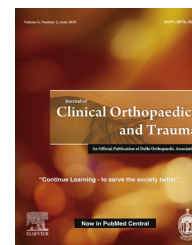


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## Original Article

# The indications for major limb amputations: 8 years retrospective study in a private orthopaedic and trauma centre in the south-east Nigeria

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## ABSTRACT

**Background:** Major limb amputation is a common orthopaedic trauma procedure and it is indicated mainly for traumatic gangrene and for trauma related limb conditions. The loss of a limb is devastating to the patient even when it is done to save life. The aims of the study are to highlight the indications for major limb amputations and to find out if there are any concurrent pattern changes.

**Patients and methods:** This is a retrospective study analysing medical records of all the patients, who had major limb amputations over a period of 8 years, between October 2007 and September 2015 in a private orthopaedic and trauma centre in the south-east sub-region of Nigeria.

**Results:** Traumatic gangrene was the commonest indication for amputation  $n = 30$  (44.7%), followed by diabetic gangrene  $n = 15$  (22.3%), and then traditional bone setters' gangrene  $n = 10$  (14.9%). These were trailed by mangled extremity, malignant conditions of the limb and polydactyl in that order of decreasing frequency.

**Conclusion:** Traumatic gangrene and other trauma related limb conditions are the leading indications for amputation in this study despite some recent reports stating otherwise. Trauma is largely preventable and so there is a need for continued intensification of the public campaign on road use as a means of preventing severe limb injuries and thus reducing consequent need for amputations.

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## 1. Introduction

Limb amputation is as old as medicine. Hippocrates first described the surgical technique of amputation for a vascular

gangrene in a published form in De Articularis. The limb was severed off from the margin of gangrenous part and left open to heal by secondary intension.<sup>1</sup> The major problems with the early amputation surgeries included haemorrhage, shock and sepsis.<sup>1</sup> These invariably resulted in a lot of deaths. Amputation

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surgeries like other aspects of medicine have evolved over the centuries and are indicated commonly in the patients, whose limbs are dead, or patients whose limbs are deadly and pose a life threat to them, or patients whose limbs are painful, functionless and constitute nuisance. Major limb amputations are the removal of limbs from the level of mid-tarsal joints or from the level of the wrist joint or from any elected site proximal to the aforementioned landmarks. Amputations are devastating to the patients and family members because of the sudden change in body form especially after trauma and the difficulties associated with rehabilitation and livelihood thereafter. Amputation is a major but preventable health problem that is associated with profound economic, social and psychological effects on the patients especially in developing countries where the prosthetic services are poor.<sup>2</sup>

It is a fairly common procedure that is carried out routinely in orthopaedic practice. It is estimated to constitute 0.38% of all orthopaedic procedure in Nigeria.<sup>3</sup> The reasons for amputations vary from region to region and from country to country. In the United States of America, vascular insufficiency in the limbs from peripheral vascular diseases or from diabetes mellitus related vasculopathy consist of 80–90% of all the indications for amputations.<sup>4</sup> In Nigeria, reports also vary according to the sub-region. Some authors had reported trauma as the commonest indication in the southern part while foot complication of diabetes mellitus is quoted as the commonest reason in the north and traditional bone setters' gangrene in the south east.<sup>5</sup> Recent publications also indicate that the trend is changing. Diabetes mellitus related complication was reported from the south west as the commonest indication for amputation.<sup>6</sup> The indications also vary accordingly whether the involved limb is the upper or the lower limb and sometimes the age of the patients. For example, the upper limbs are rarely affected by complications of diabetes mellitus unlike the lower limbs. Therefore, severe trauma may rank high as common cause for upper limb amputation, complications of diabetes that may lead to amputation in the upper limb are almost never encountered. Also amputation in children is more likely to be due to congenital limb anomalies when compared to adult patients. The aims of this study is to determine the indications for major limb amputations, to find out if there are any comparative change in the trend based on the existing regional reports as well as to determine the sex and age distribution of these patients who underwent amputation within the period of review (Table 1).

