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Original Research Article

Evolving patterns of lower limb amputations at a Nigerian tertiary hospital: a retrospective study

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ABSTRACT

Background: This study aims to review the current trends in the demographics of lower limb amputation at the University of Port Harcourt Teaching Hospital, Nigeria.
Methods: This is a retrospective, hospital-based chart review of all patients who underwent lower limb amputation at the University of Port Harcourt Teaching Hospital (UPTH) between January 1, 2020 and December 31, 2024.
Results: A total of 111 lower limb amputations were performed within the period under review. 74 males and 37 females giving a male: female ratio of 2:1. Mean age 45.3±20.5, peak age of amputation 61-69 years with 24 patients (21.6%), diabetic foot disease was the highest indication for amputation (36.9%), majority had above knee amputation (50.5%), with 95.1% discharge.
Conclusions: The major concern is the prevention of amputation. As reported in this study, diabetic foot disease is the main indication for amputation. Education on diabetic foot care will reduce this incidence. Government involvement in improving the poor economic situation will further improve access to health facilities and drugs for management of diabetes mellitus.

Keywords: Amputation, Evolving patterns, Nigeria, Port Harcourt

INTRODUCTION

Lower limb amputations (LLA) remain one of the most common operations performed by the Orthopaedic Surgeon.[1] While significant global variation exists in its incidence, lower extremity amputation reporting methods demonstrate a large variation with no single standard upon which to benchmark care. Effective standardized reporting methods of major, minor and at-risk populations are needed in order to quantify and monitor the growing multidisciplinary team effect on lower extremity amputation rates globally.

Most developed countries have national and/or regional amputation registries where all surgical amputations are recorded.[1] This makes generation of statistics, identifying trends and proffering recommendations to reduce incidence easier. Reported incidence worldwide range from as high as 9600/100000 in at risk population in Louisiana, USA, to as low as 14/ 100000 in Australia. International prevalence has been reported as 17-30/ 100000 persons.[2,3] About 113,000 LLA are performed yearly in the United States of America, over 70% being male patients, majority of which are over 70 years. Prevalence is estimated to be approximately 1 in 200.[4] Conversely, most developing countries do not have such databases and rely mostly on single-centre based studies.

However, Thanni et al estimated the prevalence of all extremity amputations in Nigeria to be 1.6/ 100,000 of

the population.[5] Within a one year period at the Kenyatta National hospital, 77 LLA were performed on 74 patients 46 (59.7%) of which were male, with a mean age of 44 years.[6] A Tanzanian study at a teaching hospital recorded 162 amputations within a two year period, with over 86% involving the lower limbs, with a male preponderance of 2:1.[7] In Nigeria Muhammad et al, recorded 320 extremity (both upper and lower limbs) amputations in a tertiary institution in Zaria over a period of 10 years, while Solagberu et al, in a 5 years study at a teaching hospital, recorded 58 amputations in 56 patients.[8] LLA were commoner (42 vs. 16), mean age was 33.3 years. Akiode et al, Shonubi et al, also at a teaching hospital, recorded 71 limb amputations in 69 patients over 5 years.[9]

These give on the average, approximately 32, 12 and 14 amputations carried out per year within these institutions. Central Hospital Warri, recorded 46 amputations in 44 patients over a 5 years period, 91% of which were LLA's, with a male:female ratio of 1.6:1.[10] Obalum et al and Okeke et al over ten years in a private clinic recorded 68 amputations in 64 patients. Male:Female ratio being 2.2:1, the mean age was 36 years and Ekere et al recorded thirty-four (34) extremity amputations within a five-year period, at a private hospital in Port Harcourt.[11,12] LLA were more frequent (24 vs. 10), with a male: female ratio of 2:1. Most patients were between 20 and 50 years.

An estimated 1.6 million amputees live in the United States of America. About 30,000 to 40,000 lower limb amputations are done in the United States of America yearly, the majority of which are for peripheral vascular disease (including diabetic mellitus).[2] Significant global variations exist in the incidence of lower limb amputations. Incidence of all forms of lower limb amputation range from 46.1 to 9600 per 100,000 population with diabetes mellitus as compared to 5.8 to 31 per 100,000 normal population.[10] There is no national database records for lower limb amputations in Nigeria, though there are some estimates on national incidence.

