A retrospective 9-year survey on amputation rates and mortality in adults with diabetes in Poole

Rajesh Rajendran, Samantha J Davies, David V Coppini

A survey was conducted to obtain information on amputation and mortality rates and assess the impact of intensification of podiatry services in Poole, Dorset, UK since 2007. A search for all recorded amputations in people with diabetes from 2000–2008 was carried out and verified by case notes and electronic records. Amputations were classified as minor (below ankle) or major (below or above knee). Mortality and time to death following amputation were also calculated. Seventy amputations (56% minor, 44% major) were recorded in 57 people (88% male). Age at amputations (mean ± SD) was 67 ± 9 years. Major amputation rates were lowest in 2007 and 2008, with a concomitant rise in minor amputations at that time. In the 23 people who died during the survey period, the time to death after amputation was 29.3 ± 17.2 months. This study has been useful in evaluating the impact of an intensified podiatry service since 2007, and the impact of a joint vascular clinic since 2008. These data now provide a much-needed benchmark for evaluating amputation and related mortality rates for our patients in future.

Article points

1. This survey found that a multidisciplinary foot care team approach leads to a decreasing incidence of major amputations in people with diabetes.
2. This is associated with a rise in minor amputations.
3. Long-term mortality rates continue to be poor following amputations.
4. Local practice styles could influence amputation rates and therefore reports must be interpreted with caution.

Keywords

- Amputation
- Incidence
- Mortality
- Neuropathy
- Vascular clinic

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Lower extremity amputations (LEAs) remain a very common outcome of diabetic foot complications (Johannesson et al, 2009).

Peripheral neuropathy, peripheral vascular disease, foot ulcers and infection all increase the risk of amputation in people with diabetes (Boulton, 1996). A number of other risk factors for amputation have been reported including increasing age, male gender, ethnic minority status, poor glycaemic control, longer duration of diabetes, and poor preventative healthcare (Dargis et al, 2009).

It is well known that people with diabetes have a 10- to 15-fold higher rate of LEAs than those without diabetes (Most and Sinnock, 1983). In fact, in some areas up to 90% of all LEAs are related to diabetes (Larsson and Apelqvist, 1995; Adler et al, 1999).

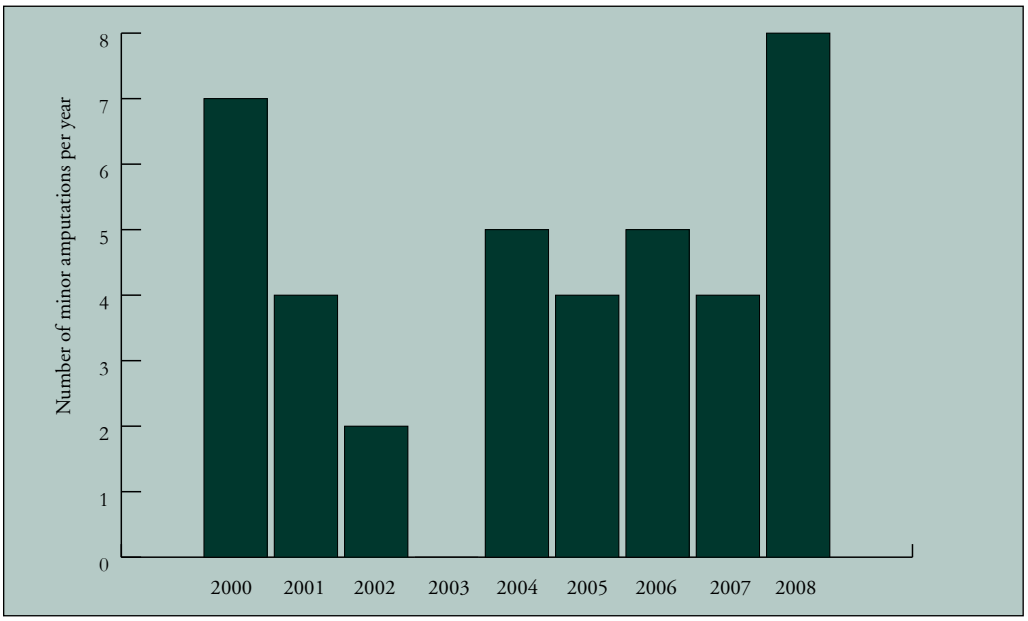

Figure 1. Minor amputations per year in the Poole area.

