A five-year audit of lower limb amputations below the knee and rehabilitation outcomes: the Durban experience

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Introduction: Lower limb amputation (LLA) due to diabetes mellitus (DM) is a growing epidemic worldwide.

Objectives: To determine the prevalence of LLAs at Addington Hospital from 2010 to 2014 and to explore the rehabilitation outcomes of amputees.

Design and setting: A retrospective chart review of LLAs below the knee was undertaken at Addington Hospital.

Subjects: Patients who underwent LLAs were filtered from theatre registers.

Methodology: A data collection sheet included demographic profile, diabetic status, level of amputation, limb orientation and rehabilitation outcomes.

Outcome measures: Study endpoints were prevalence, compliance and rehabilitation outcomes.

Results: From 2010 to 2014, 767 LLAs in 667 patients were identified. Mean age was 59 (13.2) years. M:F ratio was 1:1. Of these, 354 patients (53.1%) had DM. Level of amputation was below-knee 57%, trans-metatarsal 12.4% and toectomy 30.6%. Only 116 patients (17.4%) were referred for physiotherapy, of whom 95 (81.9%) attended. Median frequency of physiotherapy visits was five and four for diabetic and non-diabetic amputees respectively. Mobility after rehabilitation was with a walking frame (49%), crutches (32%), prosthesis and crutches (8%), wheelchair-bound (9%) and independent gait (1%).

Conclusion: Over half of amputations were associated with DM. The gender incidence was similar. Referral to physiotherapy and adherence thereto was poor.

Keywords: diabetes mellitus, lower limb amputations, physiotherapy, prevalence, rehabilitation

Introduction

Diabetes mellitus (DM) is a chronic, potentially life-threatening disorder that may be accompanied by decreased quality of life. Described as a ‘silent killer’ by Todkar, DM is a growing threat to public health worldwide. In 2015, 415 million people worldwide had DM and this number is expected to increase to 642 million by the year 2040. In Africa 14.2 million people were diagnosed with DM in the year 2015 and by the year 2040, 34.2 million people are projected to be having DM. South Africa has an estimated population of 52.98 million people and the exact prevalence of diabetes is not known. It is estimated to be between 5% and 7% of the general population with the Indian population comprising 11–13%, Coloured 8–10%, Black 5–8% and the White population consisting of 4%. In Sri Lanka the prevalence of DM is 16.4% in the urban population and 8.7% among rural populations.

DM is associated with several complications including cardiovascular disease, nephropathy, retinopathy and neuropathy, which are directly related to diabetes-related morbidity and mortality. Peripheral vascular disease (PVD), known as impairment to the major blood vessels in the lower limbs, and neuropathy, classified as loss of sensation in the feet, are the two chief pathological mechanisms of LLA in people with DM. A symmetrical peripheral polyneuropathy is the most commonly observed peripheral neuropathy in DM. Progressive peripheral neuropathy leads to loss of sensation, which causes trauma and altered proprioception as well as wasting of the small muscles. These pathological entities initiate changes in the weight-bearing areas under the foot during standing and walking. As a result of these altered changes the foot is prone to injury leading to ulceration, which can subsequently become infected and, if not remedied timeously, can lead to amputation.

In the USA, almost 2 million people have an amputated limb. There are 185 000 new cases of amputees each year and this is predicted to rise to 3.6 million by 2050. In 54% of Americans living with limb loss the cause is vascular disease whereas in Sri Lanka 4.8% of amputations are due to diabetes and in South East Nigeria 71.4% of all amputations are attributed to diabetes. Furthermore the most common level of amputation appears to be below-knee amputation (BKA) in 63.7%.

Addington Hospital is a regional South African hospital located in the eThekwini municipality and is a referral hospital for patients requiring major surgical intervention such as amputations. A study on the prevalence and management of the diabetic foot at Addington Hospital has not been previously conducted. The objectives of this study were to determine the prevalence of LLAs below the knee among patients at Addington Hospital during the period 2010–2014 and to determine the proportion of those amputations that were attributed to DM and other factors. In addition, the referral of patients for rehabilitation following amputation and the outcomes were studied.