Indications for lower limb amputations are traditionally grouped into 3D's- dead or dying limb, dangerous limb and the dud or damn nuisance (useless) limb, though there is some overlap between these groups. The common indications include peripheral vascular disease, trauma, neoplasm and potentially lethal sepsis. Others include burns, frostbite, gross malformation, recalcitrant pain, thrombo-embolic disease and in our environment, bone setter's gangrene, Madura foot and elephantiasis.[1,3]

Amputations may be done on an emergency basis or as an elective procedure. It may be provisional or definitive, with the stump being weight bearing or non- weight bearing. Levels of lower limb amputation include hemi-pelvectomies, hip disarticulations, above knee, through knee, below knee, Syme's and various foot amputations.[2]

It is not in dispute that peripheral vascular disease is the most common indication for lower limb amputations in developed countries, mostly due to complications of diabetes mellitus. Trauma, however, has been recorded as the most common indication for LLA in most centre-based studies in Nigeria and other developing countries.[10,11] The United States national limb loss information centre (revised 2008) estimates that lower limb amputations account for 61.4% of all limb amputations, the majority (39.5%) being for dysvascular causes, 31% for cancers, 17% congenital and 13% due to trauma.[3] Of the dysvascular related lower limb amputations, 53.4% were major limb amputations (25.8% above knee and 27.6% below knee), while 42.8% were at other levels.

The risk was highest among African American males in all age groups. For cancer, 36% were major limb amputations (below or above knee) while 42.8% were at other levels. The ratio of below knee to above knee amputations was approximately 7: 3. There were no notable differences by race or sex in the various age groups. There are approximately 5-6000 major limb amputations undertaken in the United Kingdom per year, 85% due to peripheral vascular disease, 10% for trauma and 3% secondary to malignancy.[13]

Trauma has been shown to be the most frequent indication in Nigeria, with complications from traditional bone setters, malignancy, diabetic gangrene and infection coming second, third, fourth and fifth respectively; the average age of the Nigerian amputee being 33 years, with a male preponderance.[14] Most local studies put the average age of patients requiring LLA at the 30 to 40 year age group, in contrast to American and European statistics, which show the greatest incidence in older patients (over 75 years) with men being more affected (2-3: 1, male: female).

At the University of Port Harcourt Teaching hospital, Adotey et al and Jebbin et al in a retrospective study over 20 years ago recorded trauma to be the most common cause of LLA, (50%) followed by diabetic foot gangrene (30.6%).[15] Other causes included neoplasms (11.1%) and non-diabetic peripheral vascular disease (8.3%).However, Dada et al and Awoyomi et al in a review at the Federal Medical Centre Ebutte- metta, found diabetic gangrene to be the most common indication (45%), followed by trauma (31%).[16] This was the first study, to the authors' knowledge in the country where diabetic gangrene emerged the leading indication for limb amputation. Another study in Warri, Delta state10 studied 44 patients who had 46 amputations and noted that 63.6% of amputations were due to diabetic foot disease, followed by trauma in 20.5%.

This study aims to review the current trends in the demographics of LLA at the University of Port Harcourt Teaching Hospital, Nigeria, by identifying the indications, frequency, levels, age and, sex distribution of the patients over a five-year period, from 2020 to 2024.

METHODS

Study design

A retrospective, hospital-based chart review of all patients who underwent lower limb amputation was carried out.

Study place

The study was carried out in the University of Port-Harcourt Teaching Hospital (UPTH). It is the main tertiary health centre in Rivers State, Nigeria. It has over 600 beds facility owned by the Federal Government of Nigeria and sub serves a population that includes patients from various surrounding states.

Study setting

This is a retrospective, hospital-based chart review of all patients who underwent lower limb amputation at the University of Port Harcourt Teaching Hospital (UPTH) between January 1, 2020 and December 31, 2024.

