Health Sciences & Diseases
The Journal of Medicine and Biomedical Sciences

Original Article

Major Limb Amputations: A Tertiary Hospital Experience In Northwestern Cameroon

Amputations majeures des membres dans un hôpital du Nord Ouest du Cameroun

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Keywords: Amputations; Pattern; Outcomes; Limb-Salvage; Prosthesis; Cameroon.

RÉSUMÉ

Objectives. The study aimed to describe the current pattern and outcome of care at a tertiary hospital in Shisong-Cameroon and to compare our experience with that of other published data. **Methods.** This observational prospective hospital-based study was conducted over the two years of 2018 to 2019. The parameters reviewed include sociodemographic data like the age and sex of the patients, then the indications for the major limb amputation, and the complications. **Results.** The study was carried out on 172 files of patients aged 1year to 84years with a mean age of 32± 10.28 years. There were 124 (72.4%) patients of the male, and 48 (21.6%) patients were of the female gender. One hundred seventy-two amputations were realized with Lower limb amputations were 99 (57.7%) in the lower extremity, and 73 (42.3%) in the upper extremity. There were 16 patients (9.30%) with complications, including surgical site infection of the stump wound closely trailed by hematoma. The most significant risk factor for amputation was diabetes (38 patients, 22.09%) followed by ulcer (2 patients, 1.16%), and vascular disease (6 patients, 3.49%). Traumatic gangrene was the most frequently encountered indication for amputation n = 104 (60.47%), followed by diabetic gangrene n = (38 patients, 22.09%). **Conclusion.** Traumatic gangrene and other trauma-related limb conditions are the leading indications for amputation in this study. Trauma is mostly 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 the consequent need for amputations.

ABSTRACT

Objectives. The study aimed to describe the current pattern and outcome of care at a tertiary hospital in Shisong-Cameroon and to compare our experience with that of other published data. **Methods.** This observational prospective hospital-based study was conducted over the two years of 2018 to 2019. The parameters reviewed include sociodemographic data like the age and sex of the patients, then the indications for the major limb amputation, and the complications. **Results.** The study was carried out on 172 files of patients aged 1year to 84years with a mean age of 32± 10.28 years. There were 124 (72.4%) patients of the male, and 48 (21.6%) patients were of the female gender. One hundred seventy-two amputations were realized with Lower limb amputations were 99 (57.7%) in the lower extremity, and 73 (42.3%) in the upper extremity. There were 16 patients (9.30%) with complications, including surgical site infection of the stump wound closely trailed by hematoma. The most significant risk factor for amputation was diabetes (38 patients, 22.09%) followed by ulcer (2 patients, 1.16%), and vascular disease (6 patients, 3.49%). Traumatic gangrene was the most frequently encountered indication for amputation n = 104 (60.47%), followed by diabetic gangrene n = (38 patients, 22.09%). **Conclusion.** Traumatic gangrene and other trauma-related limb conditions are the leading indications for amputation in this study. Trauma is mostly 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 the consequent need for amputations.

INTRODUCTION

Amputation as a surgical practice is dated back to the days of Hippocrates [1-6]. "The act of removing the whole or part of a limb by cutting through bone or joint is amputation. The procedure (amputation) is a universally acceptable ancient surgical procedure; therefore, for the same reason, the procedure retains its relevance in modern time to save life or remove a dead or useless limb" [1-6]. "Limb amputation is still a major health burden for our surgical practice. Nobody likes to lose a limb. Modern surgical care aims at limb salvage even for malignant diseases; Interestingly, this limb salvage is pursued vigorously in developed countries as the first option of care" [7-10]. Furthermore, "there are significant variations in the epidemiology of extremity amputation, which invariably is different from within and without countries [11-13] depending on ethnic background and socioeconomic status" [11, 14-16]. Some authors have suggested that the leading causes in sub-Saharan Africa include trauma and tumors [11-13]. A contradictory report by other Authors, Pisoh-Tangnyin C *et al.* [17] from Cameroon, and Katchy *et al.* [18] from Nigeria, showed that "diabetic complication was the most common indication for amputation followed by gangrene from non-infectious and infectious causes."
Moreover, "in many sub-Saharan African countries, there is a lack of centers with a capacity to provide adequate care and rehabilitation for this category of patients [19-21]. Those amputees are often left with enormous physical and psychological challenges characterized by social stigmatization and poor rehabilitation facilities" [19, 21]. Therefore, the most critical needs are those factors that may lead to a decrease in the amputation rate and an improvement in the rehabilitation of patients [7]. Besides, there has been minimal data on extremity amputation in our sub-region, most especially factors that may lead to amputations as well as their care and outcome, which necessitated this study. he study aims to determine the current pattern and outcome of care at a tertiary hospital in Shisong-Cameroon and to compare our experience with that of other published data.

