Diabetes Related Amputation in a Rural African Population: Kenyan Experience

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Abstract:

Objective: To investigate the prevalence of diabetes related amputation, in a rural African population.

Research Design and Method: This was a retrospective study at Tenwek hospital in rural Kenya involving 150 patients (106 males and 44 females) who underwent limb amputation between January 2001 and December 2008. Files of those whose amputation was related to vascular disorder and or diabetes mellitus were examined for cause, age and gender. Data were analyzed using Statistical Package for Social Sciences (SPSS) for Windows™ Version 11.50.

Results: Diabetic gangrene constituted 32% of the total amputations and 85.7% of the dysvascular cases. This represented 48% of patients presenting with diabetic foot ulcers. Infection complicated 94.6% of the cases. The mean age was 57.1 years with peak at 71 – 80 years. The male: female ratio is 2:1.

Conclusion: Diabetic vasculopathy complicated by infection is a leading cause of amputations in elderly males in Kenya. Control of blood sugar, foot care education and vigilant infection control are recommended.

Keywords: Age, amputation, Diabetes mellitus, Gender, Kenya, Rural.

Introduction

Rates of diabetic amputations in Sub-Saharan Africa vary widely between and within countries but are generally considered to be low especially in rural communities.1,2 With the anticipated increase in diabetes mellitus, a corresponding rise in diabetic amputations is largely expected.3 In other countries like Trinidad and Caribbean islands where diabetes is rampant, diabetic foot complications are the leading causes lower limb amputation.4 In Kenya, prevalence of diabetic foot complications varies widely between centers5,6 and figures concerning diabetes related amputation are conflicting. At a level 4 referral center, the majority of vascular amputations were related to diabetes mellitus7, while in the National and Regional referral hospital, the majority of vascular amputations were not related to diabetes.8 Further, there is no data on diabetic amputations in purely rural populations. This study examined the prevalence of diabetic amputations at Tenwek Hospital in rural Kenya.

Materials and Methods

This was a retrospective study. Records of all patients who underwent limb amputation in Tenwek Hospital between January 2001 and December 2008 were examined. This hospital is a rural level 4 church based 300 bed center in the Rift Valley province of Kenya. It has two permanent consultant surgeons and one physician, five general practitioners, ten medical officer interns and five medical assistants who take care of natives from mainly the Kalenjin, Masaai and Kisii communities.
Table 1 Causes of vascular amputations.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetic gangrene</td>
<td>48</td>
<td>85.7</td>
</tr>
<tr>
<td>Atherosclerosis</td>
<td>03</td>
<td>5.4</td>
</tr>
<tr>
<td>Thromboembolism</td>
<td>03</td>
<td>5.4</td>
</tr>
<tr>
<td>Buerger’s disease</td>
<td>01</td>
<td>1.8</td>
</tr>
<tr>
<td>Iatrogenic from tight plaster</td>
<td>01</td>
<td>1.8</td>
</tr>
<tr>
<td>Total</td>
<td>56</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2 Factors complicating vascular amputations.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection alone</td>
<td>49</td>
<td>87.5</td>
</tr>
<tr>
<td>Infection and trauma</td>
<td>04</td>
<td>7.1</td>
</tr>
<tr>
<td>No complication identified</td>
<td>03</td>
<td>5.4</td>
</tr>
<tr>
<td>Total</td>
<td>56</td>
<td>100</td>
</tr>
</tbody>
</table>

Ethical approval for use of patient records was obtained from the Hospital Management Board. Causes of amputation were classified into two groups; dysvascular and other causes. The dysvascular cases were further subdivided into diabetic and non-diabetic categories. All the cases were divided into 9 age groups of ten years; 1-10; 11-20; 21-30; 31-40; 41-50; 51-60; 61-70; 71-80; 81-90 years and subdivided into males and females. Cases of dysvascular amputation were isolated and analyzed for cause, age and gender distribution. Only files of patients who had complete medical records with confirmed diagnosis were included in the study.

Data collected were analyzed 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≤ 0.05. Results are presented using tables and bar charts.

Results

One hundred and fifty six cases of amputation were retrieved. Six were excluded for incomplete records and one hundred and fifty analyzed. Vasculopathy constituted the most common cause of amputation (37.3%).

Of these vascular cases, diabetic vasculopathy comprised 85.7% and 32% of the total cases of amputations. This represented 48% of the patients who presented with diabetic foot ulceration. Other causes included atherosclerotic occlusion (5.4%); thromboembolism (5.4%); Buerger’s disease and iatrogenic from tight plaster (1% each). (Table 1)

Forty nine [87.5%] of these amputation cases were complicated by infection alone and four by both trauma and infection. Only three were uncomplicated. (Table 2) Of the traumatic complications two were caused by thorn prick and two by insect bites.

Age and Gender Distribution

The mean age was 57.1 years (range 21 – 87). The peak age groups were at 51-60 and 71 – 80 years. In individuals aged over 50 years, vascular amputations comprise 54% of the cases. Forty-six of the vascular amputation patients (82.1%) were aged above 50 years. (Figure 1) There were no vascular amputees before 20 and above 80 years of age.

