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Original Research

Limb Amputations at A Rural Tertiary Hospital: Evaluating Patient Characteristics, Risk Factors for Mortality, and Functional Outcomes

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Abstract

Introduction

Amputation is the surgical removal of a body part. Trauma, infections, and non-communicable diseases are among indications of amputations, but changing trends have been highlighted in various regions. We aimed to describe the experience of limb amputations at our hospital to highlight patient characteristics, risk factors for mortality, and functional outcomes.

Methods

The study was a descriptive, retrospective case series of all patients who underwent limb amputation from January 1st 2018 to December 31st 2019. Patient data, including demographics, details of presentation, laboratory values, comorbidities, operations, and outcomes, were extracted from the electronic medical record. The primary outcomes were postoperative function and mortality. Comparison by risk factors for mortality was performed.

Results

154 patients underwent amputation. 121 (78.5%) were lower limb amputations. The average age was 52.2 years. Average duration of illness was 120 days. 93 (60.4%) patients were men. 82 (53.9%) had at least one comorbidity. Trauma was an indication for 57 (37%) patients and 74 (48%) had arterial disease. Diabetes was the most common comorbidity (N=62; 40%). The in-hospital mortality rate was 10.4% (N=16). Patients with a presenting diagnosis of diabetes had increased mortality when compared to those without diabetes (19.2% vs. 5.9%; p=0.01). For the functional outcome, 59 (47.2%) were ambulant on crutches and 27 (21.6%) were using a wheelchair.

Conclusions

Trauma and vascular disease frequently contributes to the need for amputation in our region. Diabetes was present in one third of the patients, and was a significant risk factor for mortality. Recognition of the impact of medical comorbidities is warranted given these findings.

Introduction

An amputation is the surgical removal of a part of a body, such as an arm or a leg, and has been performed for centuries.[1] Indications for amputation can include trauma, malignancy, severe infections, and complications from various chronic diseases, including diabetes and peripheral arterial disease.[2,3]

In countries with lower development indices, the burden of trauma is devastating and increasing.[4] In the past, most amputations were carried out because of trauma.[5] There has been a shift towards lifestyle-caused diseases and other chronic illnesses that put patients at risk of amputation.[6-9] There is a need to understand better the impact of trauma and non-communicable diseases on the need for amputation in our setting, to examine the risk factors for mortality, and

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to assess the functional outcomes of patients after an amputation.

At Tenwek Hospital, limb amputation is a common procedure performed by both the general surgery and orthopaedic surgery services with various indications. We aimed to describe the experience with extremity amputation at our institution to highlight various patient characteristics such as the prevalence of trauma and non-communicable diseases, the risk factors for inpatient mortality, and their functional outcomes.

Study area

Tenwek Hospital, a faith-based tertiary referral centre in Bomet County, Kenya, provides emergency management, including potential emergency amputations, upon patient admission. Post-amputation, patients are placed in the critical care unit, general surgical ward, or orthopaedic ward based on their cardiopulmonary status. During their stay, they receive standard treatments such as antibiotics, analgesics, and anticoagulation. They also undergo education on wound care, comorbidity management, and lifestyle adjustments. A multidisciplinary team, including surgeons, physicians, physiotherapists, nutritionists, and nurses, guides rehabilitation. Two weeks post-surgery, patients return for a wound assessment and potential prosthesis suitability evaluation by the physiotherapy team.

Methods

We performed a descriptive retrospective case series of patients who underwent a partial or complete limb amputation between January 1st, 2018 and December 31st, 2019. All patients who had a limb amputation were included. We extracted data through a chart review of patients identified to have undergone an amputation in the electronic medical record. We stored data in Microsoft Excel and performed the analysis in Stata (Version 16).

During chart review of the electronic medical record, the following parameters were collected: age, sex, duration of presenting complaint, presence and duration of known relevant comorbidities, tobacco smoking status, initial random blood sugars, initial white blood cell count initial Erythrocyte Sedimentation Rate, Human Immunodeficiency Virus status, Hemoglobin A1c level, any diagnosis of comorbidity while admitted, an attempt at limb salvage, amputation indication, after stump formalization, mortality, discharge diagnosis, and the patient's progress in terms of functional status. The primary outcomes were postoperative function and mortality. Risk factors for mortality were assessed, and descriptive statistics were utilized. Comparisons were performed on potential risk factors for the outcome of mortality by chi-square analysis for categorical variables and a Student's t-test for continuous variables.

