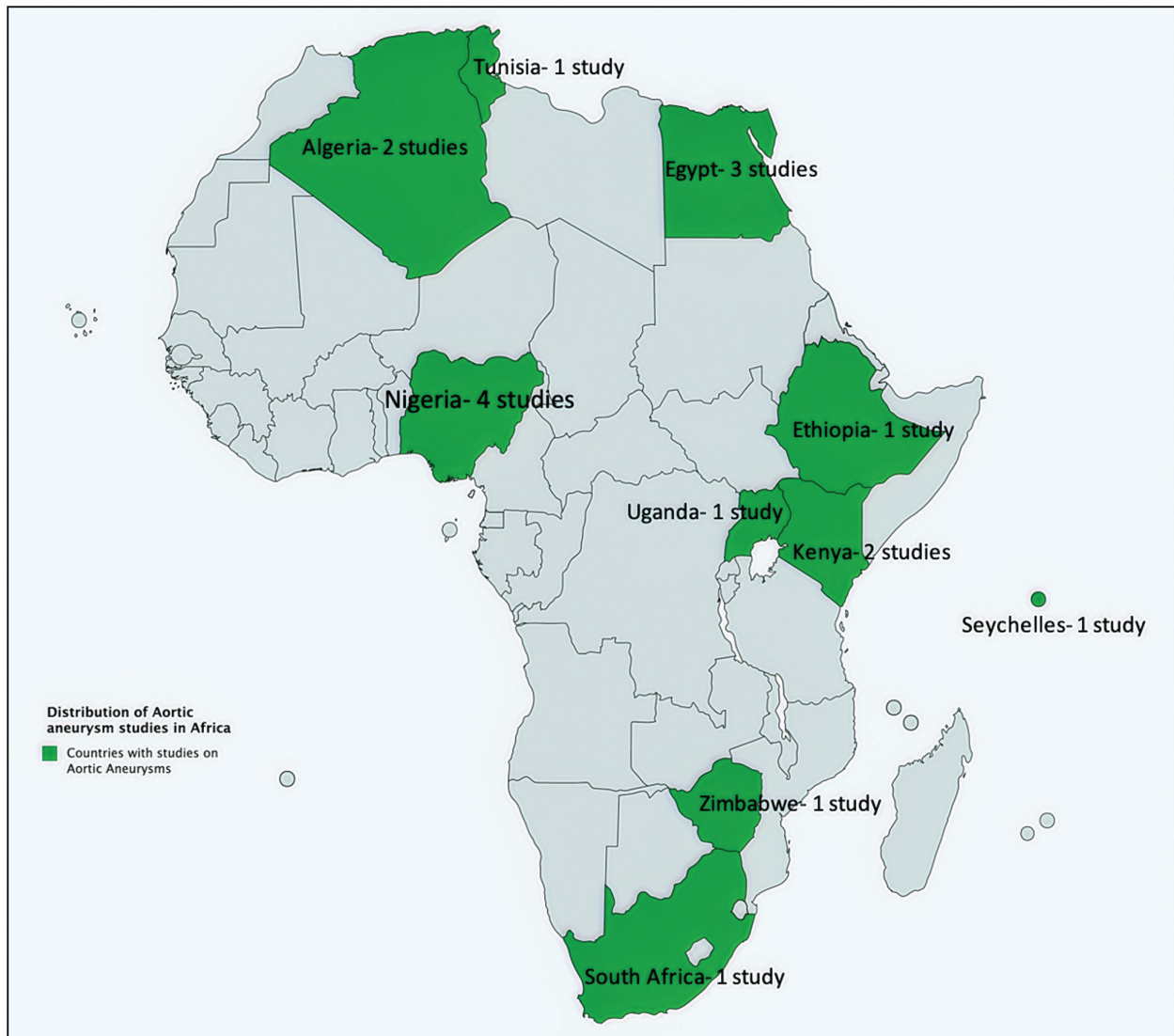
Figure 2: Distribution of abdominal aortic aneurysm studies in Africa

