

# Diabetic foot complications: a two-year review of limb amputation in a Kelantanese population

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**Introduction:** Many conditions, including benign and malignant tumours, peripheral vascular diseases and open fracture grade 3C, have been successfully treated with limb sparing procedures. However, the same could not be said for treatment of limb infection, especially late stage diabetic foot complications.

**Methods:** This is a retrospective review of patients who underwent operations at our hospital from July 2003 to June 2005. All patients who underwent various types of limbs amputations were included. The cohort was divided according to the diagnosis leading to the amputation and the level of amputation. The number and levels of amputation were then compared with the various causes leading to the amputation.

**Results:** There were 203 patients who underwent amputation during the period of study. 134 (66 percent) of the patients were diabetic and amputations performed were related to diabetic foot conditions. 69 (34 percent) patients were not known to have diabetes mellitus. Among nondiabetic patients, 55 (27 percent) amputations were due to trauma, 11 (5.4 percent) were related to musculoskeletal tumours and 3 (1.5 percent) were due to peripheral vascular disease. Among diabetic patients, 23 (17.2 percent) patients underwent above knee amputation, 44 (32.8 percent) patients underwent below knee amputation, and 67 (50 percent) patients underwent local foot amputation. 79 of 134 (59 percent) patients, who underwent amputation due to diabetic complications, were less than 60 years old.

**Conclusion:** Good diabetic control and detection of early diabetic foot complications will reduce the number of patients undergoing limb amputation as well as the number of amputees. Since the incidence of lower limb amputation is due mainly

to poor diabetic control, it is important to protect this group of patients from a probable avoidable amputation.

**Keywords:** diabetes mellitus, diabetic foot, limb amputation

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## INTRODUCTION

Limb amputation is both emotionally and physically crippling. Common conditions that lead to limb amputation include: benign and malignant bone and soft tissue tumours, uncontrolled infection, peripheral vascular disease (PVD), and traumatic crush injury. Advances in microsurgical techniques have led to tremendous improvements in orthopaedic care. Many conditions which have previously been treated with amputation are now being managed with limb sparing procedures. Benign and malignant tumours,<sup>(1)</sup> PVD and open grade 3C fractures<sup>(2)</sup> have been successfully treated with limb sparing procedures in our centre. However, the same cannot be said for treatment of limb infection, especially for late stage diabetic foot complications. The incidence of limb amputations remains high, despite the availability of advanced medical technology.

It is a well-established fact that in patients with diabetes mellitus, medical and surgical complications are related to poor glucose control. In Kelantan, a state in the northeast of West Malaysia, the prevalence of impaired glucose tolerance test is 16.5%.<sup>(3)</sup> The incidence of foot complications requiring lower limb amputation may reflect the level of effectiveness of the early detection of diabetes mellitus and the foot at risk, medical education, patient compliance and overall control of diabetes mellitus in this population. In this study, we review 203 cases of various types of amputations performed, and discuss the possible problems related to the difficulties in diabetic control of this population.

## METHODS

This is a retrospective review of patients who underwent limb amputation at Hospital Universiti Sains Malaysia

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**Table I. Distribution of diabetic patients according to types of amputation, age and gender, from July 2003 to June 2005.**

| Distribution | AKA<br>(n = 23) |    | BKA<br>(n = 44) |    | Foot<br>(n = 67) |    | Total |
|--------------|-----------------|----|-----------------|----|------------------|----|-------|
|              | M               | F  | M               | F  | M                | F  |       |
| Age (years)  |                 |    |                 |    |                  |    |       |
| < 20         | 0               | 0  | 0               | 0  | 0                | 0  | 0     |
| 21-30        | 0               | 0  | 0               | 0  | 0                | 0  | 0     |
| 31-40        | 1               | 0  | 0               | 1  | 2                | 0  | 4     |
| 41-50        | 2               | 5  | 3               | 4  | 7                | 11 | 32    |
| 51-60        | 0               | 1  | 9               | 8  | 11               | 14 | 43    |
| 61-70        | 3               | 5  | 9               | 6  | 7                | 6  | 36    |
| > 70         | 5               | 1  | 2               | 2  | 6                | 3  | 19    |
| Total        | 11              | 12 | 23              | 21 | 33               | 34 | 134   |