Study population

All patients who had any form of LLA with complete records available during the study period were included in the study. Data was collected using a standardized data-collection form to extract patient demographics, date of procedure, indications for and levels of amputation.

Inclusion criteria

All patients who underwent surgical lower limb amputation at the University of Port Harcourt Teaching Hospital within the study period, who had given consent to be included in the study.

Exclusion criteria

Patients who did not give consent to be included in the study and those with incomplete records.

Data analysis

Data was analysed using the Statistical Package for the Social Sciences (SPSS) version 22.0. Observations were tested for significance using chi-square test for associations between proportions and z test for associations between means. Level of significance was set as $p<0.05$.

Sample size calculation

Sample size was calculated using the Yamane formula.

n=N/(1+N(e)^2)

Where, n is the estimated minimum sample size, N is population size (36), e is the level of precision (0.05). Population size N, was gotten from a previous study by J. M. Adotey and N. J. Jebbin at the University of Port Harcourt Teaching Hospital.

Substituting these values in the above equation,

36/ 1+36×(0.05)2

36/1.09 gives n to be= 33

Ethical consideration

Ethical clearance was obtained from hospital's ethics committee.

Surgical procedure/ levels of amputation

Early surgical amputation was a crude procedure in which the limb was rapidly severed from an un-anaesthetized patient and the open stump then crushed or dipped in boiling oil to obtain haemostasis. The procedure, of course, was associated with high mortality rates. The procedure has, gradually been refined to the point today, where it is no longer viewed as just an ablative procedure, but as part of the reconstructive surgical arsenal available to orthopaedic surgeons and their patients.[2]

Surgical procedures for the various levels of amputation are adequately described in various orthopaedic textbooks and literature.

Lower limb amputations are usually grouped into minor (removal of part of the limb distal to the ankle) and major (below, thru or above knee, up to hind quarter amputations). It may be done as an emergency or elective procedure. Minimum investigations usually include haematocrit and urinalysis. Other investigations that may be necessary, depending on the indications include white cell count with differentials, renal function tests, serum glucose levels, radiographs and Doppler ultrasound. Some patients may have an underlying co-morbidity that may need to be managed adequately prior to surgery (uncontrolled hypertension, underlying heart disease, diabetes mellitus).

Informed written consent should be obtained, preferably from the patient and a relative or spouse and clinical photographs taken. Ideally where available, a pre-operative prosthetist's visit should be sought to discuss options of prosthetic types and fittings with the patient. This goes a long way in reassuring the patient of adequate rehabilitation.

Determining the level for amputation must take into account the indication(s), propensity of the wound to heal, adequacy of soft tissue padding of cut bone ends and the type and functionality of the prosthesis to be

used. Traditional sites of election are 12 cm above and 14 cm below the knee for above and below knee amputations respectively. However, the skill of modern prosthetists has made it possible to amputate at almost any level.[6] In some countries, a vascular consult is sought to determine the feasibility of limb conservation and limb salvage surgeries. The choice of anaesthesia used will depend on the type of amputation to be done, the extent of surgery and the patient's clinical state and can range from local infiltration, through field blocks to regional and general anaesthesia.

Peri- operative broad spectrum intravenous antibiotics are usually administered. Pre and post operative deep vein thrombosis prophylaxis may be considered in at risk patients.[12-16] The use of a tourniquet when indicated, reduces blood loss and may reduce surgical time. Myocutaneous flaps are raised depending on the level and availability, the aim of which is to provide adequate muscle padding over the bone. The bone is cut proximal to these flaps and all sharp ends filed down.

Arteries and veins are separated and ligated doubly for the arteries, while nerves are pulled, cut sharply and allowed to retract into the muscle bulk. Antagonistic muscles are sutured together over the bone (myoplasty) or attached to the bone (myodesis) and the skin flaps are closed. A drain is usually placed in the wound. Post-operative care consists of adequate analgesia, antibiotics where indicated, stump dressing and stump moulding.

RESULTS

A total of one hundred and eleven lower limb amputations were performed within the period under review. Seventy-four patients were male and thirty-seven females giving a male female ratio of M/F 2/1. Age range was between nine and 90 years, with the most patients within the 21 to 40 years age bracket, peaked indication for amputation is the 6th decade.

