Diabetes amputations: A critical event analysis

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Article points

1. Inadequate delivery of foot care is common in people with diabetes undergoing amputation.
2. Foot risk identification and stratification is an important aspect of foot care.
3. High risk patients should receive specialist podiatrist input.
4. Foot examination and risk assessment should be formally documented in a care plan.
5. Critical event analysis is highly informative for quality of care and should be undertaken on all patients with amputation.

Key words

- Amputation
- Foot care plan
- Critical event analysis

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Incidence of diabetic foot amputations is on the increase in the UK (McAlpine et al, 2005) despite the St Vincent Declaration aiming to reduce the incidence by 50 %. In this article, the authors describe a study undertaken at the Wolverhampton Diabetes Centre to identify potential failures in the provision of care in the prevention of amputation and the importance of critical event analysis in identifying areas of foot care that need improvement.

Lower extremity amputation is a devastating complication of diabetes. Multiple aetiologies, variously involving contributions from peripheral vascular disease, peripheral neuropathy, trauma, infection, impaired wound healing, limited joint mobility, foot deformity and high plantar foot pressure, contribute to the necessity of amputation (Pecoraro, 1990; Reiber, 1999). Footwear-related trauma may be the most common pivotal event leading to lower limb amputation (Fotieo et al, 1999). It is clear that effective health care provision with structured foot care programmes, identification and stratification of foot risk and promotion of self care can improve outcomes (Masson, 1989; Carrington et al, 2001; Peters and Lavery, 2001). The purpose of this study was therefore to identify potential failures in the provision of care in the prevention of amputation by undertaking a critical event analysis of cases that had involved an amputation.

Methods

The study spanned a 3-year period from 1 January 2001 to 31 December 2003. Data were obtained from the Wolverhampton diabetes register and from case notes of the participants by a study physician. The Wolverhampton diabetes register identified a total of 10 498 individuals with diabetes with 10.4 %, 3.7 % and 3.7 % suffering from peripheral neuropathy, peripheral vascular disease and both, respectively. Of the 10 498 people with diabetes, 50 had had lower limb amputations between 1 January 2001 to 31 December 2003 with the total number of amputations being 57. Of these, 30 patients were randomly selected for detailed study of their case notes. Demographic characteristics of the study group are presented in *Table 1*. The majority of the amputees were male (93 %), had an average age of 69 (±10) years, average diabetes duration of 17 (±14) years and an average HbA_{1c} of 8.6 % (±2.4 %).

Data collection was based on documentation by healthcare professionals

Box 1. Foot risk classification according to NICE (2004).

- Low current risk (normal sensation, palpable pulses).
- At increased risk (neuropathy or absent pulses or other risk factor).
- At high risk (neuropathy or absent pulses plus deformity or skin changes or previous ulcer).
- Ulcerated foot

Table 1. Characteristics of 30 study participants undergoing critical event analysis following distal amputation.

Patients audited	30
Gender	28 (93 %) male
Age	69 ± 10 years
Ethnicity	90 % Caucasian, 7 % Asian, 3 % Afro–Caribbean
Type of diabetes	12 type 1, 18 type 2
Duration of diabetes	17 ± 14 years
HbA_{1c}	8.6 ± 2.4 %
Poor control (HbA_{1c} > 8 %)	12 (40 %)
Insulin treated	22 (73 %)
Current smokers	3 (10 %)
Hypertensive	21 (70 %)
Ischaemic heart disease	11 (37 %)
History of stroke	3 (10 %)

in the relevant notes. Information was obtained on medical history, diabetes history, glycaemic control and diabetes complications. Detailed information was collected on foot care prior to amputation such as type of foot care, foot care providers, footwear assessments and foot care education. Inpatient care while admitted for amputation was also reviewed.

Foot risk was classified into low, intermediate, high or ulcerated according to NICE guidelines (2004; see *Box 1*).

A minor amputation was defined as any lower extremity amputation distal to the ankle joint; a major amputation was any such amputation through or proximal to the ankle joint.