Background

The prevalence of diabetes in the UK is expected to rise by more than two-thirds from 1.7 million in the year 2000 to 2.7 million by 2030 according to the World Health Organization (2012). The prevalence of diabetes among people older than 17 years in Bournemouth and Poole PCT is 4.1%, with a catchment population of 250 000 (DiabetesE, 2008).

Rayman et al (2004) reported that the average incidence of major and minor amputations was 1.63 per 1000 people with diabetes and 1.23 per 1000 people with diabetes, respectively, during 1997–2000 within the UK.

One hundred people lose a leg each week because of diabetes and the cost of foot disease is estimated to be 20% of the total cost of managing diabetes, and may exceed £1 billion each year (Diabetes Health Intelligence and Yorkshire and Humber Public Health Observatory, 2012).

One of the aims of the St Vincent Declaration was to reduce diabetes-related LEAs by 50% within 5 years (World Health Organization and International Diabetes Federation Saint Vincent Declaration Working Group, 1990). Although these targets have still not been met, the incidence of major amputations in people with diabetes in several areas of the UK has been decreasing as a direct consequence of introducing a multidisciplinary foot care team approach, as reported from Middlesbrough (Canavan et al, 2008), Ipswich (Krishnan et al, 2008) and Tayside (Schofield et al, 2009).

Aims

Our own podiatry service was intensified in 2007 to a daily clinic and a joint vascular clinic was established in 2008. Our retrospective study intended to explore the impact of this new service on major and minor amputation rates. The mortality and time to death following both major and minor amputations were also calculated.

Materials and methods

According to 2008 data, 14 107 people >17 years of age had a diagnosis of diabetes in Bournemouth and Poole PCT out of a total population of 250 000 (DiabetesE, 2008). The amputation rate per thousand subjects with diabetes in the Poole area was calculated based on an adult population with diabetes of 7000 people. Between January and March 2009, the authors conducted a detailed retrospective search on all recorded amputations performed between January 2000 and December 2008 as recorded on their diabetes database (Diabeta3). Data accuracy was then verified by means of case notes, mortality records from Clinical and

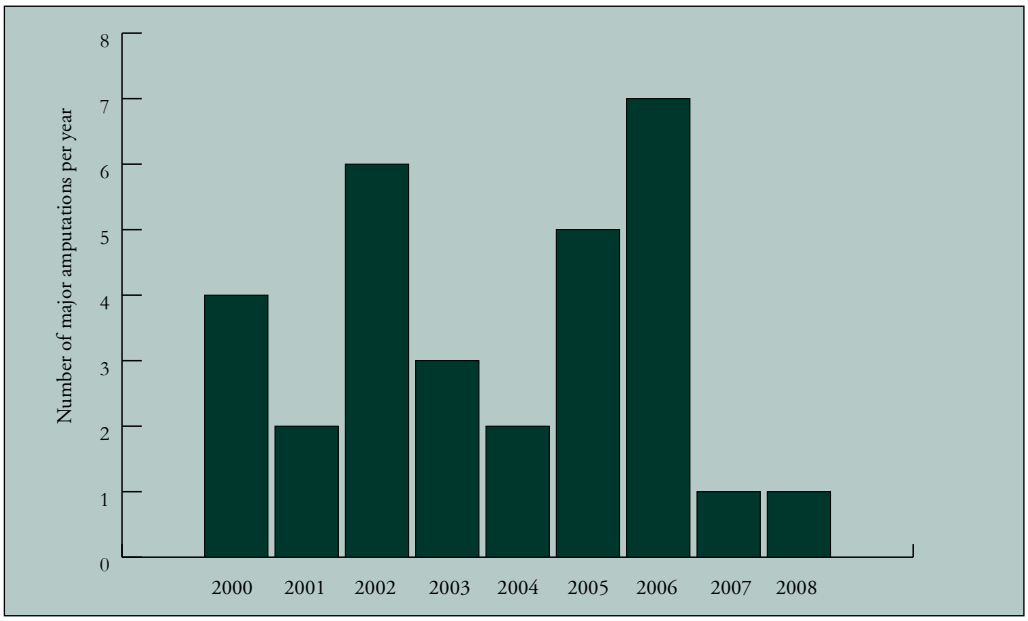

Figure 2. Major amputations per year in the Poole area.