This shows the sex distribution with more males seen compared to females (Figure 1). The age group ranges from <10 to ≥80 years, the highest 21.6% being between 60-69 and lowest being 10-19 years in which none was seen (Figure 2).

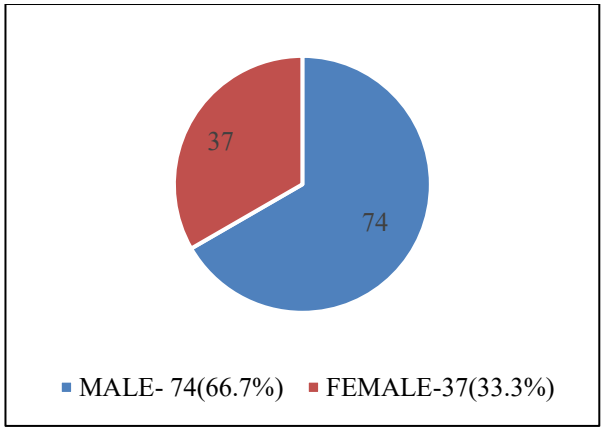

Figure 1: Sex distribution.

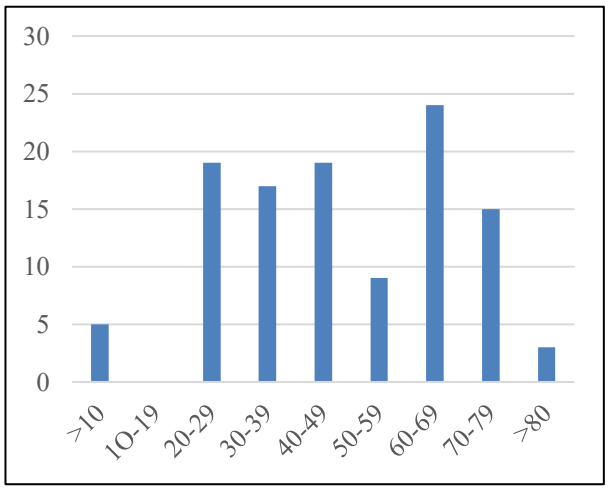

Figure 2: It depicts the age group and frequency.

The patients with below knee amputation had more hospital stay, with 16.3% >8 weeks 77.6% 4-8 weeks and 6.1% 2-4 weeks and then above knee amputation with maximum hospital stay at 4-8 weeks (Table 1). Patients with trauma had more above knee amputation. DFU had more below knee amputation, gangrene more above knee amputation and malignancy more above knee amputation (Table 2). The outcome and complications post operation, with 95% of patients discharged (Table 3).

Table 1: It depicts the relationship between level of amputation and duration of post op admission.

Level of amputation	Duration of post-op admission		
	2-4 weeks N (%)	**4-8 weeks N (%)**	**>8 weeks N (%)**
Above knee	24 (42.9)	31 (55.4)	1 (1.8)
Below knee	3 (6.1)	38 (77.6)	8 (16.3)
Distal leg	0 (0)	3 (100.0)	0 (0)
Foot	2 (66.7)	1 (33.3)	0 (0)

$\chi 2$=26.477, p=<0.001.

Table 2: Relationship between diagnosis and level of amputation.

Diagnosis	Level of amputation			
	Above knee (%)	Below knee (%)	Distal leg (%)	Foot (%)
Trauma	13 (46.4)	12 (42.9)	2 (7.1)	1 (3.6)
DFU	15 (36.6)	26 (63.4)	0 (0)	0 (0)
Gangrene	18 (62.1)	9 (31.0)	1 (3.4)	1 (3.4)
Malignancy	7 (87.5)	1 (12.5)	0 (0)	0 (0)
PVD	2 (66.7)	0 (0)	1 (33.3)	1 (33.3)
TBS	1 (50.0)	1 (50.0)	0 (0)	0 (0)

$\chi 2=27.996$, $p=0.022$.

Table 3: The post operative outcome.