The significance of the study will serve to highlight the burden of LLAs in our setting and emphasise the importance of referring patients with LLAs to physiotherapy.
**Method**

An observational descriptive retrospective chart review was conducted on patients presenting with LLAs below the knee attending Addington Hospital during the period January 1, 2010 – December 31, 2014.

**Data collection**

Employing purposive sampling, all patients who presented with LLAs below the knee during the period January 1, 2010 to December 31, 2014 were included in the study. A data collection sheet including the following variables was developed for gathering data: patient’s age, gender, diabetic status, date of amputation, level of amputation, referral to physiotherapy, number of physiotherapy visits and rehabilitation outcome. Data were obtained from theatre registers for the years 2010 to 2014. Rehabilitation information was sourced from physiotherapy records retained in the physiotherapy Department at Addington Hospital. The frequency of visits was allocated a ‘zero’ frequency if patients failed to present themselves for physiotherapy after referral. Among the patients who did present for physiotherapy, the frequency of physiotherapy visits was categorised into groups of 10 visits. Data were analysed with the Statistical Package for the Social Sciences (SPSS version 22; IBM Corp, Armonk, NY, USA). Categorical variables were summarised using proportions/percentages and graphically using bar charts or tables while continuous variables were summarised using means (standard deviations). Ninety-five per cent confidence intervals (95% CI) were constructed around point estimates. Comparison of various categories was tested using Pearson’s chi-square test. If an expected cell count had fewer than five observations, then Fisher’s exact test was employed. If the normality assumption was not upheld, then the non-parametric equivalent (namely the Wilcoxon rank-sum test) was used instead. Adjustment for multiple testing (using the Bonferroni correction) was employed. An adjusted p-value of < 0.05 was considered statistically significant. Odds ratios (OR) were employed to quantify a strong presence or absence between two entities.

**Results**

A total of 667 patients with LLAs below the knee were included, of whom 87 had more than one amputation giving a total of 767 amputations during the five-year period from 2010 to 2014.

**Table 1: Profile of patients**

| Patient characteristics | n  |
|-------------------------|----|
| Total no. of patients   | 667|
| LLAs below the knee     | 767*|
| Mean age (SD)           | 59 (13.2) |
| Gender                  | Males: 329  
                      | Females: 338  
                      | M:F ratio = 1:1 |
| Diabetic status         | Diabetes: 354  
                      | No-diabetes: 313 |
| Orientation of amputated limb | Left: 363  
                      | Right:404 |

*Some patients had more than one amputation.
Table 2 shows that only 116 of the 667 amputees (17.4%) were referred to physiotherapy for rehabilitation post-surgery. Among diabetic amputees 24.9% were referred for physiotherapy and among non-diabetic amputees only 8.9%. Thus more diabetic amputees than non-diabetic amputees were referred for physiotherapy. Some 75% of diabetic amputees and 91% of non-diabetic amputees were not referred to physiotherapy. Among the 551 amputees not referred to physiotherapy 48.3% (266 amputees) had DM.

Figure 4 shows the frequency of physiotherapy visits following referral to physiotherapy. In total, 18% of those referred to physiotherapy were non-compliant and did not attend at all. The median number of visits was five and four respectively for diabetic and non-diabetic amputees. In both groups, the largest number of patients attended for 10 or fewer visits and, after 10 visits, there was a progressive attrition in numbers until 30 visits, beyond which only a small number of diabetic amputees continued to attend.

Table 3 shows that of the 95 patients who attended physiotherapy 75 were diabetic and 20 were not diabetic. Following rehabilitation, patients were able to mobilise with walking frames (49, 52%), crutches (30, 32%), crutches and a fitted prosthetic leg (8, 8%). Seven (7%) patients were wheelchair bound and one (1%) was independently mobile. There was no significant difference in outcome between diabetic and non-diabetic patients ($p = 0.9$).

