

# Prevalence of peripheral neuropathy in the contralateral limb of unilateral diabetic amputees

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## Abstract

Sensory and motor defects are known to contribute to foot ulceration in diabetes. It is suspected that the contralateral limb in diabetes patients after unilateral amputation is at risk of peripheral neuropathy, but there is little knowledge on the extent of the problem. This study determined the prevalence of peripheral neuropathy in the contralateral limb and examined the demographic characteristics of the study population. There were 32 diabetic unilateral amputees studied, 72% of whom were male. Mean ( $\pm$ SD) age was  $60\pm 14$  years (range 40–90 years).

Using the Michigan Neuropathy Screening Instrument (MNSI), the mean ( $\pm$ SD) overall peripheral neuropathy score was  $1.0\pm 0.3$  indicating mild peripheral neuropathy in the majority of patients. There were 94% with Grade 1 and 6% with Grade 2 changes.

We conclude that peripheral neuropathy does exist in the contralateral limb of diabetic unilateral amputees. Most patients lose protective sensation, thereby putting them at risk of foot ulcers, and possible future amputation.

## Introduction

Diabetes mellitus is a metabolic disease that is brought about by either insufficient production of insulin or the inability of the body to respond to insulin. Diabetes is a major cause of lower limb amputation in many regions in the world.<sup>1</sup> In sub-Saharan Africa, fast uncontrolled urbanisation and changes in standards of living are largely responsible for the rising epidemic of type 2 diabetes, and the observed increase presents a substantial public health and socio-economic burden in the face of limited resources.<sup>2</sup> Foot ulcers are a common complication of diabetes, and a frequent cause of hospital admission in diabetic patients.

Neuropathy is a term for any disorder of peripheral nerves and a well-known complication of diabetes, which

is a major risk factor for foot ulceration.<sup>3</sup>

Lower limb amputations are commonly performed because of peripheral vascular disease (PVD), often related to diabetes. Following amputation, diabetic patients are at high risk of further amputation in the contralateral limb – in one study this happened to 50% in 2-years post-amputation.<sup>4</sup> Rates of amputation vary both between and within countries, due to socio-economic factors, the organisational environment, and clinicians' decision-making.<sup>1</sup> The most common aetiology for amputations in North America is PVD.<sup>5</sup> In a study that was conducted in Kenyatta National Hospital, researchers found that out of 77 lower limb amputations done on 74 patients PVD accounted for the majority of lower limb amputations (55%) with one-third of these patients due to diabetes-related gangrene.<sup>1,6</sup> People with diabetic foot complications in African communities often present to hospital only after the onset of gangrene or during a stage of sepsis that might be intractable to conventional supportive treatment.<sup>7</sup>

Diabetic peripheral neuropathy is an important complication and contributes to the morbidity of diabetes. Evidence indicates early detection of peripheral neuropathy results in fewer foot ulcers and amputations.<sup>8</sup> This study was aimed at identifying to what extent peripheral neuropathy is present in diabetic patients with a unilateral amputation.

## Patients and methods

This was a clinical cross-sectional study of first-time unilateral diabetic amputees who were operated on at Kilimanjaro Christian Medical Centre (KCMC) between November 2009 and January 2012. Only diabetic unilateral subjects with no other major medical conditions were part of the study. Subjects that were amputated due to trauma, tumours, and other medical conditions were not included in the study. Out of 122 patients that were amputated in KCMC during the study period, 32 diabetic patients took part in the study.

Data collection was done by use of questionnaires, and clinical examination by a physiotherapist for soft touch, nociception and tendon reflexes, which is part of the Michigan Neuropathy Screening Instrument (MNSI).<sup>9</sup> A peripheral neuropathy grading scale was adapted from the National Cancer Institute Common Terminology Criteria for Adverse Events (NCI CTCAE) version 3.0<sup>10</sup>

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was used to grade the neuropathy. Muscle strength was examined using the Medical Research Council (MRC) scale (Oxford scale).<sup>11</sup>

Data analysis and results interpretation was done with the assistance of a statistician and computer software – the Statistical Package for Social Sciences (SPSS).

## Results

**1. Demography.** Thirty-two (32) diabetic amputees took part in the study; 23 (72%) being male. Their age ranged between 40 and 90 years. Mean ( $\pm$ SD) age was  $60\pm 14$  years. Slightly more than half of patients (53%,  $n=17$ ) were aged 40 to 59 years. Of the 32 amputees, most (87%) were married, the rest were single. The majority (87%) of the study participants were attending the hospital diabetic clinic.

**2. Knowledge of peripheral neuropathy.** Patients were asked if they knew what peripheral neuropathy was. About three-quarters of the patients (72%,  $n=23$ ) said they knew about neuropathy. Almost all of these said they heard about it at the Diabetic Clinic of Kilimanjaro Christian Medical Centre (KCMC).