Presentation and clinical outcomes

More than 50% of aneurysms were detected incidentally and about one-third (23–54%) of cases presented as aortic rupture.[13] The commonest presentations were abdominal pain (34–41.2%) and pulsatile swelling (9.5–17.8%).[13,35] Open surgical approach was the main surgical management option for AAA in Africa.[35,40-43] However, some countries are beginning to adopt endovascular aortic repair (EVAR) and an Egyptian cohort study found better mortality outcomes and fewer complications when using EVAR compared with a hybrid approach.[44]

Two studies reported outcomes post-surgical intervention. Ogunleye *et al.*[35] reported operative mortality for AAA patients of 35.3% and a 30-day mortality of 64.7% with a loss to follow-up of 17%. In Ogeng'o *et al.*'s[13] study, 61 (23.1%) of AAA patients presented as rupture and the overall mortality rate for these patients was 72.1% (44 patients).

Discussion

This systematic review sought to better characterise AAA in Africa through assessing its prevalence and epidemiological pattern. Key issues arising from the findings above. First, the paucity of data in Africa on this important cardiovascular disease is disturbing, with only 10 of the 54 African countries having studies conducted on AAA prevalence or its epidemiological pattern since 1990. Potential reasons for this observation may include low research funding, as priority is given to infectious diseases, poor surgical outcomes, and competing priorities for researchers, especially from clinical work.[45]

Although there was no obvious regional variation in prevalence across the continent, there were some variations in studies conducted within some countries including Egypt and Algeria. The variability observed in the prevalence of AAA in the different studies analysed in this review may be explained by the differences in the screened populations. For instance, although the studies of Bouferrouk *et al.* and

Ouarab *et al.* were both conducted in Egypt and used almost similar sample sizes (674 vs. 600), Bouferrouk *et al.* targeted patients having echocardiography for suspected cardiac disease, whereas Ouarab focused on any patient above 60 years in two Algerian hospitals.[30,31] This may explain the high prevalence of 6.4% reported in Bouferrouk's study since cardiac diseases share similar risk factors with AAA. The prevalence reported in these studies is comparable to, if not higher than what has been reported in some Western countries.[46,47]
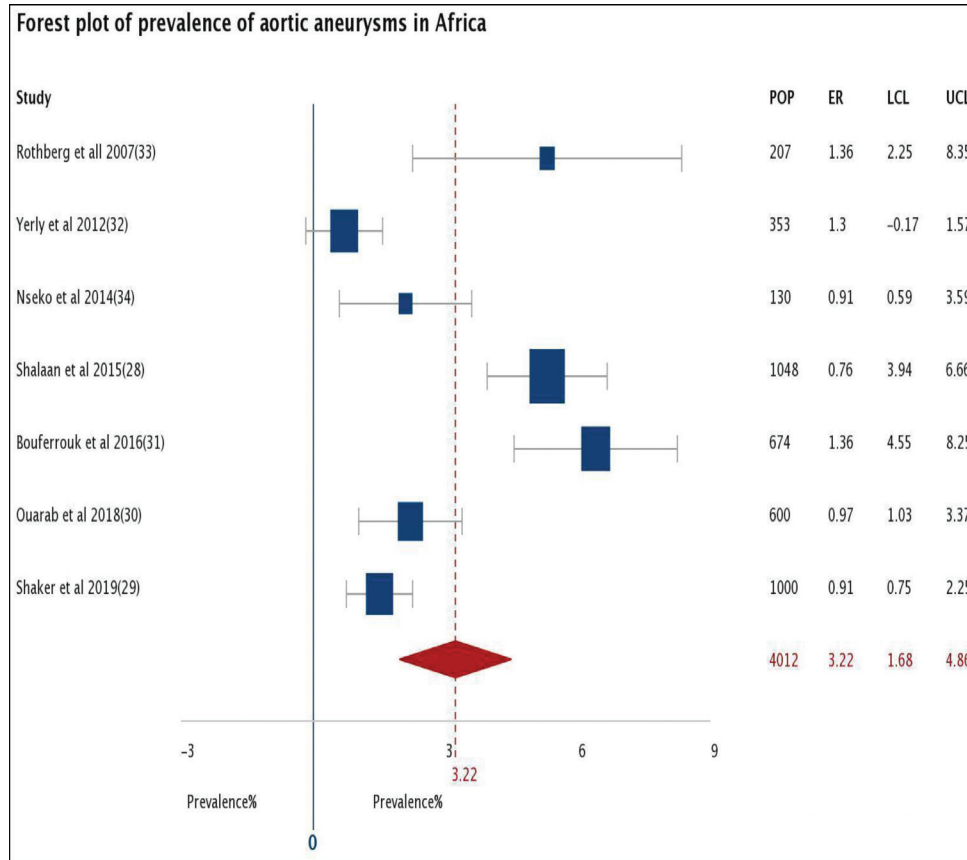