**Table 1 – Age and sex distribution of patients that had amputation.**

Age (years)	Number (%)	Male	Female
0–9	2 (1.5)	2	0
10–19	5 (7.5)	3	2
20–29	4 (6.0)	4	0
30–39	19 (28.4)	18	1
40–49	16 (23.9)	16	0
50–59	6 (9.0)	4	2
60–69	9 (13.4)	8	1
70–79	4 (6.0)	4	0
80–89	2 (3.0)	2	0
Total	67 (100)	61 (91.0)	6 (9.0)

## 2. Patients and methods

This study is a retrospective analysis, reviewing the records of patients, who had limb amputations in a private orthopaedic and trauma centre located in a densely populated commercial city in the south-east Nigeria. The centre is a 25 bedded facility with an all-time 92–100% bed occupancy in the past three and half years. The clientele base is mainly from the bustling commercial city with regular accident victims and from the scattered traditional bone setters' homes within the vicinity. All the patients were managed by one orthopaedic team consisting of a resident consultant orthopaedic surgeon and a visiting orthopaedic surgeon as well as the support staff.

The case files of all amputated patients treated between October 2007 and September 2015 that were compiled in folders and kept routinely with the medical records department were retrieved for analysis after obtaining approval from the ethical committee. The search words were amputation, gangrene or both. Additional information was collected from the operation register master list. Data analysed included age, sex, cause of injury, diagnosis and indication for amputation, type of amputation, duration of hospital stay, prosthesis fitting and mortality. Referred amputee patients with stump complications were excluded from the study. The data were subjected to statistical analysis using SPSS version 20 by International Business Machine 2011 and the results displaced as frequency distributions in tables and charts.

## 3. Results

A total of 67 amputations were carried out over the period of review. Traumatic gangrene was the commonest indication for amputation  $n = 30$  (44.7%) followed by diabetic gangrene  $n = 15$  (22.3%). Total trauma related gangrene constituted a high number of 47 patients (70%). These injuries were caused mainly by traffic accidents involving commercial motorcyclists. There was a very high male predominance with a ratio of 10:1. Young adults in the age bracket of 30–49 years were majorly affected  $n = 35$  (52.2%). The range of hospital stay was 6 to <8 weeks for the majority of the patients. There were six mortalities (9.0%), three were from complications in diabetes, two from late presenting traumatic gangrene and one from rapid cancer metastasis. Twenty-one patients (31.3%) were fitted with prosthesis on the long run.

## 4. Discussion

Major limb amputation is a fairly common surgical procedure. Onuba et al. reported that amputation surgeries constituted an estimated 0.38% of all orthopaedic procedures in Nigeria.<sup>3</sup> Also, some authors estimated that the prevalence rate of amputation in Nigeria is 1.6 per 100,000 operations.<sup>5</sup> However there are no national data to collaborate the incidence of amputation. In the United States of America, about 30,000–40,000 amputations are done annually.<sup>4</sup> The reasons for amputation vary from countries to countries and from regions to regions in the same country. Post-traumatic gangrene is the

commonest reason for amputation in our centre (44.7%). This is followed by diabetic gangrene (22.3%) and then by traditional bone setters' gangrene (14.9%). Mangled extremity, malignancy and congenital anomaly trailed the indications in that order. This followed the pattern reported by several authors in the past.<sup>7-10</sup> But in most advanced countries, vascular disorders like diabetic complications and peripheral vascular diseases are the leading indications for major limb amputations.<sup>4,11-14</sup> Distal frostbites are treated by pedal amputations<sup>15</sup> but if advanced can result in inevitable major limb amputations and these are common among mountaineers in winter times in some temperate countries. However there are conflicting reports in our environment by some authors in very recent studies on the commonest indication for amputation and they noted a changing trend. Some recent reports still maintain trauma as the commonest reason especially in the young patients just as it was many years earlier<sup>16</sup> while some reported complications of diabetes as the commonest indication having overtaken trauma.<sup>17-20</sup> They offered the explanations of the preventive and proactive measures taken to regulate road use and the limitations in the use of motorcycles as modes of transportation. On the other hand, our study supports primary traumatic gangrene as the commonest indication for amputation and it shows that the overall trend has not changed in our location if compared to reports in the early 2000s when commercial motorcycles were adopted in most cities of Nigeria as mode of intra-city transport. And when trauma related indications are considered together, trauma still remains the leading indication for amputation (Fig. 1). Unfortunately, in our setting, there is an enabling environment for a lot of road mishaps especially with commercial motorcycles still in use and also with the recently introduced tricycle as part of intra-city transport system. Many internally displaced persons from Boko Haram flight, jump at