Foot care was deemed inappropriate if those at high risk did not receive podiatrist input in the context of our hospital-based high risk foot clinic or, in the case of intermediate risk, community chiropody support in accordance with agreed local protocols of care (www.wdconline.org.uk/02care/index.htm [accessed 28.03.2007])

Results

The case notes showed that 80 % attended the hospital diabetic clinic for their diabetes

Table 2. Diabetes complications among 30 people undergoing distal amputation.

Complication	Yes n (%)	No n (%)	Not documented n (%)
Retinopathy	17 (57 %)	11 (37 %)	2 (7 %)
Nephropathy	12 (40 %)	16 (53 %)	2 (7 %)
Peripheral vascular disease (PVD)	28 (93 %)	2 (7 %)	
Peripheral neuropathy (PN)	19 (63 %)	11 (37 %)	
PVD and PN	18 (60 %)	12 (40 %)	
Foot deformity	11 (37 %)	11 (37 %)	8 (27 %)
Previous foot ulcers	20 (67 %)	5 (17 %)	5 (17 %)
Previous amputation	10 (33 %)	20 (67 %)	
Improper foot wear	12 (40 %)	9 (30 %)	9 (30 %)

Page points

1. Of the 30 study participants, 80 % of patients attended the hospital diabetes clinic and 20% were cared for by their GP.
2. Foot risk stratification identified 10 % of patients as intermediate risk and 90 % at high risk of undergoing amputation.
3. Sixteen of 30 cases (53 %) had inappropriate podiatric care prior to amputation.
4. No documentation of a foot management plan prior to amputation was noted in 43 % of the study group.
5. This study has shown an inadequacy in the delivery of foot care which may have resulted in amputations that were otherwise avoidable.

care while the remaining 20 % were under the sole care of their GPs. Their various diabetes-related complications are shown in *Table 2*. Peripheral vascular disease (PVD), peripheral neuropathy (PN) and both PVD and PN were seen in 93 %, 63 % and 59 % of patients respectively.

Data on foot examination for deformities and ulcers and assessment of footwear for appropriateness was obtained from the clinicians' documentation in the case notes. No documentation was seen in 30 %, 17 % and 26 % of participants with regards to footwear assessment, examination for foot ulcers and deformity, respectively. Among those with documentation of foot examination, 37 %, 67 % and 33 % had foot deformities, previous foot ulcers and previous amputations respectively. Ability to self care was not documented in 27 %. Documentation of foot care education was absent in 50 % of cases.

Foot risk stratification prior to amputation identified 3 people (10 %) at intermediate risk and 27 people (90 %) at high risk of undergoing amputation. *Table 3* represents the foot care that those whose case notes were reviewed had received prior to amputation. Only 13 of the 27 (48 %) high risk individuals were being reviewed in a hospital foot clinic and hence the remaining 14 received inappropriate care. Similarly, in the intermediate risk group, 1 of 3 had community chiropody input and the other 2 had no foot care input. On the whole, 16 of 30 (53 %) had inappropriate podiatric care prior to amputation.

Only 11 of the 28 who had PVD had undergone a vascular surgical review at some point prior to the acute admission for amputation.

The average hospital stay while admitted for amputation was 58 (± 53) days. This large range is due to other medical complications such as chest infections and in a few cases social circumstances had to be addressed before discharge. Fifty-three per cent of the participants had a major amputation while the rest had minor amputations. Only 19 (63 %) of the people involved in the study were noted to have had some form of specialist diabetes team involvement during admission. This was either via review by diabetes consultants and registrars or by intervention from the diabetes specialist nurse. The remaining 11 (37 %) had no diabetes team input in spite of having an average hospital stay of 14 days prior to the amputation. Foot care follow-up was arranged on discharge with the hospital chiropody clinic and community chiropody in 30 % and 13 %, respectively, while 44 % had no foot care follow-up whatsoever.

