



Risk Factors Associated with Limb Amputation in a Referral Hospital in Benue State Nigeria

E. T. Amaefula¹, I. O. G. Owoeye^{2*} and N. J. Kortor³

¹Department of Orthopaedics and Traumatology, College of Health Sciences, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

²Department of Community Medicine, College of Medical Sciences, University of Benin, Ugbowo, Edo State, Nigeria.

³Department of Surgery, Benue State University, Makurdi, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Trauma, diabetes mellitus and peripheral vascular disease are age old known risk factors associated with amputation. However, at the Nongu Kristi U Sudan hen Tiv (NKST) Rehabilitation hospital, Mkar, Gboko, Benue state Nigeria, HIV/AIDS is increasingly becoming a major risk factor for upper limb amputation, and this is investigated in this study.

Objectives: To determine the risk factors involved in amputation in a referral hospital located in Benue State Nigeria.

Methods: A Descriptive cross sectional study design was adopted for this study where the pre-operative assessments for HIV testing, serum Fasting Blood Sugar (FBS) level, Full Blood Count (FBC), CD4 counts, Hepatitis B and C antigens were carried out using standard laboratory

*Corresponding author: Email: ganigbenga@gmail.com;

investigation techniques. Dopplar ultrasonographic assessment of the affected limb was done preoperatively to determine the nature and level of vascular obstruction while post-operative histocytology of the amputated stump was performed to determine the pathology at the Benue State University. Data obtained were entered into a profoma already designed for the study while statistical analysis was performed with the aid of SPSS (Version 20) with level of significance set at 95%.

Results: A total of 60 patients booked for amputation within the study period were enrolled for this study. Majority were Males 41 (68.3%), out of which amputation cases in individuals below 10 years of age were mainly due to trauma (8.3%). The age range of 21-40 years recorded the highest number of amputations 24 (40%). In the female patients, trauma was responsible for 8 (42.1%) cases while HIV was associated with 1 (5.3%) of all amputations. In males trauma and HIV/AIDS were indications in 25 (61%) and 10 (24.4%) respectively. Other risks factors in males responsible for amputation were diabetes 2 (4.9%) and vascular diseases 1 (2.4%). In females, diabetes mellitus was associated with 6 (31.5%) of amputations. There is a statistically significant difference in the indication for limb amputation in male and female patients where HIV/AIDS was significantly higher in males 10 (24.4%) than in females ($\chi^2 = 13.1$; $p = 0.01$). Lower limbs 49 (81.7%) amputations were more than upper limbs 11 (18.3%) amputations. This study revealed that HIV/AIDS ranked second as an indication for upper limb amputations although trauma was the main indication for most upper limb amputations.

Conclusion: This study showed that trauma remains the predominant risk factor for amputation, however HIV/AIDS is emerging as a major indication for upper limb amputation.

Keywords: Amputation; risk factors; HIV/AIDS; Nigeria.

1. INTRODUCTION

Limb amputation is a common surgical procedure performed by orthopaedic, general, vascular and trauma surgeons [1]. Trauma is the most common indication in Southern Nigeria for limb amputations, while complications of traditional bone setter intervention are the most common indication in the Northern and Eastern parts of Nigeria [2]. The estimated prevalence of extremity amputation in Nigeria is 1.6 per 100, 000 [2]. Trauma, complications of traditional bone setting, malignant tumours and diabetic gangrene are common while peripheral vascular disease is an uncommon indication for amputation [2,3,4]. A study of 320 limb amputations performed on adults at the Ahmadu Bello University Hospital Zaria Nigeria over a 10 year period revealed that the major indications for upper limb amputation were trauma and post-fracture splintage gangrene while in the lower limb, the most common indication for amputation was advanced squamous cell carcinoma of the skin involving the bone [5]. Unlike developed countries, there were no cases of peripheral vascular disease in these patients [3,4] other than that seen in diabetics [5]. Diabetics however, especially those with end-stage renal disease (ESRD) have an increased risk for non-traumatic lower-extremity amputation (LEA) [6]. The LEA rate among diabetic persons with ESRD was 10 times as great as among the

diabetic population [7,8]. Although some authors consider HIV a rare cause of gangrene of the extremities compared [9] to Systemic Lupus Erythematosus (SLE), progressive systemic sclerosis, Henoch-Schonlein purpura, Anti-Neutrophil Cytoplasmic Antibody (ANCA) associated vasculitis, Takayasu arteriitis, infective endocarditis, gangrene associated with pro-coagulant states due to malignancy, anticardiolipin antibody syndrome and disseminated intravascular coagulation, it is considered a big "worry" for the Nigerian government [10]. Peripheral Arterial Disease (PAD) has been found to be more prevalent in the HIV-infected population than in the general population, and there is a six-fold increase in the risk for PAD in HIV infected individuals as well as an earlier onset of the disease compared with HIV-negative individuals [11].