Discussion

Results from this study showed that more than half (55%) of the LLAs were attributed to diabetes. A total of 767 LLAs below the knee from the years 2010–2014 were identified from Addington Hospital’s theatre registers. Apart from 2013 all other years displayed numbers of over 100 amputations per year and diabetic amputations predominated throughout. The small number of amputations in 2013 was related to renovations of the theatres at Addington Hospital and transfer of patients to Wentworth Hospital for surgery. The increasing numbers of patients with diabetes could be the contributing factor to the high number of LLAs at Addington Hospital. This is in keeping with the 2015 study by Ndukwu and Muoneme, who found that below-knee and trans-tibial amputations comprised 64.4% of LLAs, and Kayssi et al., who reported that 60–70% of BKAs were performed as a result of PVD or circulatory complications. These results also concur with findings from Odatuwa-Omagbemi, who noted that 63.6% of non-traumatic LLAs were due to diabetic foot complications.

The median age was shown to be 60 years. This is consistent with the 2012 Nigerian study, which reported that the majority (91%) of patients underwent BKAs and were in the age group 60–69 years. The majority of the LLAs occurred in the 50–70-year age range with the highest proportion occurring in the 60–69 age group. Of these, 7% of patients in the age group < 30, 46.9% in the age group 30–59 and 52.8% in the age category 60–97 were diabetic. These data reflect that LLAs are prevalent in every age group but tend to dominate in the older age groups. DM was responsible for the majority of the LLAs through diabetic foot complications. This may be explained by prolonged poor glycaemic control, foot care practices and delayed foot examinations among other factors.

Table 3: Mobility outcome in 95 patients who attended physiotherapy
Patients with LLAs characteristically present with decreased mobility, which impacts negatively on the performance of their activities of daily living and thus reintegration into society. However, evidence suggests that BKAs achieve a better functional outcome after rehabilitation compared with above-knee amputations (AKAs).28

It is concerning that only 17.4% of patients with amputations were referred to physiotherapy. This deprives patients of the opportunity to reduce their burden of challenges that present with the loss of a limb. Furthermore, among those referred to physiotherapy the attrition rate was very high. This highlights the need for a study of patients’ and doctors’ attitudes towards physiotherapy referral. We are unable to explain the reason for a higher referral of diabetic amputees compared with non-diabetic amputees. It is tempting to postulate that this may be due to the perception of doctors that diabetic amputees need more close attention.

In the current study, 1% of the very few patients referred to physiotherapy were wheelchair bound and the remaining patients were mobile with either an assistive device only or an assistive device and prosthesis. This is in contrast to findings among vascular amputees where 85% are fitted with a prosthesis after major lower limb amputation.21 Brown and Attinger in 2013 underlined the importance of rehabilitation after amputation and further emphasised that advanced technological prosthetics have led to an improved quality of life following rehabilitation among patients with LLA. These authors, however, emphasise patient selection when considering the level of limb amputation. They maintain that, despite the stated advantages of BKA, salvaged limbs with amputations below the trans-tibial level are still appropriate for ambulation in a selected group of patients. They contend that, when counselling a patient regarding limb salvage versus amputation, the clinician needs to consider the patient’s quality of life in terms of functional needs, goals and the condition of the extremity. In support of this assertion, they point out that severely compromised patients who can ill-afford to mobilise with a prosthesis are sometimes better off with a supposedly poor functioning salvaged leg than being burdened with a BKA and prosthesis that they cannot use.

Limitations

The study has some limitations. It is a retrospective study and thus some data were missing from the charts. The renovations of theatres at Addington Hospital in 2013 possibly led to some patient referral to rehabilitation. The study has some limitations. It is a retrospective study and thus some data were missing from the charts. The renovations of theatres at Addington Hospital in 2013 possibly led to some patient referral to rehabilitation. We are unable to explain the reason for a higher referral of diabetic amputees compared with non-diabetic amputees. It is tempting to postulate that this may be due to the perception of doctors that diabetic amputees need more close attention.

Conclusion

A higher percentage of LLAs in this series was attributed to diabetic foot disease. The gender incidence was similar. The most common site for amputation was the trans-tibial aspect of the lower limb. Patient referral to rehabilitation was extremely poor and so was their adherence to the rehabilitation programme. It is, however, pleasing to note that patients who did attend physiotherapy did achieve some form of mobility even if it was with an assistive device. We recommend that the knowledge and awareness of DM and foot care practices need to be
forcefully implemented at primary health care level as a start to reduce the incidence of LLAs.

**Disclosure statement**

No potential conflict of interest was reported by the authors.

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