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Scourge of Peripheral Artery Disease in a Low-Income-Setting: The Role of Vascular Surgery

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Abstract

Background: Peripheral artery disease (PAD) is a progressive disorder characterized by stenosis and/or occlusion of large and medium-sized arteries, other than those that supply the heart (coronary artery disease, CAD) or the brain (cerebrovascular disease). It is increasingly becoming a challenge in developing countries owing to poverty and ignorance.
Objective: To review the scourge of peripheral artery diseases in our institution in a low-income setting with a view to determining the role of a vascular surgeon.
Materials and method: Over a period of 15 years (2006 to 2021), patients with documented PAD were reviewed. Data of the patients were retrieved from the record department and such data included demography, aetiology/risk factors, clinical features and investigative parameters as well as modes of treatment especially vascular surgery.
Results: There were 35 patients which comprised 20 males and 15 females with male to female ratio of 4:3. Age range affected most was 71-80 years. Aetiologically, artherosclerosis was dominant. Leriche Fontaine classification used in clinical evaluation showed that type III was dominant. 6 Ps (pain, pulselessness, paralysis, paraesthesie, pallor and poikilothermia) of vascular ischemia were evident. Doppler/duplex ultrasound and computer angiography were used in diagnosis. Medical and or surgical treatments were used in patients' management. Vascular and or orthopedic surgery played significant role.
Conclusion: PAD affects the lower extremities more commonly than the upper extremity vessels especially in the elderly leading to intermittent claudicationn which is the most recognized symptomatic subset of lower extremity PAD. Morbidity and mortality emanating from inadequate revascularization are burden to emerging economy like ours.

Key words: Angioplasty, endarterectomy, thromboembolectomy, bypass, amputation

Introduction

Peripheral arterial disease (PAD) reflects systemic atherosclerosis arising from a variety of aetiological or risk factors such as age, diabetes, hypertension, obesity, smoking, and dyslipidemia.[1-4] The prevalence of PAD varies with age and method of diagnosis and possibly with the gender of the population study with dominance in the male gender.[5-8] PAD is associated with reduced functional capacity in the respiratory system and increased risk for cardiovascular morbidity and mortality due to its effects on the bronchial and coronary arteries respectively. Despite its widespread prevalence and its associations with mortality and morbidity as well as the reduction in the quality of life, PAD remains overall under-diagnosed and undertreated especially in developing countries.[9-11]
Assessment of PAD is made using clinical evaluation (Leriche-Fontaine and or Rutherford)

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criteria, and measurement of ankle-brachial index (ABI) and toe brachial index (TBI) including other parameters like Pulse oximetery, Doppler/duplex ultrasound, Computer angiography + digital subtraction angiography. Resting ABI results should be reported as: normal (0.91-1.30), mild ischaemia (0.70-0.90), moderate ischaemia (0.40-0.69) and severe ischaemia (<0.40).[13]

Peripheral arterial disease (PAD) of the lower extremity was defined by the presence of intermittent claudication,[6] by detection of two or more reduced or absent pulses of the dorsalis pedis and posterior tibial arteries, with at least one of the legs having both the dorsalis pedis and posterior tibial arteries affected, and also by an ankle-brachial index (ABI) of ≤0.9 in either of the legs.[12-15] Since PAD is more common in the lower extremity, this definition should correspondingly by extension, apply to radial and ulnar arteries in the upper extremity.

The recent data from vascular ultrasound registry of PAD at another institution in Nigeria revealed that up to 29.5% of patients have evidence of hemodynamically significant stenosis.[16] With continued exposure to risk factors, PAD may progress to critical limb ischemia (CLI), which is associated with a high rate of amputation and a marked increase in short-term mortality; mainly from angina, heart failure, and stroke.[17,18]

The situation is worse in Nigeria with rising incidence of cardiovascular risk factors. Although percutaneous transluminal angioplasty (PTA) has been practiced for more than 40 years, there is a lack of awareness, high cost, and other limited supply of devices and consumables in Nigeria.[1] This implies that vascular surgery such as balloon angioplasty, Fogarty catheter embolectomy amd or thrombectomy and vascular bypass procedures including endarterectomy are invaluable in managing the scourges of PAD in a low-income-setting such as ours.

