Podiatric surgery and the diabetic foot: an audit of a community-based diabetic foot surgery

Anthony Maher, Hannah Bond

Nottingham is home to an established diabetic foot multidisciplinary team (MDT) with good links to orthopaedic and vascular surgeons, but historically, referral to podiatric surgeons has not been considered. Nottingham is also home to an established podiatric surgery team that offers surgical treatment of elective foot complaints as a day case, under local anaesthetic in a community-based facility. This paper examines the role a podiatric surgery service can play within an existing MDT structure.

Diabetes is an ever-increasing problem with an estimated 3.6 million people living with the disease in the UK (Diabetes UK, 2016a). Up to 10% of people with diabetes will develop a foot ulcer and, at any one time, there are over 60,000 active diabetic foot ulcers in the UK (Kerr, 2012; NICE, 2015). In 2010/11, diabetic foot disease cost the NHS in the region of £650 million (Kerr, 2012). The mounting costs associated with treating ulceration are likely to continue rising, placing a strain on already stretched community and acute healthcare provision. It is necessary to continually re-evaluate the provision of care to ensure that treatment is safe, clinically effective and cost efficient.

Podiatry has for many years been integral to the diabetes multidisciplinary team (MDT) and it is acknowledged that podiatry has an important role in the prevention and management of foot ulceration (Diabetes UK, 2016b). In the USA, podiatric surgeons have firmly established their role in the diabetes MDT and various reports point to the positive outcomes of judicious surgery (Armstrong et al, 1996). However, podiatric surgeons in the United Kingdom, with a few notable exceptions, have not prioritised the diabetic foot. Reasons for this may be historic; many podiatric surgery services were traditionally hosted by community based NHS organisations, rather than Acute Hospital Trusts.

Nottingham is fortunate to have both an established hospital diabetes MDT and an established community based podiatric surgery service, but until recently the two services had not considered a partnership with a view to improving patient outcomes. Initial discussions between the two teams identified several patients with chronic foot ulceration, which was not responding to the usual conservative treatments, but may benefit from elective surgery.

The podiatric surgery service sits within a community-based Foundation Trust and offers elective surgery to patients as a day case under local anaesthetic block in a dedicated purpose built primary care facility with twin operating theatres. Agreement was reached to undertake minor surgeries in the community for patients with diabetic foot ulceration and postoperative care shared between the two services.

Aims

The authors undertook an initial audit to gain an understanding of the services they were delivering to people with diabetes, with reference

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Article points

1. The diabetic foot multidisciplinary team may benefit from access to a podiatric surgery service for the management of patients who have non-acute neuropathic foot ulceration that has failed to heal through the usual means.
2. Judicious use of community-based podiatric surgery has the potential to reduce reliance on hospital beds, inpatient stays and costly acute sector operating theatres.
3. Podiatric surgery can be safely offered in the community as a day case under local anaesthetic for patients with diabetic foot disease.

Key words

- Community
- Diabetic foot
- Local anaesthetic
- Podiatric surgery

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Page points

1. A service evaluation was developed utilising PASCOM-10
2. PASCOM-10 is a proprietary audit system developed by the College of Podiatry
3. Sixty-four patients attended for surgery on 74 occasions. The mean duration of ulceration was 52.8 weeks

to clinical effectiveness and safety. The authors audited referrals, surgical activity and outcomes, with the intention of identifying referral patterns, baseline demographics and podiatric diagnoses. The authors were also interested in the surgical procedures and the class of surgery performed. Armstrong and Frykberg describe four grades of foot surgery in diabetic patients ranging from class-1 elective surgery for the sensate foot through to class-4 emergent surgery (Armstrong and Frykberg, 2003). Outcomes of interest included patient satisfaction, quality of life, complications, recurrence, time to wound closure and whether the patient was subsequently discharged from the acute MDT.

Methods

A service evaluation was developed utilising a pre-existing approved departmental audit framework and a proprietary audit system; PASCOM-10, which was developed by the College of Podiatry for clinical audit and is routinely used in podiatric surgery (Rudge and Tollafield, 2003; College of Podiatry, 2016). Anonymised clinical, demographic and outcome data are entered into the PASCOM system at the time of surgery, and at 6 months' post-operation. This data can then be exported to Microsoft Excel. In addition to the standard clinical data collected by PASCOM, data was collated relating to the onset of foot ulceration and specific podiatric diagnosis. The authors also reviewed paper records to determine the time to ulcer healing or surgical wound healing and any complications encountered.