The overall male to female ratio was 1.8:1, displaying subtle variations with age. Over the age of 50 years, the male: female ratio is 2.3:1. (Figure 2)
Author | Population | % *
--- | --- | ---
Present study | Kenyan | 32
Gurlek et al., 1998 | Turkish | 36.7
Witoso and Ronningen, 2001 | Norwegian | 53
Hazmy et al., 2001 | Malaysia | 78.1
(Seremban hosp) | Naraynsingh et al., 2002 | Trinidad | 81.8
Moris et al., 1998 | Scottish | 27
Essoh et al., 2007 | Coted’Ivoire | 31.4
Awori and Atinga, 2007 | Kenyan | 17.5
Kidmas et al., 2004 | Nigerian | 26.4

Table 3 Rates of diabetic amputations in different populations. *Proportion of diabetic amputation (percent).

Discussion

Observations of the current study support previous reports that in Kenya, diabetic gangrene is a major cause of amputation. The prevalence of 32% in the current study is within the reported range of 0.3 – 45% among African states and also compares with rates from some developed countries. (Table 3) This suggests that in rural Kenya, diabetes is already an established problem and supports reports indicating a general increase in diabetic cardiovascular risk factors and the epidemiological transition generally occurring in Africa.

Diabetes mellitus is a recognized risk factor for peripheral vascular disease. In rural Africa, however, it is often reported that the prevalence of diabetes is only 1% and that it accounts for a minority of vascular amputations.
Diabetic foot complications and established risk factors of hypertension, poor glycaemic control, dyslipidaemia, smoking and obesity are present in a large proportion of Kenyan patients.\(^6,15\)

Among diabetic outpatients, 6 to 43% culminate in amputation.\(^18\) Observations of the present study reveal that 48% of patients with diabetic foot ulceration end in amputation. These comparatively high rates of amputation may be related to late presentation, poor foot care education, risky foot wear or walking barefoot.\(^6\) These findings and are consistent with literature reports, and imply that stringent control of blood sugar and foot care education constitute important control measures for diabetic amputations. Indeed, in Denmark improvement of diabetic foot care caused a significant reduction in diabetic amputations.\(^19\)

A notable observation of the current study is that 94.6% of the diabetic vasculopathy were complicated by infection, in some cases combined with trauma. High rates of infection remain major challenges in African countries including Kenya.\(^7\) It suggests that bare foot walking, poor wound care and late presentation are important contributory factors in this population.\(^3,20\) Preventive measures comprising screening, maintaining glycaemic control, early presentation, foot care education and greater vigilance in control of sepsis can therefore be recommended.

Over 10% of the amputations were caused by atherosclerosis and its complications. This suggests that this disease is more prevalent than previously perceived, and may be an already established problem among African countries. Hyperglycemia can be linked to atherosclerosis through several pathways: gluco-oxidation of the extracellular matrix inducing accelerated atherosclerosis, endothelial dysfunction with decreased production or activation of nitric oxide (NO), thrombogenic tendency and dyslipidemia.\(^21\) Indeed type 2 diabetes mellitus has been related to the development of macroangiopathic peripheral vascular disease.\(^22\)

Accordingly, it is difficult to segregate diabetic vasculopathy from other arterial occlusive disorders leading to amputation. Nonetheless, these observations call for evaluation of prevalence and risk factors for atherosclerosis in the rural African populations.

Vascular amputations in developed countries occur mostly in individuals older than 65 years.\(^23\) Observations of the current study reveal, in agreement with another recent Kenyan study,\(^8\) that more than 55% of the patients are over 60 years. This is concordant with the observation that in Kenya, cardiovascular disease is a major cause of morbidity among the elderly.\(^24\) It further implies that as the aging population in Africa increases, vascular amputation will increase, especially considering that vascular by-pass surgery is just beginning and universal access to health care facilities remains a challenge. In the present study, 17.9% of the patients were aged 50 years and below. Atherosclerosis in young people is known to cause peripheral vascular disease severe enough to cause amputation.\(^25\) In these cases, independent risk factors such as dyslipidemia, homocysteinemia, a hypercoagulable state and HIV\(^26\) may be important predisposing factors in the causation of peripheral arterio-occlusive disease in young patients. Indeed in the present study, three of the youngest patients were HIV positive. This implies that search for risk factors should begin early, and determination of the prevalence of asymptomatic peripheral vascular disease constitutes a useful step.

Males are affected more than females by peripheral vascular disease.\(^23\) In a recent Kenyan study, vascular amputations were more common in males than in females below 60 years but the ratio approached 1:1 in those above 60 years.\(^8\) Observations of the current study reveal that in both age groups males predominate. This suggests that age related factors such as circulating hormones in females do not play a major role in these cases, and that other factors such as constraints regarding access to health care may be important.
In conclusion, diabetic vasculopathy complicated by infection caused the majority of amputations in our elderly male patients. Evaluation of the prevalence of cardiovascular risk factors and diabetes mellitus, control of blood sugar, foot care education and vigilant infection control are recommended.

Acknowledgement

To Tenwek Hospital Management board for ethical approval and availing records, and to Catherine W Chinga for typing the manuscript.

Disclosure

There is no conflict of interest. The study had no external funding. Operational costs were met by the authors.

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