METHODS

Study Design and Setting

This observational prospective hospital-based study was conducted over the two years of 2018 to 2019 at St Elizabeth Catholic General Hospital, Shisong, Northwestern region, Cameroon. The hospital treats low to middle-class patients and handles an estimated 10 to 40 primary surgical operations per week.

Study population

The study covered all age groups and gender that underwent major limb amputations at the St Elizabeth Catholic General Hospital, Shisong, within the period of study.

Selection criteria

The patients who gave informed written consent were included in the study. Those patients who declined consent and those who were previously operated in other institutions, but required stump revision were excluded from the study.

Recruitment of patients

The patients were prospectively recruited for the study. The attending surgeon determined the indications and level of amputation. The decision for amputation was based on clinical evaluation, radiological investigations like x-rays of the affected limb, Doppler studies, etc.), and histopathological investigations. Patients who met the inclusion criteria were offered explanations about the study and requested to consent before being enrolled in the study. Major limb amputation was defined as limb removal at or proximal to the wrist and ankle. In the case where conversion to a higher level was required, the amputation level was recorded as the new revised level. We followed up the patients until discharge or death. Patients who developed complications were managed appropriately.

Data collection and analysis

Data collection was performed using a pretested proforma. The variables studied include A) Socio-demographic data (age, gender, education level, and occupation status); and B) Clinical data (indications, level of amputation, degree of trauma, Wagner's classification of diabetic foot [22], postoperative complications, length of hospital stay, and mortality). The data were analyzed to determine the hospital incidence and epidemiological pattern of amputation. Aspects of care that could be improved were identified, and appropriate recommendations were made. The data analysis was done with SPSS version 24 computer software.
Frequency table, cross-tabulation, Fisher's exact test, and Pearson's chi-square test of significance were used. For all statistical analyses, a p-value <0.05 was considered significant, and comparison with other literature on amputations to assess our trends and variations.

Ethical consideration

The study got the approval of the institutional Ethical Review Board. Confidentiality was ensured by not writing the names of patients on proforma per the Helsinki declaration.

RESULTS

Patients' demographic characteristics

A total of 172 major limb amputations were performed during the study period under review. There were 124 (72.4%) patients of the male sex, and 48 (21.6%) patients were of the female sex (M: F=2.6:1). The ages of the patients ranged from 1year to 84years with a mean age of 32± 10.28 years. One hundred and three (60.2%) patients were below the age of 40, and the predominant age group was 31-50 years (23.7%). The age group 21-40 years had the highest number of amputations with 43 (25%) cases, as seen in Table 2. The majority of amputations for mangled extremities were in patients aged less than 30 years, with 22 (12.8% of people with diabetes) between the ages of 51-80 years. In the age-groups below 25 years, there were more male patients

with amputation while above 50 years; there were more female patients with amputation.

Table 1 age group distribution

Age group (years)	Number of patients (n= 162)	Percentage
0-10	06	03.49
11-20	27	15.70
21-30	43	25.00
31-40	30	17.44
41-50	36	20.92
51-60	13	07.56
61-70	12	06.98
71-80	05	02.91
Total	**172**	**100.0**

Indications

In addition to the preceding, work-related (occupational) injury accounted for amputations in 29 (28%) patients, whereas non-occupational injury accounted for amputations in 75 (72%) patients. Overall the most common indication for amputation was trauma accounting for 104 (60.47%) amputations. The period was characterized by civil unrest in the northwestern region of the country. With the civil unrest, blast-related amputations resulted from landmines, tear gas canister and heavy explosives, etc. that contributed 38 (36.5%) patients, as seen in Table 2 and Table 3.