Management Information Systems (CaMIS) and hospital electronic patient records.

Comparative regional and national data were obtained from DiabetesE, a web-based, performance improvement tool supporting implementation of the National Service Framework for Diabetes.

Amputations were classified as minor (below ankle) or major (below knee or above knee). In people who had more than one amputation, each episode was included and counted separately in the data analysis. Descriptive statistics and frequencies in numbers and percentages were used to explore the data.

Results

Seventy amputations were recorded in 57 people with diabetes. Eleven people had more than one amputation. There were 39 minor amputations (56%) and 31 major amputations (44%) between January 2000 and December 2008 (*Figures 1* and *2*).

Fifty individuals were male (88%). The mean age at amputation across all subjects was 67 ± 9 years, and the age range was 35–90 years. There was a fall in major amputations with a corresponding rise in minor amputations in 2007 and 2008.

In 2007 and 2008, the amputation rate was 1.6 per 1000 people with diabetes, which was close to local data published in DiabetesE (1.5 amputations per 1000 people with diabetes). This was considerably lower than the amputation rate of 2.9 per 1000 people with diabetes in the South West Strategic Health Authority and the national average of 2.6 per 1000 people with diabetes (DiabetesE, 2008).

During the 9-year survey period, 23 of the 57 patients (40%) had died. Amongst those who had died, 14 had undergone major amputations (61%) and nine had minor amputations (39%). The mean (± SD) time to death after amputation was 29.3 ± 17.2 months. Post-amputation survival time in people who underwent major amputations was 41.7 ± 19.6 months versus 17.8 ± 8.4 months in people who underwent minor amputations ($P<0.01$).

Discussion

Rayman et al (2004) have highlighted the limitations of retrospective data collection methods, which can underestimate the incidence of diabetes-related LEAs. Underestimation of amputation rates may also occur as major amputations are often more reliably documented than minor amputations. The authors verified the data across different aforementioned sources in order to reduce the likelihood of such underestimates, and acknowledge this limitation in their data.

Despite this limitation, the authors' survey showed an interesting reduction in major amputations and a corresponding increase in minor amputations since the intensification of our podiatry service in 2007 from a twice-weekly clinic to a daily multidisciplinary foot clinic that included a podiatrist and a diabetes physician with an interest in diabetic foot disease, and the introduction of a joint vascular clinic in 2008. The vascular service for the authors' diabetic foot patients is located in a neighbouring hospital to their own and admitted patients tend to be offered a more conservative approach in their management (Coles and Coppini, 2004). This may have had a small role in affecting the amputation rates in Poole.

Canavan et al (2008) reported that following adoption of organised diabetes foot care, the number of amputations fell from 3.1 to 0.86 per 1000 people with diabetes in Middlesbrough. Similar approaches in Ipswich saw a fall in the incidence of major amputations from 4.1 to 0.77 per 1000 people with diabetes (Krishnan et al, 2008). Schofield et al (2009) demonstrated a reduction in the incidence of major amputations from 5.1 to 2.9 per 1000 people with diabetes that coincided with the establishment of a community-wide multidisciplinary foot service.

The authors' survey also identifies males as being more vulnerable to this most devastating complication of diabetic foot disease, as other authors have found (Boulton, 1996; Dargis et al, 2009). Male sex has previously been associated as a risk factor for a number of diabetes-related lower extremity complications. In general, women seem to have fewer complications and better prognosis than men.

The prevalence of peripheral arterial occlusive disease and sensory neuropathy is lower in women with diabetes. Likewise, the prevalence and incidence of amputations and mortality associated with amputations of the foot are significantly lower in women (Franklin et al, 1990). This may be related to delays in male subjects when seeking

Page points

1. The survival time in people who underwent minor amputations was shorter than those who underwent major amputations.
2. The introduction of a vascular service and extra podiatry clinics may have had a small role in affecting the amputation rates in Poole.
3. The survey identified males as being more vulnerable to amputation, supporting evidence from other studies.