the opportunity to eke out a living in this ever busy commercial city, even when they cannot ride these vehicles very well. The result is increased rate of accidents. Following trauma and amputation, the sudden change in body form is devastating to the patient and family members. There are both severe emotional and physical burden following loss of a limb.<sup>20</sup> Majority of the patients do not accept the option of amputation even when it is the only life-saving procedure. Getting an informed consent should involve the family members who must be aware of the options and have realistic expectations of surgical outcome in order to make informed decisions regarding amputation.<sup>4</sup> This is important because some limbs may not be out-rightly dead but are severely damaged, so managing them may amount to waste of man-hour, fund and eventually may result in painful, stiff and functionless limbs. Therefore early decision to amputate by the surgeon and early acceptance of same by patients and the family members are essential in the effective and timely management of their conditions.

The male to female ratio in this study is 10:1, slightly higher than a similar study from Karachi but a very high male predominance when compared to other studies.<sup>8-10,19,21</sup> There is no definite explanation for this staggering difference but in this bustling city, commercial motorcycles and tricycles are understandably male business and are patronised more often by males who supposedly are more daring and often more in a haste to get to their businesses. The frequent traffic gridlocks in the city make transport by commercial motorcycles easier and especially through areas that are not motorable. The road menace of these commercial cyclists is a common knowledge yet this mode of transportation is still a booming business. Severe trauma leading to gangrene from traffic accident was the leading indication for amputation in our study and in our setting where more males are more actively engaged in riskier

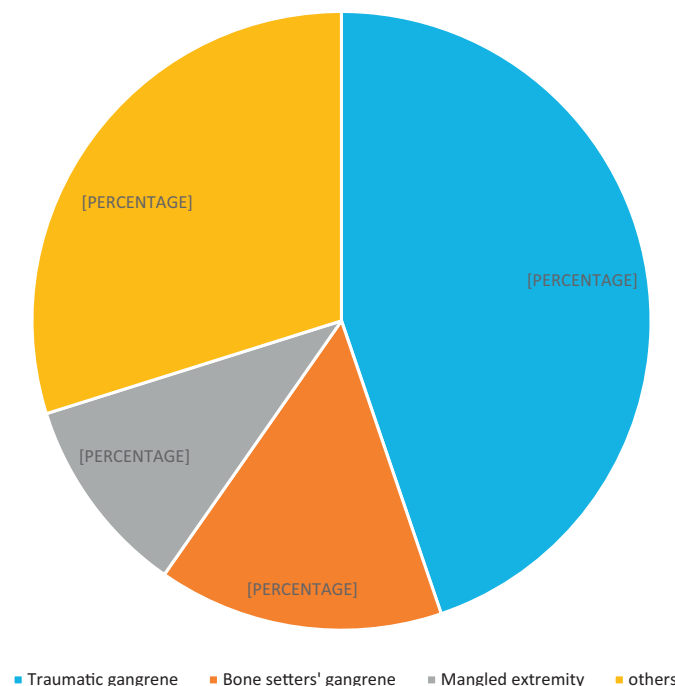


Fig. 1 – Pie chart showing distribution of trauma related indications for amputations and others.