Table 2: indications for amputation

Indications	No of patients	Percentage
Trauma	104	60.47
Diabetes foot gangrene	38	22.09
Peripheral Vascular disease	6	03.49
Malignancies		
Squamous cell carcinoma	1	00.58
Rhabdomyosarcoma	1	00.58
Malignant Histiocytoma	1	00.58
Chronic ulcers	2	01.16
Congenital malformation	5	02.91
Necrotizing fasciitis	4	02.33
Snake bite	3	01.74
Severe Burns	5	02.91
Chronic Osteomyelitis	2	01.16
Total	**172**	**100.00**

The crushing type of amputation was observed in 28 (26.9%) patients, whereas the guillotine type was observed in 10 (9.6%) patients. There were 22 patients also with heavy gunshot related amputations, while gunshots from armed robbery attacks accounted for amputation in eight patients. Road traffic injury accounted for amputation in 12 (11.5%) patients, as seen in Table 2 and Table 3. In the road traffic injury group, 5 (45%) patients were involved in a motorcycle crash, 5 (45%) patients in a motor vehicle accident, and two (10%) patients in pedestrian injury.

Table 3: causes of injury among traumatized patients

Indications	No of patients	Percentage
Warfare (Blast) injuries	38	36.5
Gunshot injury	30	28.9
Road traffic accident (Mangled limb)	12	11.5
Fall from height	4	3.9
Industrial accident	10	9.6
Domestic accident	6	5.7
Limb gangrene complicating TBS treatment	4	3.9
TOTAL	**104**	100

Furthermore, we had traditional bonesetters' gangrene in four (3.9%) patients, out of the 104 patients with trauma-related amputations. Industrial machine and machete injuries accounted for ten (9.6%) and five (4.9%) cases, respectively, as shown in Table 3. Industrial machine injury in a cassava processing factory accounted for four major amputations in patients who were pulled-in and injured by machines when their clothing became caught by the rolling-belt. Then, the machine injuries in asphalt, bread, concrete block, quarry, and poultry feed industries accounted for one amputation in each case.

One severe challenge in the treatment of the patients were some delays in performing outright amputations which were experienced in an estimated 25 patients due to refusal to give consent in three, lack of fund to pay for surgery in nineteen and logistic problems in three patients. The risk factors showed diabetes as the second leading reason for amputation (38 patients, 22.09%) followed by ulcer (2 patients, 1.16%), and vascular disease (6 patients, 3.49%), as shown in Table 2. The majority of amputations in the upper extremity involved the digits (Table 4). Lower limb amputations were 99 (57.7%) with above-knee amputations (AKA) the most common accounting for 58 (33.7%) of the total extremity amputations while the upper limb amputations were 73 (42.3%) with digit amputations the most common accounting for 33(19.3%) of the full extremity amputations (Table 4).

Table 4: types amputation performed

	Type of amputation	No of patients	Percentage
Upper Limb	**Above Elbow**	31	18.2
	Below Elbow	9	4.8
	Digit	33	19.3
Lower Limb	**Above Knee**	58	33.7
	Below Knee	32	19.2
	Digits	9	4.8
Total		**172**	**100.0**

Domestic accidents and burns accounted for 6(5.7%) and 5 (4.9%) cases (Table2). Trauma accounted for 18 (50%) of AKA, while complications of diabetes were responsible for 23 (51%) of below-knee amputations (BKA), making it the most frequent cause of BKAs. Trauma, 10 (71.4%) was the most common reason for upper limb amputation. Malignancy in 3 patients was predominantly responsible for amputation.

Outcomes

There were 16 patients (9.30%) with postoperative complications dominated by stump infection (8 cases, 4.7%) followed by hematoma or seroma (5 cases, 2.91%), hemorrhage (3 cases, 1.74%), and a majority evolved favorably and were discharged to continue rehabilitation as out-patients. One-third of the patients accepted a pre-prosthetic rehabilitation plan. An estimated 30 patients spent an average of one month in the hospital with the most prolonged stay of 58days.

The risk of wound infection was significantly related more to amputations by the crushing mechanism than the guillotine type (Fisher's exact test, $p<0.001$). About 50% (34/68) of patients who presented to the hospital later than 24 hours had stump wound infection, whereas about 74% (22/30) of patients who presented within six hours of injury had wound infection.

The Average Duration of Hospitalization

The mean and median period of hospital admission was 21.08 days and 25 days, respectively.

Revision Amputation and Mortality Rates

No fatality recorded in the cases managed, and only four patients (2.33%) required revision amputations.