Page points

1. Amputation data should always be interpreted with caution.
2. A decrease in the incidence of amputations should be accompanied by improvements in morbidity, mortality and patient function.
3. This study has been useful in evaluating the impact of an intensified podiatry service and a joint vascular clinic, showing a reduction in major amputations in people with diabetes after these services were introduced.
4. These data provide a much-needed benchmark for evaluating amputation and related mortality rates for patients in the region.

medical attention and a higher prevalence of smoking in men (Kattainen et al, 2005). This observation has also been noted in other studies (Watts et al, 2001; Ince et al, 2007).

Following amputation, 40% of the individuals in this survey had died over the 9-year survey period. A 2-year mortality of up to 50% has been reported in several other studies in people with diabetes who had amputations (Tentolouris et al, 2004; Schofield et al, 2006). Interestingly the authors' survey shows that the survival time in individuals who underwent minor amputations was shorter than in those who underwent major amputations. This may be related to concurrent co-morbidities, which may have influenced the decision on surgery in those with minor amputations. It may also reflect the influence of neuropathy on associated cardiovascular risk (Coppini et al, 2000). Alternatively, it may also suggest the possible benefits of a more definitive procedure in reducing the long-term risk of recurrent diabetic foot ulceration. This finding further questions the relevance of major amputations as a marker of poor performance.

Although clinicians are generally keen to avoid amputations, such procedures should not always be considered as the worst outcome for a patient. An early decision on amputation may be the best therapy option for the patient in whom, for example, recurrent foot ulceration and infection seriously hinders quality of life and adequate diabetes self-management (Leese and Schofield, 2008). Patients' (and or family and carers') beliefs and wishes are also important when deciding on amputation and in part may explain geographical differences between areas of varying ethnic and socio-economic diversity.

The Department of Health recently published figures from the NHS Atlas of Variation in Healthcare programme reporting on amputation rates in patients with diabetes in England (NHS Right Care, 2010). These figures suggest that the rate of major amputations in the southwest of England is almost twice that of the southeast.

These figures should also serve as a reminder that amputation data should always be interpreted with caution. This programme looked only at major amputations over a 5-year period in people with type 2 diabetes who were registered with a strategic health authority. There appeared to be no inclusion of minor amputations or people with type 1 diabetes undergoing amputation.

The variation when coding a major amputation should also be considered alongside the fact that amputation is a treatment decision dependent on many factors and often on various healthcare professionals. Such variability of factors is likely to confound the role of amputation as a benchmark of success. A decrease in the incidence of amputations should be accompanied by improvements in morbidity, mortality, patient function and mood (Jeffcoate and van Houtum, 2004). Additionally, despite researchers claiming that their data were adjusted for geographical areas, comparisons with the older retiring populations in the southwest may be difficult, as longevity *per se* is likely to increase diabetes duration and thus the risk of diabetic foot complications. Professional prejudice within the multidisciplinary team is also likely to play an important part in regional variation. Wrobel et al (2001) reported that people with diabetes were nine times more likely to have a major amputation based on local practice styles alone after adjusting for factors such as age, gender and race.

This retrospective study highlights the importance of a multidisciplinary team approach in the management of diabetic foot disease in future years (Coles and Coppini, 2004; Canavan et al, 2008; Krishnan et al, 2008; Schofield et al, 2009).

The authors' figures are comparable to those published regionally and appear to have remained consistent, as recently reflected in a further DiabetesE publication in August 2011, *Diabetes Foot Care Profile*. Amputation activity was monitored between April 2007 and March 2010, revealing an annual amputation rate of 1.8 per 1000 people with diabetes in Bournemouth and Poole (DiabetesE, 2011). The quoted national average for this time period remained relatively unchanged at 2.7 per 1000 people with diabetes.

Regular audit on amputation rates is of paramount importance in monitoring both practice and outcomes in managing diabetic complications. Comparison of amputation rates between different areas should be interpreted with caution, as the authors believe that amputation trends, quality of life measures and mortality rates within specific regions would be better surrogate markers of success.

Conclusion

This study has been useful in evaluating the impact of an intensified podiatry service since 2007, and the impact of a joint vascular clinic since 2008, following which there was a reduction in major amputations in people with diabetes. These data also provide a much-needed benchmark for evaluating amputation and related mortality rates for patients in future years. ■

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