Original Article

Limb Revascularization of Peripheral Artery Disease in the Developing Countries: Earliest 1-Year Experience from Northwestern Nigeria

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ABSTRACT

Purpose: The purpose of the study is to present the preliminary audit and challenges of earliest cases of balloon angioplasty from Northwestern Nigeria. **Materials and Methods:** We present our first 25 cases of peripheral angioplasty in Northwestern Nigeria. The clinical diagnosis of peripheral artery disease was confirmed with Doppler ultrasound and angiography. Angioplasty was done either through femoral or brachial artery approaches. The patients were monitored for minimum of 6 months with serial clinical and Doppler ultrasound examinations. **Results:** Our patients consist of 19 males and 6 females. Their ages ranged from 20 to 80 years with a mean of 54 ± 17.5 years. There were 13 hypertensive and 15 diabetic patients while 5 patients have co-morbidities of diabetes and Hypertension. Although femoral antegrade route is the common access for angioplasty (14 out of 25), seven patients who were treated through the left brachial artery, six of them had either Type C or D aortoiliac disease in addition to distal lesions. At follow-up, 36% had limb amputation while one patient died a day after the procedure. Out of nine patients who had amputation, six are diabetic. **Conclusion:** Although more than half of them had improved blood flow with healing ischemic ulcers and reducing claudications, still substantial number of our patients often present late with severe peripheral artery disease. As a result, we had to resort to cumbersome arterial access and high amputation rate.

KEYWORDS: *Angioplasty, diabetes, peripheral artery disease*

INTRODUCTION

*P*eripheral arterial disease (PAD) is atherosclerotic obstructive arterial disease of the lower extremities. It reduces arterial flow during exercise or, in advanced stages, at rest.[1] The prevalence has increased exponentially due to the increase in the prevalence of diabetes mellitus (DM) and other risk factors.[2] The recent data from vascular ultrasound registry of PAD at our institution revealed that up to 29.5% of patients have evidence of hemodynamically significant stenosis.[3]

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.[4,5]

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. This communication is an attempt to present the first 25 cases of PTA done in our institution and likely the first report from Nigeria, to highlight the trends, patients' correlates, outcomes, and challenges of lower limb angioplasty in a typical resource-poor setting.

MATERIALS AND METHODS

The patients were mainly from medical (diabetes/ endocrine and cardiology) and surgical clinics of the

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hospital. Doppler ultrasound scan of the lower limb arteries was used to confirm the clinical suspicion of PAD. These symptoms include intermittent claudication, ischemic ulcers/diabetic foot disease, and limb/digital gangrene. Laboratory investigations of renal function test, fasting plasma glucose, complete blood count, and clotting profile were conducted on each. The serum lipid profiles were checked on each patient by the referring physicians but were not repeated in preparations for angioplasty.

In all participants, Seldinger technique was used for catheter angiography to access the common femoral (through antegrade or crossover routes) or high brachial arteries for diagnostic angiography as appropriate; under aseptic conditions. Diagnostic angiography was done to confirm the ultrasound diagnosis and to characterize the lesion based on the Trans-Atlantic Inter-Society Consensus on the Management of PAD (TASC II)[6] classification. Stenosis analysis (in terms of diameter of the diseased artery, length of the lesion, and branching pattern) was done to select appropriate size of the balloon and dilatation techniques. Furthermore, all measurements (luminal arterial stenosis and number and diameter of the collateral arteries) were agreed upon by the radiologists before decision is taken. Following the segmental dilatation by angioplasty catheter, post-PTA diagnostic angiogram is obtained to document the impact of the angioplasty. At times, a repeat dilatation had to be done to improve contrast flow if the posttreatment angiograms were unsatisfactory. Representative examples were shown in Figures 1-3.

After completing the angiography and PTA, a firm pressure was applied over the puncture site against the bony background for minimum of 15 min to secure hemostasis. The patients were routinely observed for at least 4 h. The puncture site, pulse rate, and blood pressure were closely monitored half-hourly for 4 hours.

All angiograms were done by at least two radiologists, one of which had a minimum of 5 years of postqualification. The patients were monitored for minimum of 6 months with serial Doppler ultrasound along with other complimentary clinical evaluation.

Statistical analysis was performed using the Statistical Package for the Social Sciences Software, version 20.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics, including mean, median, standard deviation, frequency, and percentage were used to describe demographic and clinical data. Chi-squared test was used to test possible association between categorical variables. A statistical difference was considered statistically significant when the $P < 0.05$.