Materials and Methods

This is a retrospective hospital based cohort study. Over a period of 15 years (2006 to 2021), patients with documented PAD were reviewed. Data of the patients were retrieved from the vascular artery surgery wards, operating theater registry and hospital record department data base and such data included demography, aetiology, clinical features and investigative parameters as well as modes of treatment especially vascular surgery. Data were analyzed using SPSS version 20 (Chicago). Data analysis involved the use of chi-square (for discrete variables) and student's t-test (for continuous variables) and a p-value of ≤0.05 will be taken as significant (IBM Corp., 2011). Patients with acute limb ischemia arising from other causes other than PAD, treated with Fogarty catheter thrombectomy were excluded from the study

Results

Table 1: The distribution of age ranges of patients

S/No	Age Ranges(yrs)	Male	Female
1	21-30	2	1
2	41-50	3	3
3	51-60	4	2
4	61-70	5	3
5	71-80	7	6
Total	(35)	21	15

This table displays the age ranges of patients affected by PAD. The range of 71-80 was the highest while the least was 21-30. This is in keeping with established risk factor for atherosclerosis (increasing age) the corner stone for PAD. In the more affected age group, males were more than females. This supports the risk factor status that it is more common in male gender

Table 2: The distribution of aetiological factors

S/No	Aetiology	Number	Percent (%)
1	Stenosis (athero)	22	62.9
2	Thrombosis (athero)	9	25.7
3	Embolism (AF, thrombosis)	2	5.7
4	Foreign body	0	0
5	External compression	2	5.7
Total		35	100

Table 2 shows the aetiological factors in our review. Atherosclerotic stenosis or outright occlusion was dominant (62.9%) while least was external

compression.

Table 3: The distribution of Clinical evaluation parameter (Leriche' Fontaine Classification)

S/No	Grades	Number	Percentages(%)
1	I	5	14.3
2	IIa	5	14.3
3	IIb	6	17.1
4	III	14	40.0
5	IV	5	14.3
Total		35	100

Keys
I: Asymptomatic, detected by Doppler ultrasound
IIa: Non invalidating intermittent claudication
IIb: Invalidating intermittent claudication
III: Established gangrene/trophic changes
IV: Critical ischemia with threat to limb loss

In Table 3, the Leriche – Fontaine grading system were used in the clinical evaluation of the patients. Most of the patients evaluated were in the grade III which is typified by established gangrene or trophic changes. This is in keeping with late presentations of patients to hospitals owing to poverty and ignorance.

Additional evaluation: 6 Ps of vascular ischemia
Pain, Pulselessness, Pallor, Paralysis, Paraesthesia, Poikilothermia/perishing cold
The 6ps were used in the clinical evaluation of some patients with acute on chronic status but its use was not statistically significant.

Investigative parameters
1. Ankle brachial index and toe brachial index (automated/digital sphygmomanometer)
2. Pulse oximeter
3. Doppler/duplex ultrasound
4. Computer angiography + digital subtraction angiography
5. Chest x-ray
6. Electrocardiogram(ECG)
7. Echocardiography

In the outlined investigative parameters, the ABI or TBI, pulse oximeter, Doppler/duplex ultrasound and angiography were used in confirming the diagnosis of PAD in our review while others like chest x-ray, ECG and ECHO were used in the assessment of the cardiovascular status and hence the fitness of patients prior to vascular or orthopaedic surgical interventions.

Treatment modalities
Medical
Minor medical treatment
Counseling about risk factors
Aspirin/clopidogrel
Simvastatins
Ramipril

Major medical treatment
1. Pentoxyfilline
2. Cilostazol

In our review, we classified treatment into minor (counseling about risk factors, lipid lowering drugs, antiplatelet drugs including vasodilators) and major which included pentoxyfilline (increases red blood cell flexibility by increasing erythrocyte ATP and cyclic nucleotide levels) and cilostazol (inhibits platelet function and also improves endothelial cell function).

