Pattern of limb amputation in a Kenyan rural hospital

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Abstract Causes of limb amputations vary between and within countries. In Kenya, reports on prevalence of diabetic vascular amputations are conflicting. Kikuyu Hospital has a high incidence of diabetic foot complications whose relationship with amputation is unknown. This study aimed to describe causes of limb amputations in Kikuyu Hospital, Kenya. Records of all patients who underwent limb amputation between October 1998 and September 2008 were examined for cause, age and gender. Data were analysed using the statistical package for Social Sciences (SPSS) for Windows Version 11.50. One hundred and forty patients underwent amputation. Diabetic vasculopathy accounted for 11.4% of the amputations and 69.6% of the dysvascular cases. More prevalent causes were trauma (35.7%), congenital defects (20%), infection (14.3%) and tumours (12.8%). Diabetic vasculopathy, congenital defects and infection are major causes of amputation. Control of blood sugar, foot care education, vigilant infection control and audit of congenital defects are recommended.

Introduction

Causes of amputation vary between and within countries [7, 23] depending on ethnic background and socioeconomic status [12, 20]. In sub-Saharan Africa, tumours

and trauma are often reported to be the leading causes [1, 23]. With increasing incidence of cardiovascular risk factors [2], however, a corresponding rise in vascular amputations is largely expected. In Kenya, rates of vascular amputations vary between 25% and 56% [3, 15]. Diabetes mellitus is an established risk factor in peripheral vascular disease (PVD) [5, 12], and in Trinidad and the Caribbean, for instance, diabetic foot complications are the leading cause of lower limb amputation [10]. Figures concerning diabetes-related amputation from Kenya are conflicting. In one level five referral hospital, diabetic complications accounted for the majority of vascular amputations [15], while at the national and regional level six referral centre, the majority of vascular amputations were not related to diabetes mellitus [3].

Kikuyu Hospital is a 400-bed capacity rural church-based level four referral facility with a specialist orthopaedic centre headed by an orthopaedic surgeon. The hospital treats low to middle class natives, largely from the Kikuyu ethnic group of central Kenya, and handles eight to 12 major surgical operations per week. Incidence of diabetic foot complications there is nearly 30% [17]. Whether this correlates with the aetiology of amputation is unknown. This study therefore examined the pattern of causes of amputation in this hospital.

Patients and methods

Records in Kikuyu Hospital of all patients who underwent amputation during the period of October 1998 through September 2008 were examined. Ethical approval for use of patient records was obtained from the Hospital Management Board. Data on cause, age and gender were recorded by the investigators.

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Table 1 Summary of major causes of amputation

Cause of amputation	Number of cases (%)
Trauma	50 (35.7)
Congenital defects	28 (20)
Dysvascular	
Diabetic	16 (11.4)
Non diabetic	8 (5.7)
Infection	20 (14.3)
Tumour	18 (12.9)

Causes of amputation were classified as dysvascular with or without diabetes, traumatic, congenital defects, infections or tumours. Only files of patients who had complete medical records were included in this study.

Data collected were analysed using the Statistical Package for Social Sciences for Windows version 11.50 (SPSS, Inc., Chicago, Illinois). Descriptive statistics were applied to determine means, frequencies and ranges. A confidence interval of 95% was assumed, and the difference considered significant at $p \leq 0.05$. Results are presented using tables, graphs and pie charts.

Results

Out of a total of 4,324 operations performed between October 1998 and September 2008, 140 (3.2%) were amputations. Trauma constituted the most common cause of amputation (35.7%), followed by congenital defects (20%), dysvascular causes (17.1%), infection (14.3%) and tumours (12.8%) (Tables 1, 2, 3). Of the trauma cases, road traffic accidents (RTA) constituted 29%, burns 24% and falls 22% (Fig. 1).

Bacterial osteomyelitis was the most common type of infection (80%). Tumours were fifth on the list with osteogenic sarcoma constituting the majority of cases (Fig. 2).