Figure 3: Forest plot of prevalence of aortic aneurysms in Africa
POP = population; ER = Event rate; LCL = Lower Confidence Level; UCL = Upper Confidence Level

Table 3: Quality assessment using Newcastle-Ottawa Scale for cross-sectional studies

Study	Design	Selection				Comparability	Outcome		Score
		Representativeness of sample	Sample size	Nonrespondents	Ascertainment of exposure	Based on Design and analysis	Assessment of outcome	Statistical test	
Bouferrouk *et al.* (2016)[31]	Cross-sectional	Somewhat representative*	*	*		No comparator group	**	*	6
Shalaan *et al.* (2015)[28]	Cross-sectional	Somewhat representative*	*	*	**	No comparator group	**	*	8
Yerly *et al.* (2012)[32]	Cross-sectional	Totally representative**		*		No comparator group	**	*	6
Rothberg *et al.* (2007)[33]	Cross-sectional	Totally representative**		*		No comparator group	**	*	6
Nseko *et al.* (2014)[34]	Cross-sectional	Selected sample			*	No comparator group	**	*	4
Ouarab *et al.* (2018)[30]	Cross-sectional	Somewhat representative*	*	*	*	No comparator group	**	*	7
Shaker *et al.* (2019)[29]	Cross-sectional	Somewhat representative*	*	*	*	No comparator group	**	*	7

The star score represents the quality of the study. The higher the score the lower the risk of bias (Maximum score 10)

Table 4: Quality assessment using scale for retrospective case series

Domains	Leading explanatory questions	Ogeng'o et al. (2010)[13]	Seyuom et al. (2019)[39]	Eze et al. (2010)[41]	Ogunleye et al. (2019)[35]	Marks et al. (1995)[16]	Mesrati et al. (2017)[36]	Sule et al. (2012)[37]	Ogeng'o et al. (2011)[38]
Selection	1. Does the patient represent the whole experience of the investigator or is the selection method clear?	*	*	*	*	*	*	*	*
Ascertainment	2. Was the exposure adequately ascertained?	*			*	*	*		
	3. Was the outcome adequately ascertained?	*	*	*	*	*	*	*	*
Causality	4. Were other alternative causes ruled out?								
	5. Was there a challenges/re-challenge phenomenon								
	6. Was there a dose effect response								
	7. Was follow-up long enough for outcomes to occur?	*			*	*		*	*
Reporting	Is the case(s) described with sufficient details to allow other investigators to replicate?	*	*	*	*	*	*	*	*
Score		5	3	3	5	5	4	4	4

The star score represents the quality of the study. The higher the score the lower the risk of bias. (Maximum score 5)

The wide age range (31–72 years) in the cases of AAA across the studies is indicative of possible different aetiologies including infections affecting younger people and degenerative causes for the older population. On average, AAA patients in this study are found to be 10–15 years younger than their western counterparts, with the mean age of the cases being 56.4 years old compared with 72 years in Spain and 75 years in England.[48,49] In the Ogeng'o *et al.* study, in particular, about 21% of AAA cases were below the age of 40 years.[13]