Prosthetic services in developing countries are poor, therefore limb loss by an individual is associated with very severe physical and emotional challenge, and as illustrated in a study of 100 major amputations in two regional hospitals in Nigeria, only 25 amputees could afford successful prosthetic fitting and social rehabilitation [1,12]. Mkar-Gboko is in Benue state which was reported in 2013 to have the highest HIV prevalence of 10% seropositivity in the age group of 15 to 49 years in Nigeria [10],

and HIV-associated arterial occlusive disease is recognized as a specific clinical entity with median age of patients between 30-40 years [13].

2. MATERIALS AND METHODS

The overall objective was to study the role of the various risk factors in extremity amputations and to highlight the emergence of HIV as a risk factor in our community. An understanding of these variations and a high index of suspicion of the various risk factors will enhance early diagnosis and reduction in the amputation rates; more over early identification of the risk factors may contribute to early diagnosis of at risk limbs thus enabling early surgical intervention.

This study was carried out at Nongu Kristi U Sudan hen Tiv (NKST) Rehabilitation hospital, Mkar, Gboko, Benue state Nigeria. The hospital is a specialist orthopaedic hospital strategically located in the Nigerian middle belt Sudan savannah, providing Orthopaedic services to residents of the Nigerian middle belt. Farming is the predominant occupation, and commercial motorcycle taxi is the major means of transportation. Gboko is a major center of learning with secondary and tertiary institutions.

2.1 Study Design

Descriptive Cross sectional Study.

2.2 Minimum Sample Size Determination

The minimum sample size required for this study was calculated using the formula; $n = Z^2pq/e^2$ (where n =the desired sample size, Z =standard Normal Deviate at 95% confidence level (1.96), p is the proportion in the target population estimated to have a particular characteristic [14]. P is therefore the proportion of patients that have had amputation, taken as $1.6\%^{10}$. $q = 1 - p$, while e is the allowable error margin of $5\% = 0.05$). Therefore, $n = (1.96)^2(0.016)(1 - 0.016) / (0.05)^2 = 24$. The minimum sample size required for the study was calculated to be 24 using this formula. However, sixty (60) patients who had amputation in NKST were enrolled in this study while seven (7) cases were excluded due to incomplete documentation.

2.3 Data Collection Methods

1. A spread sheath designed for the study was used to collect qualitative and

quantitative data from the case notes of each respondents. All respondents had screening for HIV 1 and 2 antibodies by ELISA technique [15,16] using DIALAB. HIV-EIA reagent (DIALAB, A-1160 Vienna, Austria). The ELISA test was performed as an indirect solid phase sandwich-type immunoassay. Microwells were coated with gp36 and gp160 antigens. HIV1 & 2 present in the positive control and patient samples bind to the coated antigens. The antigen-antibody complex is reacted with enzyme labeled recombinant conjugate resulting in the HIV antibodies being sandwiched between the solid phase antigen and the enzyme conjugate. The enzyme converts added substrate to form a coloured solution. The intensity of the colour change, which is proportional to the concentration of the HIV antibodies present in the sample, is read by a micro-plate reader at 450 nm. The CD4 counts were done manually using optical fluorescence microscopy [Coulter Corporation, USA] and Dynabeads® [DynaL Biotech, Norway] [17].

2. Fasting blood sugar and 2hours postprandial sugar were assessed using a glucose oxidase- peroxidase method as described by Cheesbrough to identify diabetic respondents [18].
3. Full Blood Count (FBC) was performed using an auto analyzer.
4. Dopplar ultrasonographic assessment of the affected limb was performed for features of vasculopathy.
5. Patients with non-traumatic gangrene had Post-operative histocytology of the amputated stump performed at the Benue State University.

The information obtained were coded and transferred onto a profoma already designed for the study

2.4 Statistical Analysis

Statistical analysis was performed with Statistical Package for Social Sciences software SPSS version 20 where nominal data were compared using the chi square test (χ^2) and the difference between means determined by the students t- test with the level of significance set at $\alpha = 0.05$. Approval for this work was obtained from the hospital ethical and research committee.

2.5 Limitations

Further diagnosis to determine the other causes of peripheral vascular diseases recorded in this study (aside those secondary to diabetes mellitus and HIV related vasculitis) was made purely on clinical evaluation as facilities for their confirmation were not available.