The most commonly affected age group was ten to 19 years with a mean age of 29.2 years. Dysvascular amputations were made on patients with an age range of 40–80 years with a mean age of 60 years (Fig. 3).

The age distribution depended on the cause. Victims of congenital defects were the youngest, followed by trauma, while the dysvascular causes afflicted the oldest individuals. The overall male to female ratio was 2:1 (93 males, 47 females). Most causes showed a male predominance, with dysvascular cases showing a male to female ratio of 5 to 1. Congenital defects did not show a gender bias. These gender differences, when subjected to ANOVA, were not statistically significant ($p = 0.652$).

Discussion

Observations from this study reveal that diabetes mellitus accounts for the majority of vascular amputations. These findings support those reported by Muyembe and Muhinga [15], but are at variance with those by Awori and Atinga [3].

The role of diabetic vasculopathy in amputation varies between countries. For example, while in Tanzania it is very low [13], it is substantial in Nigeria [23] and Kenya [3].

The relatively high rate of diabetic vasculopathy in our study may be related to the incidence of diabetic foot complications [17]. A notable finding of our study, consistent with other studies, is that most of those affected were over 50 years of age, males more than females [3]. Thus, our study supports previous Kenyan reports that PVD related to diabetes mellitus constitutes a significant cause of amputation.

Although the figures of PVD as a cause of amputation are lower than those reported from developed countries [16, 18, 19], it appears to support the cardiovascular disease epidemiological transition being experienced in Africa [14].

This suggests that control of blood sugar and better diabetic foot care are useful measures in reducing amputations. Indeed, in Denmark, improvement of diabetic foot care was associated with decline in diabetic amputations [6].

Trauma was the leading cause of amputation, with a significant proportion caused by road traffic accidents (RTA), as previously reported [3]. This high incidence of traumatic amputation is consistent with that of RTA in Kenya [21]. Implementation of stringent road safety regulations therefore would be a feasible control measure.

Burn injuries resulting in amputation are generally uncommon. In most cases amputation is done in thermal burns with extensive tissue necrosis or on those complicated by infection [25]. In our study, similar to reports from Tanzania [13], burns constitute a significant proportion of traumatic amputations. As suggested by Loro and Franceschi [13], the custom of placing fires at floor level predisposes to burns in children who crawl or play inside or around the hut. In these cases, early amputation reduces the mortality rate [9].

Table 2 Summary of dysvascular versus other causes of amputation

Description	Dysvascular	Others	P value
Age			
Less than 29 y	1	82	0.013
More than 29 y	22	34	
Gender			
Male	19	75	0.653
Female	4	42	
Outcome			
Good	14	89	0.841
Bad	9	28	
Duration of hospital stay			
Less than 11 days	4	90	0.044
More than 11 days	19	27	

Table 3 Leading causes of amputation in some African countries

Author	Country	Number of cases	Leading causes
Current study (2008)	Kenya	140	Trauma 32% Congenital defects 20%PVD 17.1% (diabetic 11.4%, non diabetic 5.7%)
Awori and Atinga [3]	Kenya	77	PVD 55.3% (diabetic 17.5%, non diabetic 38.7%)Tumour 24.4%Trauma 18.9%
Loro and Franceschi [13]	Tanzania	241	Tumours 40%PVD 17.8%
Muyembe and Muhinga [15]	Kenya	102	Trauma 26.5% Tumour 26.5%PVD 41.2% (diabetic 26.5%, non diabetic 14.7)
Thanni and Tade [23]	Nigeria	1,642	Trauma 34%Tumour 14.5%Diabetic gangrene 8%

PVD peripheral vascular disease

Falls from height constitute another major cause of amputation in young people. In developed countries falls are a leading cause of hand injuries [11]. In a recent Kenyan study, falls were the third most common cause of hand injuries after occupational injury and assault [8].

Industrial accidents in the form of fractures, crushes and amputations to the hand and fingers were not uncommon, consistent with literature reports [24]. Indeed, it has been demonstrated that workplace machines and assault are the most common causes of hand injuries [8]. This calls for enhancement of work place safety measures.