On the whole, no documentation of a foot management plan prior to amputation was noted in 43 % of the study group. The analysis of foot care is graphically depicted in *Figure 1*.

Table 3. Provision of foot care prior to amputation.

	High risk	Intermediate risk
None	7	2
Community chiropody	7	1
Hospital chiropody or high risk foot clinic	13	0

Conclusions

This study has shown an inadequacy in the delivery of foot care which may have resulted in amputations that were otherwise avoidable.

Inadequacies were found in documentation of matters which are very important in identifying foot risk and the danger of amputation. Assessment of risk factors, such as foot deformities, foot ulcers and improper footwear, were key aspects of the foot care pathway neglected in our study group. Risk stratification did not always follow and, when it did, individuals were not always seen in the correct setting. Vascular assessment was not completed adequately. Even during and after amputation, care was not according to accepted standards at the

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1. All people with diabetes at intermediate and high risk should have a care plan formulated and be seen by the appropriately skilled team.
2. All amputations should be reviewed by critical event analysis.

Wolverhampton Diabetes Centre.

As well as establishing guidelines and configuring specialised multidisciplinary teams our analysis suggests that every person with diabetes within any local health economy should have a recorded foot examination and their foot risk documented. All people with diabetes at intermediate and high risk should have a care plan formulated and be seen by the appropriately skilled team. Such stipulations may however be pipe dreams without health-economy-wide integrated information systems which can impart a true ability for system driven effective and appropriate care.

Currently, we are dependent on human systems to make care happen. The authors emphasise the power of the critical event analysis of all cases of people with diabetes undergoing amputation. Furthermore, the authors believe it can act as a driver and key quality assurance tool to inform quality improvement in foot care and the prevention of amputation.

In a recent article in this journal, Chadwick and Young (2006) suggested that all amputations should be reviewed by critical event analysis in a non-judgemental, no-blame environment in order to identify system failures, poor communication, delayed and inappropriate referrals, failure of protocol and poor levels of training or awareness among key personnel.

Our audit of a systematic approach to the analysis of events leading up to amputation in people with diabetes strongly supports that conclusion. ■

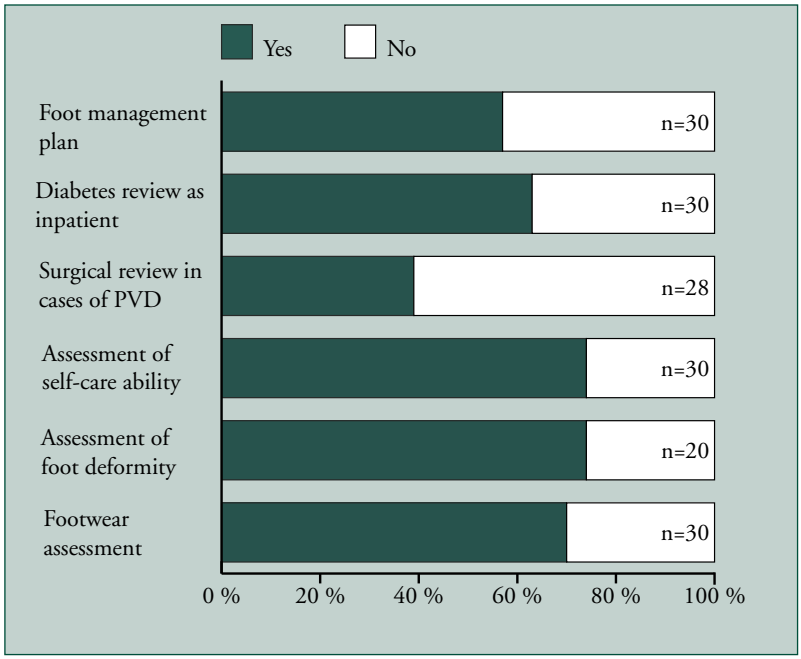

Figure 1. Analysis of the failure of the key aspects of foot care.

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