DISCUSSION

In this study, majority of our patients were young adults. Our results favorably compared with that of Ofiaeli *et al.* [23] in Nigeria and other African authors like Bushra *et al.* [1, 3, 4]. Paudel [18, 24] in his series have adduced reasons that the young male adults are very agile, usually out of doors, exposed to hazards, and highly vulnerable to major traumas as well as invariably at risk of amputation. The preliminary finding is not unexpected, especially in the face of the prevailing civil unrest, otherwise known as the 'Anglophone crisis' [7-10, 18]. Mostly because trauma remains the most common indication for amputation in such crisis-ridden communities involving a significant number of young male energetic adults [7, 25, 26]; also, in agreement with a report by Pisoh-Tangnyin C *et al.* who submitted that trauma is a leading cause of extremity amputation in Cameroon. Interestingly, in the western world, several works of literature reports equally suggest that trauma is the leading cause of extremity amputation [11, 13, 17, 27, 28]. Similar statements have been obtained from Zaria, Nigeria, and East Africa but contrast with the report from North-Eastern Nigeria, where malignancy was the most common indication [7, 29].

Besides, from the view-point of evidence-based practice, amputation is no longer considered as the gold standard but now undertaken only as a last resort. Limb salvage is the primary goal of modern limb surgery [7-10]; especially in facilities where such services are available, a practice which reliably evolved from recent advances in microvascular surgery and clinical oncology [7-10]. Among our trauma patients, severely mangled-extremity cases from the blast, gunshot, and road traffic accident (RTA) with the compromise of the peripheral blood supply was understandably the most frequent reason for amputation in this study [7, 30].

A review of the literature implicated a carefree attitude and inadequate foresight of the victims of falls from height and some occupational accidents [7, 30]. For instance, in our study, a palm tree climber fell as a result of a dry and brittle cane which occurred during the dry harmattan season. This fall from a height could have been averted by regular checks and soaking of the cane in water. Some authors corroborated this submission in their reports [7, 30].

In a related development, industrial accidents were even more pathetic. The inappropriate dressing was mostly responsible in many of the cases [7, 30]. The majority of the patients (industrial workers) in our series claimed responsibility for wearing unsuitable dresses. Therefore, the rising edge of the clothes was trapped when they operated very close to the exposed fast running conveyor-belts of industrial machines like cassava grinding and electricity power engines. It means adherence to safety tips such as concealed conveyor-belts and appropriate short-sleeve or smart dresses that ultimately make these risks of trauma-related amputations highly preventable are critical for such industrial workers" [7, 30].

This study highlights diabetic foot sepsis as another significant indication for limb amputation. The finding of diabetic foot gangrene is in contradiction to what is reported in developed countries where the peripheral vascular disease is the leading cause for limb amputation [2, 31-33].

Diabetes mellitus, especially type II, has an insidious course. Unfortunately, most often, patients present late when extensive gangrene has occurred, and revascularization and limb salvage is not a feasible option [2, 31-33]. The majority will report to the hospital only when the complications do not offer possibilities of recovering the limb [17, 34, 35].

Interestingly, the majority of our patients are from the rural community in the Northwestern region and suburbs. Lower extremity surgical complications have been more frequently reported among patients of the lower socioeconomic groups as they are more likely to be living in rural areas. The rural communities have little or no health facilities, so they and not likely to have insulin and oral diabetes medications [17, 34-37]. The report is inconsonant with other authors including Akiode O *et al.* [3], and Katchy AU *et al.* [18] from Nigeria; Ogeng'o JA *et al.* [11] from Kenya; and Pisoh-Tangnyin C *et al.* [17], from Cameroon. These African authors had observed that patients who had limited education had limited knowledge of their disease and did not practice any prevention for podologic traumatism. The author recommended programs for the prevention of podologic complications taking into account local specifics [3, 11, 17, 18].

Similarly, an analysis of the cases with gangrene showed 4 cases (3.9%) limb gangrene complicating TBS treatment [17, 20, 22, 25, 38-41]. Many authors have, in several series, highlighted the role of Traditional Bonesetters (TBS). Recommendations ranged from unacceptability of complications arising from their roles with calls for an outright ban and legislation to the

training of practitioners [7, 20, 40-44]. For the later, the question posed by Osime and Elusoji [45] on how safe this practice will be? needs to be answered before we can embark on it. For the former, we need to examine the issue [46, 47] of market forces in Nigeria, which favors the use of TBS. Indeed current market factors in the United States are skewed in favor of TBS in keeping with recent WHO recommendations for collaborations of biomedical and tradomedical practitioners [40, 41, 45, 48].