activities of daily living, it is not unusual for males to dominate. The age range mostly affected was 30-49 years which is similar to findings by other authors.<sup>5,8-10</sup> This is the prime age, when people work hard to earn their livings and are, therefore prone to injuries. A study from Karachi reported a mean age of 47 years even though slightly more of the amputations were for diabetic complications than for trauma.<sup>21</sup> The age commonly affected in the reports from advanced countries is 60 years and above which is in line with the aetiologies.<sup>12-14</sup> The economic impact of amputations on the patients and their family members and on the society are profound and where the support system is lacking, many of the amputees are often seen in the streets of major cities hopping about with wooden crutches, begging for alms. Putting preventive measures in place to reduce the rate of traffic accidents will go a long way to reducing limb injuries and invariably reducing the rate of amputations. Where motorcycles popularly known as okada and recently introduced tricycle popularly known as keke na pepe cannot be banned, there should be an enforceable legislation for them to ply along the less busy routes and act as feeder vehicles to the relatively safer motor vehicles on the major roads.

The level of amputation in this study was slightly more above knee  $n = 29$  (43.3%) than below knee  $n = 25$  (37.3%) and lower limb amputations  $n = 54$  (80.6%) were more than upper limb  $n = 3$  (4.5%) amputation (Table 2). Other authors reported more B/K than A/K.<sup>16,18</sup> Our result was probably skewed by the number of traditional bone setters' gangrene who because of sepsis, high level of gangrene, late presentations and tight splint that usually spanned the entire leg, were treated by above knee amputations. However when possible, retaining the knee joint is very essential to ensure easier and faster rehabilitation, reduce the energy expenditure and improve efficiency during gait.<sup>22</sup> An ultra-short B/K stump is still more effective than an A/K and this is made possible by the improvement in prosthetic technology<sup>22</sup> which unfortunately is not readily available in developing countries. The elected level of amputation is dependent on the surgeon's need to conserve a longer stump, to ensure that the margin of the wound and surrounding soft tissues are viable so that healing will be possible and timely too, and the need to have bulky, painless soft tissue cover on the bony stump either as end bearing or for prosthetic fitting. The viability of the tissue left behind is dependent on the blood flow and this can be assessed grossly by palpating the pulse or by Doppler assessment or

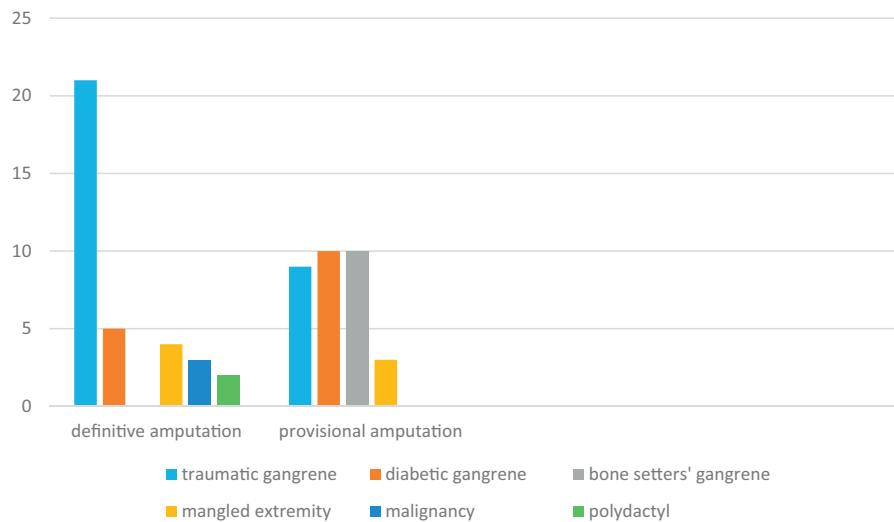
when available by measuring the transcutaneous oxygen pressure.<sup>23</sup>