Table 1. Patient characteristics

Factor	Value
N	154
Age (years), mean (SD)	52.2 (21.7)
Male	93 (60.4%)
Duration of illness (days), mean (SD)	119.6 (624.6)
Presence of Medical Comorbidity	67 (43.5%)
Diabetes	52 (33.8%)
Initial Random Blood Sugar mmol/L, mean (SD)	15.0 (8.1)
Initial White Blood Cells cell/ x 10^9/L, mean (SD)	14.4 (8.7)
Initial Erythrocyte Sedimentation Rate mm/hr, mean (SD)	101.5 (157.4)
Diagnosis of new comorbidity during hospital stay	22 (14.3%)
Presence of medical comorbidity (pre-existing or new)	82 (53.2%)
Indication Category	
Arterial disease	74 (48.1%)
Congenital	2 (1.3%)
Infection	14 (9.1%)
Trauma/burn	57 (37.0%)
Tumor	3 (2.0%)
Unknown	4 (2.5%)
History of trauma	64 (41.6%)
Infection present	100 (64.9%)

Results

There were 154 patients who underwent amputation during the data collection period. Among these, 121 (78.5%) involved the lower limbs. The average age was 52.2 years (SD 21.7) and men constituted 93 (60.4%) patients. 82 patients (53.9%) had at least one medical comorbidity, with 22 patients (14.3%) receiving a new diagnosis during admission. Diabetes was the most common comorbidity (N=62, 40.3%). Arterial disease was the most common indication for amputation (N=74, 48.1%). Among patients with diabetes who had an HbA1c checked, the average was 10.3% (SD 3.3). Infection was listed as present in 100 patients (64.9%). Patient characteristics are listed in table 1.

The most common final amputation level was a below-knee amputation (BKA) (N=65, 42.2%). Sixty-six patients (42.9%) required a guillotine amputation. On functional outcomes, the majority were ambulant on crutches (N=59, 47.2%) and 27 (21.6%) patients used a wheelchair. The in-hospital mortality rate was 10.4% (N=16). Table 1 shows the attributes of the patients collected during their hospital visits. Furthermore, interventions and outcomes are detailed in Table 2, while potential risk factors for mortality are displayed in Table 3. Patients with a presenting diagnosis of

Table 2. Operative interventions and patient outcomes

Initial amputation was guillotine	66 (42.9%)
Initial attempt at limb salvage prior to amputation	29 (18.8%)
Level of final amputation	
AKA	45 (29.2%)
Above elbow	4 (2.6%)
BKA	65 (42.2%)
BKA, AKA	1 (0.6%)
Below elbow	2 (1.3%)
Bilateral below elbow	1 (0.6%)
Finger	19 (12.3%)
Forequarter	1 (0.6%)
Hip disarticulation	1 (0.6%)
Syme	1 (0.6%)
Through wrist	2 (1.3%)
Toe	4 (2.6%)
Transknee	4 (2.6%)
Transcarpal	1 (0.6%)
Transhumeral	1 (0.6%)
Transmetacarpal	2 (1.3%)
Hospital length of stay (days), mean (SD)	11.4 (8.8)
Admission to critical care unit	19 (12.3%)
Alive at time of hospital discharge	138 (89.6%)
Outcome	
Ambulatory	1 (0.8%)
Bed bound	3 (2.4%)
Crutches	59 (47.2%)
Death	16 (12.8%)
Limited function	18 (14.4%)
Prosthesis	1 (0.8%)
Wheelchair	27 (21.6%)

diabetes had increased mortality when compared to those without diabetes (19.2% vs. 5.9%; p=0.01).

Discussion

Our findings demonstrate a considerable burden of disease due to amputations for both trauma and non-communicable disease in our population. There were a large number of guillotine amputations required (66 patients; 43%), which is a marker for the severity of the illness.[9] Typically, these amputations are necessary when a limb is infected, and the patient is too sick to tolerate formalization during the initial operation. The rate of mortality for our series was consistent with other reports in Africa.[3,8-11] From the region, half of the patients may experience complications after amputation as reported in a case series from Tanzania.[10] As often the last option available for patients, these findings indicate the severity and complexity of amputations at our hospital.