Surprisingly, our findings on age, indications, and mortality are at variance with those of Anyanwu and Naaeder [20, 21, 49, 50], who also studied the pattern of amputation in West Africa. Meanwhile, both studies were carried out in similar general surgical units with a resulting difference in the etiology. This difference merits further study to determine the contributory role of peripheral vascular disease in amputation surgery within the West Africa sub-region.

Besides, the duration of hospital stay has been identified as one of the primary determinants of the cost associated with amputation [2, 18]. Mean hospital stay was 21.08 days in this study, which is less than that reported from Nigeria (24.7 days) [2, 3] and Netherland (42 days) [2, 52] and more than that reported from the United States (15.9 days) [2, 37].

Furthermore, these amputees are often left with enormous physical and psychological challenges characterized by social stigmatization and inadequate rehabilitation facilities [7, 21]. In many instances, the amputees are often viewed as incomplete individuals. The patient can readily undergo complete rehabilitation and following the application of an appropriate prosthesis. Consequently, they become an active member of the society by maintaining an independent lifestyle after a given amputation [2, 3, 18, 37, 52]. It is also evident from this study that primary amputation remains a formidable tool in the management of patients with primary soft-tissue tumors in whom wide excision is not possible and in this series three patients with malignancy ultimately had amputation [53].

Moreover, the range of complications observed post-operative stump infection (8 cases, 4.7%) followed by seroma or hematoma (5 cases, 2.91%), hemorrhage (3 cases, 1.74%), and a majority evolved favorably and were discharged to continue rehabilitation as out-patients. The risk of wound infection was significantly related more to amputations by the crushing mechanism than the guillotine type. These complications contradict the findings of Jawaid *et al.* [1, 2] and Kidmas *et al.* [1, 42]. They found a mortality rate of 12.6%. Ploeg *et al.* [1, 54] in the Netherlands reported hospital mortality for BKA as 9% and AKA 18% from a contemporary series. No record of fatality in this series was recorded.

In a related development, major limb replantation is defined as the replantation of limbs proximal to the wrist or the ankle [3, 55]. Crushed and avulsed parts make reconstruction more challenging to achieve [3, 56, 57]. Twenty-five cases were identified as clean-cut traumatic amputations that might have benefited from limb replantations if the skills and facilities were available during the period covered by this audit. Replantation in the lower extremities remains a controversial issue [3, 58]. Some works of literature advocate that lower limb prostheses provide a stable stance and a functional gait; therefore, the prosthesis may be more practical than the replanted limb. However, the majority of patients in our environment prefer to have their poorly functional limbs, rather than have an artificial one. We also live in the developing world where prostheses are not readily affordable by most patients [3, 7, 43, 55, 59]. In our study, 90.5% of the patients did not have a prosthesis fitted for financial reasons.

Nonetheless, a challenging problem encountered by amputees in our environment is the lack of prosthetic facilities. The prohibitively high cost of the prosthesis, coupled with the psychological intolerance of the amputees, may contribute to the initial reluctance of the patients to give consent for amputation. As a matter of urgency, there is an extreme need for the establishment of prosthetic fitting centers in Cameroon. Also, the patients need some form of assistance to make the prosthesis easier to acquire. We must reiterate that a well-rehabilitated amputee is the best therapist for his counterpart [7, 60]. Lack of prosthetic facilities in our center may be one of the reasons for the high default rate of the patients since we could no longer help them at the next phase of their management.

CONCLUSION

In conclusion, limb salvage is the ultimate target, and this demands that more vascular units be established. Trauma remains the most significant reason for amputation in this environment, and there is strong advocacy for the reduction in the rate by accident prevention and injury control measures. Finally, there is an urgent need for a resolution of the on-going Anglophone crisis and a desperate call to making prosthesis more conveniently available.

DECLARATIONS

Acknowledgments: Not applicable.

Funding: No record of the financing for this Clinical Research Study declared.

Availability of data: All data generated or analyzed during this study are included in this published article.

Disclosures: The author has no disclosure to make.

Author's contributions: The Author conceived of the study and participated in its design and coordination as well as helped to draft the manuscript; the author also read and approved the final manuscript.

Ethics approval: The Institutional Ethical Review Board provided ethical approval. Confidentiality was ensured by not writing the names of patients on proforma per the Helsinki declaration. A copy of the written Approval is available for review by the Editor-in-Chief of this journal.

Competing interests: The author has no competing interests.

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