**Table II. Distribution of non-diabetic patients who underwent limb amputation according to disease type, age and gender, from July 2003 to June 2005.**

| Distribution | Tumour<br>(n = 11) |   | Trauma<br>(n = 55) |   | PVD<br>(n = 3) |   | Total |
|--------------|--------------------|---|--------------------|---|----------------|---|-------|
|              | M                  | F | M                  | F | M              | F |       |
| Age (years)  |                    |   |                    |   |                |   |       |
| < 20         | 3                  | 2 | 24                 | 4 | 0              | 0 | 33    |
| 21-30        | 1                  | 0 | 7                  | 1 | 0              | 0 | 9     |
| 31-40        | 1                  | 0 | 4                  | 2 | 0              | 0 | 7     |
| 41-50        | 1                  | 1 | 5                  | 0 | 1              | 0 | 8     |
| 51-60        | 1                  | 0 | 5                  | 1 | 0              | 0 | 7     |
| 61-70        | 0                  | 0 | 1                  | 0 | 0              | 0 | 1     |
| > 70         | 1                  | 0 | 1                  | 0 | 2              | 0 | 4     |
| Total        | 8                  | 3 | 47                 | 8 | 3              | 0 | 69    |

from July 2003 to June 2005. The patients' data were obtained from the operation theatre registry. All patients who underwent various types of limb amputations were included. The cohort was divided according to the diagnosis leading to the amputation and the level of amputation. The number and levels of amputation were then compared and analysed for the various causes leading to the amputation.

## RESULTS

203 patients underwent amputation between July 2003 and June 2005. Their ages ranged from three years to 85 years. 125 patients were male and 78 were female. 134 (66%) patients were diabetic and the amputations performed were related to diabetic foot conditions (Table I). 69 (34%) patients were not known to have diabetes mellitus. Among the non-diabetic patients admitted, 55 (27%) amputations were due to trauma, 11 (5.4%) were related to musculoskeletal tumours and three (1.5%) were due to PVD without any evidence of diabetes mellitus (Table II).

For amputations involving the lower limb, 83.6% of the procedures were performed for diabetic foot

complications, 9.4% on traumatic conditions, 5% on patients with tumour and 2% on patients with PVD. For upper limb amputations, 93% were related to trauma and 7% were related to musculoskeletal tumours. Two forequarter amputations were performed in this group. For patients who underwent lower limb amputations, above knee amputations (AKA) were involved in 70% of diabetic patients, 18% were related to musculoskeletal tumour, 6% due to PVD and 6% were due to trauma. For below knee amputations (BKA), 94% involved diabetic patients, and 2% of patients each had PVD, trauma and tumour. For local (foot) amputations, 85% of them were diabetic patients and the rest (15%) were related to trauma involving the affected foot. Among diabetic patients alone, 23 (17.2%) patients underwent AKA, 44 (32.8%) patients underwent BKA, and 67 (50%) patients underwent local foot amputations. 79 of 134 (59%) patients, who underwent amputation due to diabetic complications, were less than 60 years old. None of them underwent upper limb amputation.

## DISCUSSION

Foot lesion related to diabetes mellitus is the leading

cause for amputation of the lower limb. In our population, the number of patients who underwent lower limb amputation was higher compared to other centres.<sup>(4)</sup> Diabetes mellitus was the major cause of amputations seen in this population. A similar pattern was also seen in the West. Pohjolainen and Alaranta reported that 49% of amputations in Finland resulted from diabetic complications.<sup>(5)</sup> The prevalence of diabetes mellitus is higher in Kelantan compared to other states in Malaysia. This may explain the higher incidence of diabetic foot complications requiring various types of lower limb amputations.<sup>(3)</sup>