RESULTS

Of the 29 patients who had angioplasty, 4 patients were lost to follow-up within the 6-month post-PTA.

Figure 1: Diagnostic digital subtraction abdominal aortogram through high brachial artery access, showing complete occlusion of the origin of the right common iliac artery

Figure 2: Transluminal angioplasty of the occlusive lesion at the origin of the right common iliac artery
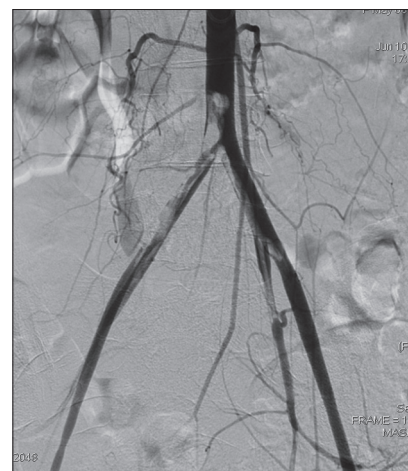

Figure 3: Posttreatment angiogram showing moderate flow restoration in the right iliofemoral arteries

Therefore, the records of 25 of them were available and reviewed. They consist of 19 males and 6 females. Their ages ranged from 20 to 80 years with a mean of 54 ± 17.5 years. There were 13 hypertensive and 15 diabetic patients while 5 patients have co-morbidities of diabetes and Hypertension. Femoral antegrade route

Table 1: Trans-Atlantic Inter-Society Consensus classification of aortoiliac disease

TASC	Frequency (%)
Valid	
None	19 (76.0)
A	0
B	0
C	4 (16.0)
D	2 (8.0)
Total	25 (100.0)

TASC=Trans-Atlantic Inter-Society Consensus

Table 2: Trans-Atlantic Inter-Society Consensus classification for femoropopliteal disease

TASC	Frequency (%)
Valid	
A	2 (8.0)
B	0
C	10 (40.0)
D	13 (52.0)
Total	25 (100.0)

TASC=Trans-Atlantic Inter-Society Consensus

Table 3: Treatment outcome of angioplasty in relation to blood glucose

Treatment outcome	Blood glucose		Total
	Normal	Diabetic	
Above-knee amputation	1	4	5
Below-knee amputation	2	2	4
Died after 1 day	1	0	1
Poor	0	1	1
Satisfactory revascularization	6	8	14
Total	10	15	25

is the common access for angioplasty (14 out of 25); seven patients who were treated through left high brachial artery access while four were treated with retrograde/crossover route.

Following diagnostic angiogram, eight patients had type C femoropopliteal lesion while nine had had type D. In addition, six patients had either type C or D aortoiliac disease. Other less common types in this review are shown in Tables 1 and 2.

Table 3 showed the outcome of angioplasty at 6 months. Based on patency restoration seen on follow-up Doppler ultrasound of the lower limbs, 14 patients had satisfactory revascularization, constituting 56%. Even though 20% of them had above-knee amputation, 16% had below-the-knee amputation; while one patient died a day after the procedure. Out of nine patients who had amputation, six are diabetic.

When arterial access was compared to the treatment outcome, femoral access was statistically associated with satisfactory revascularization compared to high brachial access (The Chi-square statistic is 8.4656, $P = 0.004$, The result is statistically significant at $P < 0.05$).

Table 3 showed the outcome of angioplasty at 6 months. Fourteen patients had satisfactory revascularization, constituting 56%. Twenty percent had above-knee amputation while 16% had below-the-knee amputation. One patient died a day after the procedure. Out of nine patients who had amputation, six are diabetic. However, there is no statistically significant association between diabetic status and limb amputation (the Chi-square statistic is 0.1082, $P = 0.742$, and the result is not statistically significant at $P < 0.05$).