The PASCOM system also captures satisfaction data using the proprietary PSQ-10 questionnaire with a score range of 0–100; higher scores signify greater levels of satisfaction (Rudge and Tollafield, 2003; Taylor et al, 2008). Health-related quality of life (HRQoL) is captured through PASCOM with the Manchester Oxford Foot Questionnaire (MOXFQ). The MOXFQ was developed and validated in the context of elective foot surgery and measures quality of life across the domains of pain, walking/standing and social interaction (Dawson et al, 2006; Dawson et al, 2012). There are various methods for analysing MOXFQ scores, but of interest is minimal clinically important change (MCIC), which estimates the score change required for the patient to notice an actual as opposed to a statistical improvement in their HRQoL. The MCIC for each of the three MOXFQ domains has been estimated at 13 points (Dawson et al, 2014).

Referral criteria (*Table 1*) were developed before the Podiatric Surgery team began receiving referrals direct from the MDT doctors and podiatrists in April 2014. Data were captured for all referrals from April 2014 through to November 2016. Where possible, patients were followed up until 6 months post operation or discharge from the MDT, or until the end of the initial audit period.

All patients attended for a pre-operative assessment with the podiatric surgery team and all surgery was completed by a consultant podiatric surgeon. All treatment was performed under either a digital or ankle local anaesthetic block with or without an ankle tourniquet. All patients received a same day discharge. Post-operation, all patients were given access to a podiatrist lead on-call service and received a courtesy telephone call at 24 hours post-operation. The first re-dressing was scheduled for approximately 48 hours in a podiatrist lead out-patient clinic. Subsequent dressing appointments were offered at 7 and 14 days or as dictated by clinical need and were shared between the podiatric surgery service and the MDT. Arrangements were put in place for direct admission to the diabetic foot ulcer ward in the event of severe postoperative infection.

Results

During the audit period (April 2014 to November 2016), the podiatric surgery team received 104 referrals from the acute MDT. Of these, 64 patients (50 male, 14 female) attended for surgery on 74 occasions. A total of 109 surgical procedures were performed. The average age of patients was 60 (range 32–89). *Table 2* details the range of podiatric problems patients were referred with. The mean duration of ulceration was 52.8 weeks (range 2–534 weeks). Four admissions were classified as elective according to Armstrong and Frykberg's

Table 1. Referral criteria.

Criteria	Note
Failed to respond to usual care	Podiatry, orthotics, footwear, casting, antibiotics
Non- healing neuropathic ulceration of the forefoot	Digits, metatarsophalangeal joints
Adequate perfusion	No evidence of critical limb ischaemia. Pedal pulses and ABPI reviewed
Systemically stable	Stable cardiovascular function and renal function (i.e. no unstable angina or acute kidney injury/ stage 4 renal disease)
Home support	A friend or relative available to the patient in the first 48 hours
No infection beyond the site of surgery	If infection is present, the surgery should be curative (i.e. distal tip amputation for osteomyelitis)
Class of surgery	Non-emergent i.e. prophylactic, or curative procedures

definition (2003), while four admissions were classified as prophylactic. The remaining 66 admissions were classified as curative, for the treatment of active ulceration.

A total of 109 surgical procedures were performed with a mean 2.9 per patient. *Table 3* details the range of surgical procedures performed. Of note, only 22.9% of the procedures were classed as amputation and many of these were partial amputations. Most wounds (93.3%) were closed or partially closed, only seven admissions received no form of closure. Of these, five admissions were for ulcer debridement, one patient received a nail avulsion without closure, and one amputation was left open to heal by secondary intention.

Fifty (67.5%) admissions for surgery resulted in healing without complication, however, several complications were encountered and are detailed in *Table 4*. Thirteen patients required antibiotic treatment following surgery; three patients deteriorated and were subsequently admitted for intravenous antibiotics. Of the 13 patients who required continued treatment for infection, seven patients developed a new post-operative infection where there had been no clinical, radiographic or microbiological evidence of infection pre-operation. One patient developed an immune reaction to Flucloxacillin and was also admitted for monitoring.

A total of four patients were lost to follow-up. Patients who underwent surgery in the past 6 weeks of the study (seven admissions) were excluded from any assessment of wound healing; of the remaining cohort, 85.9% of wounds healed. The mean time to wound closure or ulcer healing was 5.9 weeks (range 1–29 weeks). Again, excluding those patients who had treatment in the past 6 weeks, a total of 44 patients (70%) were discharged from the MDT. Subsequently, four patients were re-referred with ulceration at new locations.