3. RESULTS

A total of 60 respondents were recruited for this study out of which 41 (68.3%) were males and 19 (31.7%) were females. The mean age of the male respondents was 38.9 years while the mean age for female respondents was 39.2 years with no statistically significant difference: ($t = 0.04$; $df = 58$; $p = 0.966$) in the age distribution of both male and female patients. Majority of the respondents were within the range of 21 – 40 years (40%). Considering the other sociodemographic characteristics of the respondents, majority were Farmers or housewives 21 (35%), had secondary level education 32 (53.3%) and were Christians 54 (90%). There is a statistically significant difference in the occupation ($\chi^2 = 11.254$; $p = 0.047$) and educational status ($\chi^2 = 12.544$; $p = 0.002$) of male and female patients but no statistically significant difference in the Religion of the patients ($\chi^2 = 2.559$; $p = 0.278$). Although Christianity is the predominant religion, other religious believes are Islam and traditional African believers.

Table 2 reveals the anatomical region of amputation when considered with the indication/risk factor for amputation and the gender of the patients. Majority of the amputation were in the lower limb 49 (81.7%) while the remaining 11 (18.3%) occurred in the upper limb. The major indications/risk factors for amputation were Trauma 33 (55%), HIV/AIDS 11(18.3%) and Diabetes 8 (13.3%). There is no statistically significant difference in the indication for lower limb or upper limb amputations ($\chi^2 = 7.724$; $p = 0.102$; $df = 4$). Trauma 25 (61%) was the lead indication/risk factor for which male patients had amputation, followed by HIV/AIDS 10 (24.4%). Among the female patients, trauma 8 (42.1%) was also the leading indication/risk factor for amputation, followed by Diabetes 6 (31.5%) while HIV/AIDS 1(5.3%) was the least indication/risk factor for amputation. There is a statistically significant difference in proportions of amputation risk factors when

compared to the gender of the patients ($\chi^2 = 13.105$; $p = 0.011$; $df = 4$).

4. DISCUSSION

Trauma from both domestic and road traffic accidents remain a major risk factor for amputations. More males of the active age range of 21-40 years accounted for majority of all amputation in this study. This is comparable to similar studies in Nigeria [19,20,21], in contrast to findings in developed countries where peak incidence is in the 7th decade [3,4,22] and peripheral vascular disease is most common indication [23]. This study was conducted in Gboko, a city that may be considered underdeveloped in terms of infrastructure and road networks. With very high unemployment rate, most young males survive mostly on riding commercial motorcycles popularly called "Okada" [24], with 70% involved in agriculture [25]. Therefore, limb amputation in this group who are the main earners of livelihood may have devastating economic implications for the family [26,27]. Diabetes has been reported as major risk factor for lower limb amputation but this study revealed a higher preponderance of HIV associated amputation when compared to diabetes in this locality, this could be because Mkar-Gboko in Benue state has the highest HIV prevalence of 10% seropositivity in Nigeria [10]. Studies elsewhere however shows incidence of lower-extremity amputation (LEA) is higher among end-stage renal disease (ESRD) patients than in the general U.S. population [3]. Almost every pattern and type of vasculitis of small, medium, and large vessels has been encountered in the HIV setting [9]. This study revealed that majority of amputations occurred in the lower limb secondary to trauma [2] but HIV was responsible for more upper limb amputations only second to second to trauma. Patients with AIDS were significantly more likely to present with spontaneous onset of infection in the absence of penetrating injury than were those who were HIV seropositive and hence amputation [20,27]. Routine follow up of HIV patients with at risk features suggestive of vascular occlusion such as limb edema, pain and redness with dopplar ultrasonogram may facilitate pre-emptive limb conserving surgeries such as vascular bypass procedures and thrombectomy thereby obviating amputation [9,13]. The age range of our patients with HIV was 21-30 years and is similar to the average age of 40 of HIV positive patients with vasculopathy in comparison to 55 years in

patients with atherosclerotic disease [21]. The two major mechanisms by which infection is thought to induce a vasculitis are direct microbial invasion, with resultant damage of the vessel wall, and immune mediated injury (both humoral and cellular) [22]. The target organs that are