Although there is higher male-to-female ration in this study, there are more women with above-knee amputation compared to females [Table 4]. In addition, 13 out of 14 patients with satisfactory blood flow at

Table 4: Gender and treatment outcome crosstabulation

Gender	Treatment outcome					Total
	Above-knee Amputation	Below-knee Amputation	Died after 1 day	Poor	Satisfactory revascularization	
Female	4	0	1	0	1	6
Male	1	4	0	1	13	19
Total	5	4	1	1	14	25

Table 5: Arterial access and treatment outcome crosstabulation

Arterial access	Treatment outcome					Total
	Above-knee amputation	Below-knee amputation	Death	Poor	Satisfactory revascularization	
Crossover	0	2	1	1	0	4
Femoral antegrade	0	1	0	0	13	14
Left brachial artery	5	1	0	0	1	7
Total	5	4	1	1	14	25

6-month postangioplasty are males. This difference is statistically significant (Chi-square statistic is 4.957, $P = 0.026$, and the result is statistically significant at $P < 0.05$). As shown in Table 5, when arterial access was compared to the treatment outcome, femoral access was statistically associated with satisfactory revascularization compared to high brachial access (the Chi-square statistic is 8.4656, $P = 0.004$, and the result is statistically significant at $P < 0.05$).

Discussion

The mean age of 54 ± 17.5 years in our patients is in close agreement with the findings of Soyoye *et al.*[7] from Western Nigeria (of 58.24 ± 7.73 years) and Odenigbo *et al.*[8] (of 58.9 years ± 8.9 years) from Eastern Nigeria. In Spain, the mean age of the participants with PAD was 51.2 (±14.7) years.[9] However, in Japan, Iida *et al.*[10] recorded a higher mean age of 71 ± 11 years in patients treated with angioplasty from CLI, this could be attributable to the higher life expectancy in Japan and other advanced economies. The higher prevalence of the disease in men (76%) in our setting may be explained by the fact that men were more likely than women to have DM, higher glucose levels, a history of coronary artery disease, and to be current or former smokers.[11] Although these factors were not recorded in our audit, we plan to make the subsequent record more robust to include other risk factors for atherosclerotic disease.

We noted that our patients are diabetic, hypertensive, or both. This underscores the importance of these risk factors in the etiology of PAD and atherosclerotic disease in general.[12] As exemplified by Odenigbo *et al.*[8] from Southeastern Nigeria, where they found hypertensive participants with DM had a slightly higher prevalence rate (26%), compared to those with hypertension only (24%). The prevalence of PAD was much higher in patients above 55 years (30.7%) than in those below 55 years of age (15.5%).

Antegrade femoral route is associated with relatively better outcome as it implies healthier common femoral artery, while the high brachial access is associated with high above-knee amputation rate due to lengthy diseased segments and possible multilevel disease. Nevertheless if available, selective use of endovascular stents, particularly drug eluting, could have improved outcome in these challenging patients.

From the findings of this study, 56% of our patients had successful revascularization at 6 months while 20% had above-knee amputation and 16% had below-the-knee amputation. According to De Sanctis,[13] long-term success rates of PTA of aortoiliac disease vary from 53% to 70% at 5 years, depending on the severity of

disease and which diseased blood vessel was treated. In another study by Dalainas and Nano[14] on 116 cases of PTA, patency after 2 years was 86% for intermittent claudication. Amputation rate is high in our patients due to lack of bailout facilities (stenting, drug-eluting balloons, and bypass surgeries) in our institution, being a developing nation. At the moment, there are few experts dedicated to the surgical management of peripheral vascular disease.[15]

As shown in Tables 1 and 2, our patients present with advanced disease, mainly types C and D of aortoiliac and femoropopliteal disease. This is attributable to late presentation[4] and poor economic status that limited the affordability of diagnostic and treatment services available.[12] This could partly explain the poor prognosis following PTA compared to high patency rates of other studies.[10,13,14]

Although this communication is limited by little number of patients, lack of state of the art facilities and devices, and short follow-up period, compared to many studies[10,13,14] on this subject, we feel it is worth to share this preliminary experience of our institution from Northwestern Nigeria. Our report shows that there is our patients' benefit from angioplasty in the care of PAD despite the fact that our patients present with advanced disease and higher amputation rates compared to advanced economies. This outlook was compounded by limited number of functioning angiography machines in the region and limited availability of bailout tools and devices to cater for challenging cases of advanced/multilevel stenotic disease. Therefore, this preliminary baseline data should stimulate interest of policy-makers, researchers, industry, and other stakeholders to develop interest in the care of PAD in Nigeria.

Conclusion

This preliminary report showed improved blood flow with healing ischemic ulcers and reducing claudications in more than half of our patients. However, still substantial number of our patients often present late with severe peripheral artery disease. As a result, we had to resort to cumbersome arterial access and high amputation rate. We hope that this data will stimulate interest of all stakeholders to commit resources in the care of PAD in Nigeria.

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Conflicts of interest
There are no conflicts of interest.

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