Patient reported outcomes were reviewed where available. Only 27 (42.2%) patients completed a pre-operative and postoperative MOXFQ questionnaire, while 29 patients completed a PSQ-10 patient satisfaction questionnaire. The MOXFQ response was variable and the data are summarised in *Table 5* and *Figure 1*. A mean improvement was noted for all three domains. Patient satisfaction with surgery was good, with a mean score of 91.8 (standard deviation = 8.14, range = 65-100). Twenty-eight of 29 patients felt their aims of surgery had been met. One patient felt their aims had not been met as they went on to require further surgery.

Table 2. Presenting complaint.

Diagnostic categories	Count
Digital — other	2
Digital osteomyelitis/ necrosis/ulcer	34
Hallux — other	1
Hallux apical ulcer	1
Hallux interphalangeal joint ulcer	21
Metatarsophalangeal joint plantar ulcer	13

Discussion

Diabetes is a health epidemic that is not going away and, as a consequence, acute hospital MDTs are increasingly under pressure (Diabetes UK, 2016c). The demand for involvement from MDTs comes at a time of sustained public sector austerity and the rationing of services (Campbell, 2015). It is incumbent on all those treating the diabetic foot to look for smarter, more cost-effective ways of working. Judicious use of community based podiatric surgery has the potential to reduce reliance on hospital beds, inpatient stays and costly acute sector operating

Table 3. Surgical procedures.

Procedure	Count
Digit amputation (whole/partial)	25
Ulcer debridement	21
Proximal interphalangeal joint arthroplasty	12
Hallux interphalangeal joint arthroplasty	11
Calcium sulphate/antibiotic insertion	11
Exostectomy	9
Soft tissue excision	6
Isolated bone biopsy	4
Metatarsal head excision	3
Osteotomy	2
Nail avulsion	2
Hallux interphalangeal joint arthrodesis/Jones suspension	1
Sesamoid excision	1
Tenotomy	1

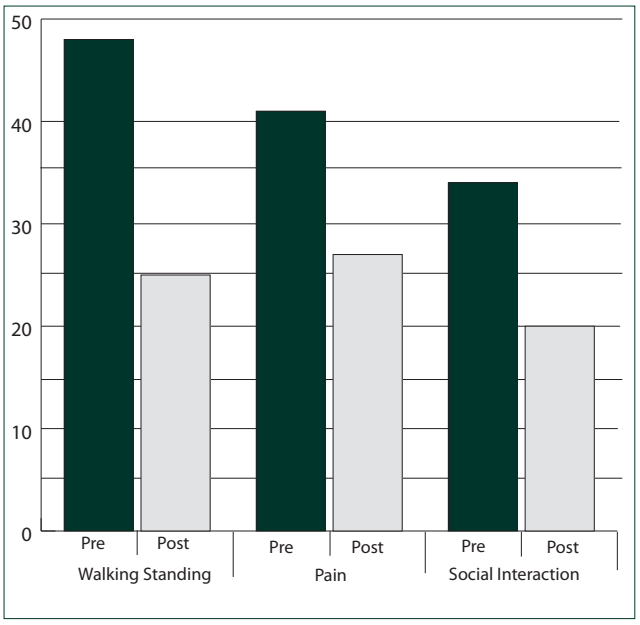

Figure 1. Mean MOXFQ scores before and after surgery.

theatres. Triaging surgical patients to ensure those with a lower medical need are treated in the community, in turn, releases hospital specialists to concentrate on medical emergencies, such as limb-threatening ischaemia. Community-based podiatric surgery has the potential to offer timely treatment to patients in need of relatively straight forward procedures who, while their needs may not be acute, do still have the potential to deteriorate.

Podiatric surgery has, over the past 40 or more years, established itself as a safe provider of foot surgery with a number of successful services established across England (Borthwick, 1999; Maher and Metcalfe, 2009). Armstrong et al found that prophylactic podiatric surgery was safe and effective with operated toes remaining ulcer-free at 3 years post-operation (Armstrong et al, 1996). Podiatric surgery can be safely offered in the community as a day case under local anaesthetic for patients with diabetic foot disease. The range of procedures offered reflects the referrals received and the facilities available to the team. Amputation only accounted 22.9% of surgeries, pointing to the fact that when treated early, there are surgical alternatives that can avoid the need even for digital amputation.