**3. Knowledge of risk factors of diabetes.** None of the respondents gave a history of past or current cigarette smoking. Four out of 32 participants (12%) admitted to taking alcohol – three out of the four drank once per week and one twice per week. Regarding the duration of taking alcohol, three said 20 years and only one said 5 years. The amount taken was 2 litres of beer per occasion for three respondents and 1 litre of beer for the other.

**4. Remedial action and precautions.** Respondents were asked whether they were doing physical exercise. Only 13 (41%) said they were exercising. When asked if they were on treatment, only one (3%) was not under medication. For those taking medication, 16 (52%) were on insulin and 15 (48%) on oral agents. All respondents said they had never been taught on appropriate footwear for diabetic patients.

**5. Peripheral neuropathy grading.** Regarding motor function, most patients (78%,  $n=25$ ) were in Grade 1 (mild grade, asymptomatic) neuropathy and the remaining 7 (22%) were Grade 0 (normal). On the sensory grade, 30 (94%) were in Grade 1 (loss of deep tendon reflexes or paresthesia) while the remaining 2 (6%) were in Grade 2 (sensory alteration or paresthesia). As regards painful neuropathy, most (72%,  $n=23$ ) were in Grade 1 (mild pain) followed by 6 (19%) in Grade 2 (moderate pain); the fewest were Grade 0 (normal) with 3 (9%) patients. The mean ( $\pm$ SD) overall peripheral neuropathy score was  $1.0\pm 0.3$ , indicating mild peripheral neuropathy in the majority of patients. The mean overall peripheral neuropathy score showed that 91% scored Grade 1. Of the rest, 2 (6%) were Grade 0 and only one was Grade 2 (see Figure 1).

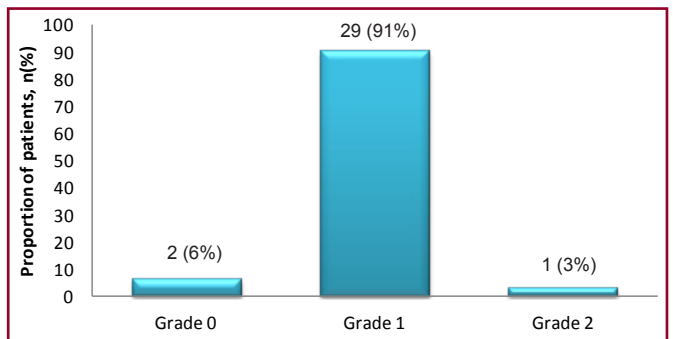


Figure 1 Average grade of peripheral neuropathy ( $n=32$ )

**6. Associations of neuropathy with treatment.** The grade of pain, sensory, and motor function were not significantly related to the type of medication taken ( $p>0.05$ ). The proportion with painful neuropathy was higher for Grade 0 for patients on oral agents than on insulin agents (13% vs 6%) and higher for Grade 2 patients on insulin than on oral hypoglycaemia (31% vs 6%). The association was not statistically significant with a  $p$ -value of 0.207.

## Discussion

Diabetes mellitus has been the leading common cause of amputation at the KCMC for the last few years. The current results are contrary to what has been published before by other researchers on the common cause of amputations in sub-Saharan Africa, where tumours and trauma have been reported to be the leading causes.<sup>11</sup> Peripheral neuropathy is one of the complications associated with diabetes and it can affect both sensory and motor nerves. Patients are often not screened for neuropathy when they come to attend the diabetic clinic. This could be due to the non-existence of a diabetic foot clinic or podiatrist in KCMC. This may be why our subjects responded that they had never been educated or told of the appropriate footwear for diabetic patients.

It was found that patients drinking alcohol or taking physical exercise did not differ significantly in the prevalence of neuropathy compared with those who did not drink or undertake exercise. These results are not consistent to those published previously from the western world. One of the possible explanations for this variation could be related to differences in sample size involved in other studies, since in this study only 32 diabetic amputees were involved.

The motor power of most of the subjects was not affected as the majority tested normally according to the MRC muscle grading scale.<sup>11</sup> Only elderly (those above 80 years) subjects had decreased muscle power, and this may not necessarily be related to neuropathy and could be due to ageing. Sensory nerves appeared to be the most affected as nearly all subjects had lost protective sensation, which could put them at risk of getting injured without noticing, potentially leading to infections or ulcers if not attended to. There were 94% of the subjects with Grade 1 and 6% with Grade 2 changes. Most (72%) were associated with some degree of neuropathic pain.

In conclusion, peripheral neuropathy does exist in the contralateral limb of diabetic patients with unilateral amputation. Most patients lose the protective sensation and this puts them at risk of ulceration, which could lead to amputation of the contralateral limb. Larger studies from elsewhere in Africa may be helpful. There is also an urgent need for foot-related education being made available to all diabetic patients. Patient care for diabetic amputees should include all members of the rehabilitation team.

#### Acknowledgement

This work would not have been accomplished without the assistance of various people. I wish to extend my special gratitude and appreciation to Dr Sarah Urasa, who was my internal supervisor on this research study. My special thanks also go to Dr R Mhina from Muhumbili Orthopaedic Institute for being my external supervisor.

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