There is an emerging shift from communicable to non-communicable diseases in developing countries.[6] This study recorded the number of amputations caused by arterial disease at 48%, which aligns with similar estimates that point to a growing percentage of non-communicable diseases in the region.[8] Forester et al. found that at a referral health facility in Cameroon, the most common reason patients had amputations were infections and vascular disease from poorly treated diabetes and peripheral vascular disease.[12] Diabetes was present in one-third of patients, and a significant risk factor for mortality. Systematic reviews and meta-analyses have demonstrated the high incidence of diabetes-related amputations to demonstrate the large burden of diabetes.[13,14] At another facility in Kenya, Ogeng'o et al. found that diabetic vascular disease was the most common reason for amputation between October 1998 and December 2008.[15] This appears to be a growing problem with high inpatient mortality.[10]

Interestingly, the study from Ogeng'o was before the widespread subsidization and increase of motorcycles.[16] Thus, motor vehicle collisions have likely increased and trauma as an indication for amputation may increase as well. Trauma is increasing in Africa and in Kenya.[16] A history of trauma was responsible for 37% of amputations in our population. Efforts to prevent trauma are necessary.[17]

Several patients were diagnosed with a new medical comorbidity during their admission for amputation. Diabetes was the most common newly diagnosed comorbidity (40%) and the prevalence of this is a potential future study topic. Practitioners should be aware of the higher risk of mortality among patients with diabetes who undergo amputation. The population's knowledge, attitudes, and practices regarding health seeking behavior can also be deduced from patients noted to have a new comorbidity diagnosis at admission.[18] Delays on presentation to the hospital were considerable with an average of 120 days for the duration of illness. Investigation into referral patterns and health-seeking behavior appears necessary. Efforts to detect problems and avoid amputations, which have been effective in other settings, seem appropriate in our population.[7]

Altered function is assessed from a patient's rehabilitation using a prosthesis, crutches, or a wheelchair. The economic status of the study population is informative in this regard, as funds are an important factor that influences a patient's decision on postoperative rehabilitation.[10,19] Almost all patients did not have access to a prosthetic after amputation. This limited uptake is an avenue for future intervention.

There were several limitations to this study. The retrospective nature of the chart review limited the outcomes available. The ability to determine the underlying cause of amputation and the impact of diabetes on arterial disease or infection was challenging. This is particularly important

Table 3. Risk factors for mortality after amputation

Factor	Died	Alive	p-value
N	16	138	
Age (years), mean (SD)	57.9 (26.2)	51.5 (21.2)	0.27
Male	10 (62.5%)	83 (60.1%)	0.86
Duration of illness (days), mean (SD)	31.9 (45.2)	128.9 (656.5)	0.58
Medical Comorbidity prior to admission	11 (68.8%)	56 (40.6%)	0.031
Diabetes	10 (62.5%)	42 (30.4%)	0.010
Tobacco use	1 (7.1%)	10 (10.0%)	0.73
Medical comorbidity (pre-existing or new)	12 (75.0%)	70 (50.7%)	0.065
Diabetes either existing or new diagnosis	11 (68.8%)	51 (37.0%)	0.014
Initial Random Blood Sugar, mean (SD)	16.6 (8.9)	14.6 (7.9)	0.38
Initial WBC Count, mean (SD)	16.8 (9.5)	14.2 (8.6)	0.25
Initial ESR, mean (SD)	100.0 (43.6)	101.6 (164.0)	0.99
Initial attempt at limb salvage prior to amputation	1 (6.2%)	28 (20.3%)	0.17
Initial amputation was guillotine	11 (68.8%)	55 (39.9%)	0.027
Indication for amputation			0.35
Arterial disease	11 (68.8%)	63 (46.0%)	
Congenital	0 (0.0%)	2 (1.5%)	
Infection	1 (6.2%)	13 (9.5%)	
Trauma/burn	3 (18.8%)	54 (39.4%)	
Tumor	1 (6.2%)	2 (1.5%)	
Unknown	0 (0.0%)	3 (2.2%)	
History of trauma	4 (25.0%)	60 (43.5%)	0.16
Infection present	13 (81.2%)	87 (63.0%)	0.15

with the rising burden of noncommunicable disease and the effect of peripheral arterial disease and diabetes.[20] Ideally, patient-oriented and quality of life outcomes would be particularly interesting for patients undergoing life-altering procedures. The prosthetic clinic shares the electronic medical record but does not routinely document why patients do not have prostheses. Future investigations should prospectively evaluate the patient's experience with amputation.

Conclusion

This paper looked to describe the most common indications for amputations in the population. Trauma and non-communicable disease were found to be substantial causes of morbidity in the population studied. Medical comorbidities, like diabetes, have a significant impact on patient outcomes.

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