Figure 1: Treatment modalities for Peripheral artery diseases

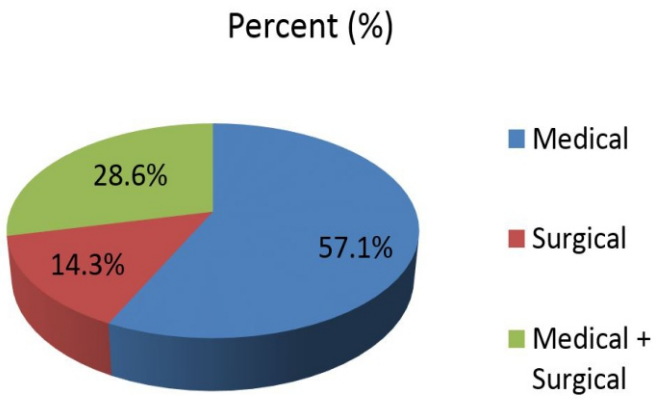

Figure 1 shows the categorization of treatment modalities offered to the patients in our review. Medical treatment was dominant because the affectation of medium and small arteries contradicted surgical treatment.
Table 4 displays the types of surgery done for

Table 4: The surgical options of treating peripheral artery diseases

S/No	Surgical options	Number	Percentages(%)
1	Endarterectomy + angioplasty	2	9.5
2	Fogarty catheter embolectomy	4	19.1
3	Fogarty catheter thrombectomy	3	14.3
4	Bypass procedure(femoropopliteal)	1	4.8
5	Foot debridement	6	28.6
6	Below knee amputations	2	19.1
7	Above knee amputations	3	14.3
Total		21	100

patients in our review. Foot debridement was the dominant followed by Fogarty catheter embolecyomy. The least was bypass procedure (femoropopliteal) with reversed ipislateral autogenous great saphenous vein.

Discussion

Worldwide, management of PAD includes conservative methods, pharmacology and surgery. In surgery, revascularization of the limb plays a central role in the management of symptomatic PAD. Advances in the pathogenesis, genetics, and medical management of PAD during the last 20 years have been going on pari-pasu with an ongoing evolution of revascularization options. Application of revascularization treatment methods has affected practice patterns for good.[19] Surgical treatment (vascular or orthopaedic) remains the pivot of management of advanced PAD in our institution.

Globally, 202 million people were reported to have peripheral artery disease in 2010.[20] About 69·7% of them were in low- and middle-income countries (LMIC), including 54·8 million in Southeast Asia and 45·9 million in the Western Pacific Region.[20] This number has increased by 28·7% in LMIC and 13·1% in high-income countries in the past decades.20 In our institution, cardiovascular unit is entrusted to manage patients with PAD. For a period of 15 years, a total of 35 patients with PAD were managed by it, averaging about 2.5 patients year see table 1. The incidence is far higher in patients above 60 years of age. In a related study by Akpan IS, PAD was found to be high in patients of > 80 years.[21]

In our review, the aetiologies of PAD were categorized as atherosclerosis, thrombosis complicating atherosclerosis, embolism from thrombosis in the atherosclerotic arteries and the heart as a result of atrial fibrillation. Another cause in our review was popliteal artery entrapment syndrome see table 2. According to Soyoye DO et al, risk factors for PAD, similar to those of other atherosclerotic vascular diseases, include smoking, obesity, diabetes, hypertension, and dyslipidaemia, with smoking and diabetes having the strongest association with PAD.[5] Atherosclerotic cardiovascular disorders represent the leading cause of morbidity and mortality for individuals with diabetes and are the largest contributor to the direct and indirect costs of diabetes. Therefore, cardiovascular risk factors, including hypertension, dyslipidemia, smoking, a family history of premature CAD, chronic kidney disease, albuminuria, should be systematically assessed at least annually in all diabetic patients.[22]