Infection was not a primary reason for amputation in our study. Post-operatively, we did not record ascending infection that would have necessitated a more proximal revision but there were some wound infections and breakdowns. Ascending infections on the stumps were major postoperative complication reported by some authors with a rate as high as 21%.<sup>24</sup> Delays in presentations, initial alternative care from the traditional bone setters, gangrene in addition to the compromised immune status in uncontrolled diabetes mellitus and inadequate resuscitation are the risk factors for developing wound infection post-amputation. A good number of the patients were considered for two or more staged amputations (open amputation) because of infection and the need to do more conservation and provide a longer residual limb that is more efficient. Provisional amputations were necessarily done for all the traditional bone setters' gangrene and for more cases of diabetic gangrene because of sepsis (Fig. 2). And because of infection, the more proximal the elected site of amputation, the more likely a surgeon will have a good clearance of local sepsis at the expense of longer residual limb, and therefore difficult rehabilitation and higher energy expenditure during gait. If the surgeon decides to be more conservative and amputates the limb through levels that are viable but are not cleared of sepsis, it becomes surgically imperative not to close the wound primarily but to leave the stump open for dressing and drainage and to institute the appropriate antibiotic therapy. Also provisional amputation can be carried out within a shorter operation time than a definitive amputation and this principle is necessary for these patients who were usually not too stable for prolonged surgery and anaesthesia despite the resuscitation, but at the same time needed the amputation to remove the source of toxemia and source of systemic inflammatory response and possibly reverse any organ dysfunction.

The wound infections and wound breakdowns were mainly on the stump of traumatic and diabetic gangrenes that were treated by one stage definitive amputation. This initial cursory observation by the team causes us to revert to two or more stage provisional amputations in the later cases especially for traditional bone setters' gangrenes. Even though we have not done any comparative study on the outcome of treatment by definitive and provisional amputations on the basis of rate of wound infection and dehiscence, length of hospital stay, need

**Table 2 – Cross tabulation of diagnosis with level of amputation carried out.**

Diagnosis	Treatment carried out					Total (%)
	A/K (%)	B/K (%)	A/E	Ray	Mid-tarsal	
Traumatic gangrene	12 (18.0)	15 (22.4)	2	1	0	30 (44.7)
Diabetic gangrene	3 (4.5)	5 (7.5)	0	6	1	15 (22.3)
Bone setters' gangrene	7 (10.4)	2 (3.0)	1	0	0	10 (14.9)
Mangled extremity	4 (6.0)	3 (4.5)	0	0	0	7 (10.4)
Malignancy	3 (4.5)	0	0	0	0	3 (4.5)
Polydactyl	0	0	0	2	0	2 (3.3)
Total	29 (43.3)	25 (37.3)	3	9	1	67 (100)



**Fig. 2 – Histogram showing the distribution of the amputation type in relation to the diagnosis.**

for antibiotics and total cost of treatment in the two groups, it will be necessary to determine their impacts on amputation surgeries. Many authors have reported sepsis as the underlying cause of death in their series.<sup>25-27</sup> This is similar to our findings as two diabetic and two traumatic amputees died from sepsis related complications with persistent fever, copious purulent wound discharges and eventually septic shock and death. One diabetic developed renal failure 4 weeks post-amputation, and he was referred to dialysis clinic but a return referral confirmed he died after one session of dialysis.

The provision of affordable, durable and light prosthesis is a *sine qua non* to efficient rehabilitation and re-integration of amputees into the society. Only 24 amputees out of the 67 amputees were able to get their prosthetic fittings. This was made possible through an arrangement the centre has with a local orthotic and prosthetic company to provide these artificial limbs speedily and at affordable costs. However, a lot of the amputees were still not fitted with prosthesis. It will be nice, if National Health Insurance Scheme is expanded to include this aspect of amputations after care. Some Non-Governmental Organizations have helped in the past but help can only be complete when these amputees are fully rehabilitated and the first step is the provision of user friendly prosthesis.

### Conflicts of interest

The authors have none to declare.

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