Gunshots and assault together comprise about 10% of the traumatic amputations. An observed increase in firearm injuries in Kenya has been attributed to poor economic environment, young population, drug abuse, availability of guns and absence of violence prevention programmes [22]. Stemming this tendency depends on addressing these issues.

A small but remarkable hitherto unreported cause of traumatic amputation is snake bite at incidences comparable to those reported from Tanzania [13]. In these cases, amputation is due to ischemic limb necrosis from snake venom or tourniquet. Notably, as in Tanzania, the bites involved the upper limb in young individuals working on the farm. Enforcement of snake eradication programmes by

trapping, confinement or killing may constitute a valuable control measure.

In this series, the peak age for traumatic amputations was 10–30 years with a mean age of 29 years, similar to that reported for Nigeria [24] and lower than that for an earlier Kenyan study [3]. This age group has a generally better outcome, probably due to a lower incidence of other complications [24], and is amenable to successful rehabilitation. Ideally, such rehabilitation should begin from the moment the decision to amputate is made and requires a multidisciplinary approach involving the surgeon, prosthetist, physiotherapist, occupational therapist and social worker. Unfortunately, in Kenya for example, there is insufficient attention from physiotherapists and prosthetists and only about 22% of the amputees get a prosthesis fitted due to limitation of resources [15].

Amputation due to congenital defects is rare and varies widely [7]. In the Van region of Turkey, for example, where congenital malformations are common, they constitute only about 7% of the amputations [4]. Observations from our study suggest that it constitutes 20% of all amputations and is the highest in literature.

Both the prevalence and profile of defects, namely, tibial pseudoarthrosis, macrodactyly, polydactyly, talipes equinovarus, syndactyly, acromelic fibula, and amniotic band complex are hitherto unreported and suggest that the incidence of limb defects in this environment is higher than previously perceived. A comprehensive audit of congenital defects at the hospital may be a useful venture.

Slightly over 14% of amputations are due to infection, especially chronic osteomyelitis. These figures are much higher than those reported for Tanzania [13]. Previous Kenyan studies did not report infection as a significant cause of amputation. Treatment of osteomyelitis by amputation is preserved for cases in which active or recurrent disease is so entrenched that cure with the preservation of a reasonable amount of limb function is not possible, as in cases with non union and extensive necrosis of bone, muscles, arteries and nerves [10].

In other cases bacterial infection was secondary to trauma, diabetes mellitus or spina bifida. The relatively

Fig. 1 Traumatic causes of amputation

Fig. 2 Types of tumours that caused amputations

high rate of bacterial infection suggests late presentation and poor wound care, and calls for greater vigilance in management of sepsis.

The two cases of parasitic and fungal infection each are also consistent with reports from other tropical countries [25]. Control of infection and use of appropriate foot wear may be useful preventive measures.

Tumours were responsible for 12.8% of amputations, lower than those reported in Kenyan literature. Consistent with other reports though, osteogenic sarcoma constituted over 55% of the tumours. The high proportion of amputations due to osteogenic sarcoma, which is amenable to non surgical treatment or limb salvage surgery, has been attributed to late presentation of patients [24] due to low level of education [3].

A curious observation of our study is that most of the other tumours were cutaneous in origin. The development of such tumours is associated with long standing ulcers, burn scars and leprotic ulcers, factors which may predispose to carcinomatous degeneration of the skin [13]. Pertinent to this suggestion is the observation, in our study,

that burns are among the most common causes of traumatic amputation. Most likely, the tumours are overlooked because of their slow progress and the fact that they can be tolerated. Early suspicion and investigation of ulcerating conditions may be a useful control measure.

Conclusion

Diabetic vasculopathy causes the majority of dysvascular amputations. Congenital defects and infection are also substantial causes of lower extremity amputation. Control of blood sugar, foot care education, greater vigilance in infection control and audit of congenital defects are recommended.

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Fig. 3 Age distribution of amputees

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