Diagnosis of PAD was made by systematic utilization of clinical evaluation as espoused by Leriche' and Fontaine classification and investigative parameters see table 3. Since atherosclerosis engendered by diabetes was the commonest cause of PAD, it is not surprising that type III Leriche' Fontaine classification was more common. Imaging: duplex ultrasound, computed tomography, or magnetic resonance is useful to diagnose anatomic location and severity of stenosis for patients with symptomatic PAD in whom revascularization is considered, whereas invasive angiography is useful for patients with critical limb ischemia (CLI) in whom revascularization is considered; CLI is defined as chronic (2 weeks) ischemic rest pain, non-healing wound/ulcers, or

gangrene in 1 or both legs attributable to objectively proven arterial occlusive disease.[23] Critical acute limb ischemia presents with 6 Ps: Pain, Pulselessness, Pallor, Paralysis, Paraesthesia, Poikilothermia/perishing cold. These signs are usually indicative of warm ischemic time which if exceeded leads to irreversible tissue damage and gangrene.

Therapeutic options were aimed at reducing adverse cardiovascular event rates associated with PAD and include promotion of daily exercise, adoption of a non-atherogenic diet, modification or elimination of atherosclerotic risk factors, including hypertension, smoking, dyslipidemia, and diabetes. Pharmacotherapy is required when target levels of blood pressure, plasma glucose, and LDL cholesterol (<100mg/dl, <70mg/dl in very high risk patients) are not reached.[24] In our review, patients received non-pharmacologic, pharmacologic and or surgical therapy see figure 1. The non-pharmacologic therapy was directed at reduction of modifiable risk factors. The pharmacologic therapy included statins, antiplatelets, ACEIs like ramipril and those directed at modulation of atherosclerosis, for example, pentoxyfilline and cilostazol.

The emergence of endovascular techniques has changed the landscape of vascular therapy in PAD, but has not fundamentally altered the selection of candidates most likely to benefit from revascularization. The indication for treatment is predicated on the severity of clinical presentation, with broadly dissimilar initial management strategies (primarily medical versus primarily revascularization) depending on whether the symptoms are claudication or critical limb ischaemia (CLI). Choosing between open versus endovascular approaches takes into consideration a wide variety of factors, including but not limited to the pattern of occlusive disease, anesthetic risk, severity of comorbid conditions, durability of the intervention, extent of tissue loss, previous failed interventions, or other specific anatomic considerations.[24]

Surgical treatments were directed at revascularization in limb threatening acute limb ischaemia so as not exceed warm ischaemic time. For some patients who presented with chronic limb ischemia or whose warm ischaemic time has been exceeded, orthopaedic surgeons were involved in life over limb procedures such as foot debridement or amputations see table 4. The vascular procedures documented in our review were femoropoliteal bypass with reversed ipislateral autogenous great saphenous vein in atherosclerotic calcified proper femoral artery, Fogarty catheter balloon angioplasty in varied arterial stenosis, thombo-embolectomy, endarterectomy and angioplasty. Others included release of medial heads of gastrocnemius muscle in cases of popliteal artery syndrome.

Conclusion

The causes of atherosclerosis and consequently PAD are grouped as modifiable and non-modifiable factors. Late presentation and delay in diagnosis lead to poor outcome.

The revascularization procedures achieved successes in our review. However, those that presented late were offered orthopedic procedures like debridement or amputations. The scourge that surrounds amputation of non-salvgeable limbs in low-income setting like ours is worrisome in the sense that some patients preferred dying with gangrenous limbs to undergoing amputations. In those offered amputations, considerable counseling took place prior to acceptance and issuing of consent for the procedure by the patients and or the family care givers.

Authors' Declarations

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Conflict of interest: There is no conflict of interest whatsoever

Ethical clearance: This retrospective review was exempt under Nigeria's National Code of Health Research Ethics, and our institutional ethics committee agreed that it did not require approval.

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