Table 1. Sociodemographic characteristic of patients

Variables	Male f (%)	Female f (%)	Total f (%)
Age (years)			
≤10	5 (12.2)	0 (0)	5 (8.3)
11-20	3 (7.3)	2 (10.5)	5 (8.3)
21-30	8 (19.5)	6 (31.6)	14 (23.3)
31-40	8 (19.5)	2 (10.5)	10 (16.7)
41-50	3 (7.3)	4 (21.1)	7 (11.7)
51-60	4 (9.8)	3 (15.8)	7 (11.7)
≥61	10 (24.4)	2 (10.5)	12 (20)
Total	41 (68.3)	19 (31.7)	60 (100)
	$\bar{x}_1 = 38.9$ $t = 0.04$	$\bar{x}_2 = 39.2$ $p = 0.966$	df = 58
Occupation			
Farmers/housewives	12 (29.3)	9 (47.4)	21 (35)
Students/teachers	14 (34.2)	6 (31.6)	20 (33.3)
Clergy	1 (2.4)	0 (0)	1 (1.7)
Soldiers/police	3 (7.3)	2 (10.5)	5 (8.3)
Motor cycle riders	10 (24.4)	0 (0)	10 (16.7)
Others	1 (2.4)	2 (10.5)	3 (5)
Total	41 (68.3)	19 (31.7)	60 (100)
	$\chi^2 = 11.254$ p = 0.047	df = 5	
Educational status			
Primary	3 (7.3)	9 (47.4)	12 (20)
Secondary	26 (63.4)	6 (31.6)	32 (53.3)
Tertiary	12 (29.3)	4 (21)	16 (26.7)
Total	41 (68.3)	19 (31.7)	60 (100)
	$\chi^2 = 12.544$ p = 0.002	df = 2	
Religion			
Christian	38 (92.7)	16 (84.2)	54 (90)
Muslim	2 (4.9)	3 (15.8)	5 (8.3)
*ATR	1 (2.4)	0 (0)	1 (1.7)
Total	41 (68.3)	19 (31.7)	60 (100)
	$\chi^2 = 2.559$ p = 0.278	df = 2	

*ATR (African Traditional Religion)

Table 2. Distribution of anatomical regions of amputation, gender and risk factors

Variable	Trauma f (%)	Diabetes f (%)	Vascular disease f (%)	HIV/AIDS f (%)	Others f (%)	Total f (%)
Anatomical region of amputation						
Upper limb	8 (72.7)	0 (0)	0 (0)	3 (27.3)	0 (0)	11 (18.3)
Lower limb	25 (51)	8 (16.3)	1 (2)	8 (16.3)	7 (14.3)	49 (81.7)
Total	33 (55)	8 (13.3)	1 (1.7)	11 (18.3)	7 (11.7)	60 (100)
	$\chi^2 = 7.724$ p = 0.102		df = 4			
Gender						
Male	25 (61)	2 (4.9)	1 (2.4)	10 (24.4)	3 (7.3)	41 (68.3)
Female	8 (42.1)	6 (31.5)	0 (0)	1 (5.3)	4 (21.1)	19 (31.7)
Total	33 (55)	8 (13.3)	1 (1.7)	11 (18.3)	7 (11.7)	60 (100)
	$\chi^2 = 13.105$ p = 0.011		df = 4			

usually involved are muscles and nerves, although skin and the gastrointestinal tract can also be involved [23]. In general, there are two modes of presentation: Either as a peripheral neuropathy or with digital ischemia. There are several important differences between Polyarteritis Nodosa (PAN)-like vasculitis seen in the HIV setting and so called classic or idiopathic PAN [22]. First, the waxing and waning clinical course of classic PAN which is not seen in patients with HIV infection. Second, it is well-recognized that classic PAN can be associated with viral infections, especially hepatitis B virus (HBV), but in HIV associated cases serology for HBV is invariably negative [23,24]. Third, multisystem organ involvement, particularly renal involvement, is not seen in HIV associated cases. Some researchers have observed that the affected arteries in HIV associated PAN tend to be smaller than that seen in classic PAN [24]. Lower Extremity Amputations is commoner than upper extremity amputations [25] and this is similar to findings in this study. Intravenous drug use has been identified as a risk factor for upper extremity infection in HIV patients for which amputation may become necessary [28].

5. CONCLUSION

Trauma remains the main indication for all limb amputations especially amongst male patients. Although there is no statistical significance in the indications for upper limb and lower limb amputations, it appears that HIV associated gangrene is becoming an indication for limb amputations. In the absence of a vascular or skilled general surgeon, all the patients in this study were offered primary amputation and they experienced remarkable improvement in their quality of life. Though there are no works on the cost benefits of repeated surgery on these patients, it will however appear that primary amputation is a preferred option in a resource challenged economy.

CONSENT

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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