Even though the incidence of injuries to the lower limb due to motor vehicle accidents is high, this rarely leads to amputation. In our five-year observation of open fractures of the lower limb in our hospital, only 6% of patients sustained Gustillo-Anderson grade IIC fractures which may require amputation.<sup>(6)</sup> Moreover, limb salvage procedure is the preferred treatment option for severe open fractures of the long bones of the lower limb, and is always attempted before amputation.<sup>(7)</sup> Hence, this has contributed to the low number of amputations in the trauma group. Uncontrolled infection of the lower limb in diabetic patients is almost always treated with an amputation. Limb salvage cannot be performed successfully in diabetics, as infection, the main component of the condition, cannot be properly ameliorated. Furthermore, amputation is still the best treatment for uncontrolled infection, even after a "successful" limb salvage procedure.<sup>(8)</sup> Amputation due to musculoskeletal tumours is very uncommon as compared to diabetes mellitus and trauma. At our centre, the limb salvage procedure is always attempted before amputation is performed for musculoskeletal tumours. Since it was introduced at our centre, over 50 patients with limb tumours have benefited from limb salvage procedures. This further reduces the incidence of amputations among patients with musculoskeletal tumours.<sup>(1)</sup>

Diabetic foot complications lead to amputation in the majority of cases in our series, due to late presentation to the hospital. This is due to various psychosocial reasons. Firstly, in a state considered to be among the less developed in the country, there is a poor level of understanding of diabetes mellitus among the afflicted, especially among the elderly population. This leads to poor compliance in their dietary intake and prescribed hypoglycaemic medication. Secondly, most patients from rural areas have to travel long distances to seek medical treatment. Hence, not many would benefit from specialist diabetic clinic follow-ups. These are vital to educating, maintaining optimal treatment and detecting early complications of diabetes mellitus,<sup>(9)</sup> as well as providing regular foot care and podiatric services. Thirdly, due to low awareness of modern medical care, a significant number of patients

believe in traditional folk medicine, taking this as their primary healthcare. This again leads to poor compliance and delay in presentation. Fourthly, most patients, understandably, are not keen to have an amputation. This is further worsened by the belief of taboos regarding amputations in the community. Lastly, amputees and their families are adversely affected in terms of financial loss due to the amputee's inability to work, and dependence on familial assistance in daily activities. As a result of the inhibitive nature of these reasons, patients are often sent to the tertiary hospital at a stage where it is too late for nonablative procedures.

Even though our data showed that infections are the main cause of patients to lose their legs, this may also be due to underlying conditions of PVD. PVD is uncommon in our population and could have been underdiagnosed. A retrospective review has shown that the prevalence of PVD in diabetic patients is four-fold that of their nondiabetic counterparts, and has been identified as the key component in the causal pathway to amputation.<sup>(10)</sup> Since the incidence of diabetes mellitus is significantly higher in this population, diabetic patients with PVD may be primarily diagnosed as diabetic foot patients. Angiopathy and neuropathy are the main components of diabetic feet. Early diagnosis and treatment of this condition may reduce the risk of infection. Unfortunately, associated medical problems, nature of vascular disease and the patients' reluctance may reduce the opportunity for an early salvage procedure. In our series, none of the diabetic patients ever had vascular surgery for the foot problem prior to amputation.

The functional outcome of the amputee is not always good. The use of prostheses is also not satisfactory as there are a lot of problems related to using the prostheses. In our country, the rate of patients using prostheses for more than six hours a day is as low as 37%.<sup>(11)</sup> The real scale of the problem might be larger. Since there are two main referral hospitals for operations in this the state, the total number of patients who undergo amputation is undoubtedly higher. The other tertiary hospital is a government general hospital in which the number of patient admission is more than ours, which is a teaching hospital. If a similar number of amputations were performed there, the total number of patients who have undergone amputation in our state would at least be double the number in our series. It is important to note that about 60% of the patients were less than 60 years of age. With the current prevalence of amputation, there will be a significant number of lower limb amputees in our population in the future. Worse still, they would probably be physically handicapped and economically unproductive.

Good control of diabetes mellitus and detection

of early diabetic foot complications will reduce the number of patients undergoing limb amputation, and conversely, a reduction in the number of amputees. Since the incidence of lower limb amputations is mainly attributed to poor control of diabetes mellitus, it is important to protect this group of patients from a probable avoidable amputation. Necessary actions, including health education, good diabetic control and early detection of feet at risk, must be taken in order to reduce the number of amputations among diabetic patients. Close collaboration between the podiatrist, diabetologist, vascular and orthopaedic surgeons must be initiated to avoid lower extremity amputation in high-risk diabetic patients.

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