Variables	N	%
Breakdown	5	4.2
Bleeding	1	0.8
Death	2	1.7
Discharged	109	95.1

DISCUSSION

This study is aimed at updating us on the incidence of amputation in UPTH, since the last review in 2002 by Adotey and colleagues.[15] The incidence of amputation varies from environment to environment, region to region and changes with time. This study shows the changing pattern in the indications for amputation in UPTH.

In most studies, there is a male preponderance for amputations although the ratio varies from one environment to the other. The result of the index study showed more males had amputation compared to females in a ratio of 2:1, this is similar to most studies, but with varying ration, Omagbemi et al, 1.6:1, Rafael et al, 1.8:1 and Thanni et al, 3:1.[5,10,17] On futher review, it is noted that the male to female ratio is lower where diabetic foot ulcer is the leading cause of amputation and higher where trauma is the leading cause of amputation. This may be attributed to the fact that trauma is a more common event in males than females.

The index study reported the peak age of amputation in the 6th decade , similar to Dada et al, 6th and 7th decade, Rafael et al, 6th decade, this may be due to the fact that, diabetic foot was noticed to be the commonest complication in these studies in which type II diabetes mellitus was the commonest cause, which manifest in later years as opposed to lower peak ages of 2nd and 3rd in studies where trauma was the commonest indication, the increased incidence of trauma in the lower decade may be due to the fact that they are in their productive age, with increased human activity, increased risk of road traffic accidents, falls from height and gunshot injuries.[15,17-19] The most frequent cause of amputation in this study was diabetic foot disease 36.9%, others where gangrene 26.1% trauma 25.2%, malignancy 7.2%, bone setting 1.8% and PVD 2.7%. This is in keeping with recent studies with diabetic foot disease, being the major cause of amputation, but differs to studies by Adotey et al, Thanni et al and Rafael et al, in which the commonest cause of amputation was PVD.[5,10,15-17,20,21] Type II diabetes is a preventable and treatable disease, poor clinical and social economic situation may be a cause of poor management. Diabetic mellitus and its complications are usually more pronounced among the poor socioeconomic group and those with low level of education, that are unable to afford the cost of treatment and regular check-ups needed for good glycaemic control. It has been reported that education on diabetic foot care reduced the incidence of diabetic foot complications, this will help to reduce the complications of diabetic foot and resources in health the sector.[16,22,23] This shifting trend in the cause of amputation in my centre, is likely to be due to a lower degree of motorization in the southern regions and, therefore, motor vehicle accidents.

Majority 50.5% of amputation was above the knee amputation, this is in keeping with study by Umaru et al, but in contrast to Adotey et al, Odatuwa-Omagbemi et al, Ofiaeli et al and Dada et al, this may be due to the change in cause of amputation, which in the index study is diabetic foot disease.[10,14,15,20] 1.7% of death postop was reported in the index study in which all the patients are diabetic, this is lower compared to Jawaid et al, 1.9%, Ofiaeli et al, 16%, Dada et al, Odatuwa-Omagbemi et al and may be attributed to good postop glycaemic control, good surgical technique and adequate postoperative management.[10,16,20,21]

In the index study, patients with below the knee amputation had more hospital stay of up to 8weeks compared to others, this may be due to higher risk of stump complications and re-amputation at more distal levels, other comorbidities and the fact that most of the cause of the amputation in the study was diabetic foot ulcer.[24,25] The 4.2% infection rate noted in this study is low, compared to the 30% reported by Omagbemi et al. 10 36% Ofiaeli et al and 31,4% Dada et al, again this may

be attributed to good postop glycaemic control, good surgical technique and adequate postoperative management.[16,20] The study provides a valuable insight into lower limb amputation patterns in Nigeria, but it is constrained by its retrospective, single centre design with significant difficulty in data collection due to the absence of computerized databanks leading to data incompleteness, lack of standardization and lack of long-term outcome tracking.

CONCLUSION

The major concern is the prevention of amputation. As reported in this study, diabetic foot disease is the main indication for amputation. Education on diabetic foot care will reduce this incidence. Government involvement in improving the poor economic situation will further improve access to health facilities and drugs for management of diabetes mellitus.

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