These findings raise two key issues are as follows: first, the need for a large multinational community-based screening study to establish the true prevalence of AAA in the general population. This is particularly important as most of the reviewed studies were conducted in hospital settings and therefore may not be generalisable. Second, African countries need to evaluate the feasibility of national AAA screening programs, although potentially in a younger population than in Western countries. African countries could learn from the experiences of the United Kingdom, Sweden, and the United States which already have screening programs.[50] These efforts will help in the early detection and management of AAA as screening has been shown to reduce emergency surgery by 50–75%, rupture rate by 49–55%, and mortality by 42–75%.[22,51]

Interestingly, despite the relatively high prevalence of AAA reported in the studies conducted within the African continent, very few deaths have been primarily attributed to AAA compared with other cardiovascular causes. Possible explanations for this may include the low population life expectancy or misdiagnosis. Life expectancy is shorter in Africa (mean 63 years),[52] and AAA typically presents beyond 65 years of age; people may be dying from other causes despite having AAA. Also, because of the lack of screening services, most AAA is not detected before rupture, and deaths at this stage may be misdiagnosed as sudden cardiac death. A cultural reluctance to perform postmortems also hinders accurate diagnoses.[53,54] Noteworthy is that about half of the studies on AAA prevalence were from Northern Africa (Egypt, Algeria, and Tunisia) and are predominantly from an Arab population. This further emphasizes the paucity of data in the Sub-Saharan region and the need for more research.

Risk factors associated with AAA identified in this study are similar to those reported elsewhere including hypertension, increasing age, male sex, and coronary heart disease.[55] The challenge for Africa may be greater as infectious diseases especially HIV are thought to also play a role in AAA growth.[40,56,57] Trends in the incidence and prevalence of ischemic heart disease (IHD) have been shown to correlate with AAA.[58] IHD is on the rise in Africa with projections of a 70% and 74% increase in age-standardised mortality, respectively, in men and women from 2010 to 2030.[59] This provides additional evidence that we may be missing most of the AAA. Smoking was shown to be a key risk factor for AAA in studies included in this review which is consistent with findings in studies conducted in other continents.[7,60,61] Some African countries including Ethiopia, Rwanda, and Zambia have experienced a significant increase in tobacco smoking among both men and women in the last two decades, and some countries like Sierra Leone and South Africa have a smoking prevalence of 25.8% and 22%, respectively, in a most recent study.[62] It is therefore important that efforts should target a reduction of cardiovascular risk factors as well as other infectious diseases.

About one-third of AAA (23–54%) presented as aortic ruptures, which have generally worse surgical outcomes in well-studied Western populations.[8,63] This is reflected by Ogunleye *et al.* whose study reported operative mortality between 35.3% and 30-day mortality of 64.7%.[35] This reiterates the great challenge of managing this disease in a resource-poor setting and the need to improve vascular surgery in these regions.[43] The majority of African countries do not have dedicated vascular surgery units or vascular surgeons, leaving most of the vascular procedures to the cardiothoracic and general surgeons. As a result, the management of AAA (particularly in the emergent setting) poses a significant challenge.[21] These findings are; however, not surprising considering that access to essential surgical care alone, as shown by the global surgery Lancet commission report, is poor in low-income and middle-income countries with an annual unmet need of 42 million cases.[1] Although some case reports from Malawi and Congo have reported on successful AAA operations, a lot still needs to be done.[42,64]

The findings from the current study should be interpreted cautiously owing to a number of limitations. The risk of bias in the included studies was high and there were significant heterogeneities as a result of differences in the screened populations, that is, high risk (e.g. hypertensive group) vs. the general population. Also, all these studies were observational meaning no causal relationship could be established between the outcome of interest (AAA prevalence) and the risk factors.

Conclusion

This study highlights that the prevalence of AAA in Africa may not be as low as was previously thought. The rising burden of noncommunicable diseases like hypertension, increasing life expectancy and background of the unresolved burden of communicable diseases like HIV are risk factors for AAA and these may contribute to its prevalence. Although several health system challenges still remain in the management of AAA in this setting, priority should be given to the better characterisation of the burden, epidemiology, and outcomes of this disease. This, therefore, calls for larger epidemiological studies to provide a better understanding of AAA in African countries with the aim of informing policy and management approaches.

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Conflicts of interest

There are no conflicts of interest.

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