Most wounds were primarily closed at the time of surgery, there has though been some debate about the risk of closing complicated diabetic wounds (Saipoor et al, 2016). Connolly et al reported a 90% success rate when closing diabetic wounds (Connolly et al, 2000). Fisher et al described three factors to consider when determining whether to close a wound; the extent of any necrosis, the amount of drainage from the wound and the presence or extent of any infection (Fisher et al, 2010).

Zgonis et al (2007) state that closure by secondary intention will increase the risk of complications and re-ulceration. Primary closure appears to have been successful in this audit; most patients healed (85.9%) and, subsequently 70% of patients were discharged from the MDT. However, the follow-up period was relatively short and not standardised for all patients. It must be accepted that there is a high probability of many patients ultimately requiring further treatment for new or re-ulceration and, as such, they are probably best considered as being in remission rather than cured (Armstrong and Mills, 2013).

Surgical intervention is not without risk and patients with diabetic foot disease will experience a much higher rate of surgical complications than

is expected of a typical elective cohort. The rate of new infections (9.5%) was much higher than the anticipated elective rate of below 1% (NICE, 2013). However, in the context of diabetic foot surgery, others have reported infection rates of between 13% and 14% (Armstrong et al, 1996; Wukich et al, 2010). It is crucial then that appropriate measures are in place to manage infection when treatment is offered. An ability to admit patients promptly when the need arises is of critical importance.

The collection of PROMS data was poor (27 patients). One reason for this is that most patients remained primarily under the care of the MDT and so following their surgery, immediate postoperative care was effectively lost to follow-up with the surgery team. Despite this, the data collected suggest that patient satisfaction with treatment was extremely high. The satisfaction scores were actually better than those typically recorded following elective podiatric surgery (Rudge and Tollafield, 2003). This may be because patients with diabetic foot disease have more specific expectations of surgery, such as ulcer healing, than elective cohorts.

The MOXFQ data were less certain. Overall, there was a mean improvement in all three domains and most patients saw an overall improvement in scores, with between 12 and 15 patients exceeding the MCIC thresholds for each domain. There were between 7 and 10 patients reporting a deterioration in scores for each domain. It is perhaps surprising that the MOXFQ found any significant improvements in the pain domain, pointing to the fact that neuropathic patients will still experience some pain. Further work is required to validate the use of the MOXFQ in the context of diabetic foot surgery.

Before contemplating diabetic foot surgery in a community setting, several safeguards were put in place. The community facility itself was already well equipped with emergency equipment, including automated external defribrillators, oxygen and patient monitoring equipment. All patients were first assessed by a Consultant Physician and the extent of any vascular insufficiency was documented. All patients received a same day discharge, so adequate home support was essential for the first 48 hours.

Table 4. Postoperative complication.

Complications	Count	Percentage
Healed without complication	50	67.5
Re-ulceration	3	4.1
New infection*	7	9.5
Ulceration at other location	10	13.5
Revision ray resection (failure to heal)	2	2.7
Immune reaction to Flucloxacillin	1	1.4

n = 74 admissions

*Infections which were confirmed post-operation with no clinical or microbiological evidence of infection pre-operation.

Patients with diabetic foot disease were more likely to require emergency hospital admission post-operation than typical elective patients and so arrangements were put in place to ensure that the on-call podiatry team could liaise with the on-call medical team to admit patients as necessary.

To further ensure the safety of patients, regular MDT meetings were organised to discuss patients ahead of referral and to discuss their ongoing care needs following surgery. The project also benefited from having a link podiatrist, a member of the surgery team who also worked for part of the week in the diabetes MDT.

Conclusion

This article has demonstrated that the diabetes MDT may benefit from access to a podiatric surgery service for the management of patients who have non-acute neuropathic foot ulceration that has failed to heal through the usual means. Patients can be offered surgery safely in a community setting under local anaesthesia and following treatment, most patients will heal and be discharged from the MDT. Although this audit has not looked directly at the cost of treatment, it is probable that delivering surgery in a community setting for these patients has the potential to achieve considerable cost savings for the NHS. ■

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Table 5. Summary of patient reported outcomes.

Domain	Walking Standing		Pain		Social interaction		
	Pre	Post	Pre	Post	Pre	Post	PSQ-10
Mean	47.6	25.5	41.1	28.0	34.3	20.1	91.9
SD	34.2	29.0	30.9	28.8	30.1	24.2	8.1
Range	0–100	0–85	0–95	0–95	0–87	0–75	65–100
MCIC met (number of patients)		15		12		12	
Deterioration (number of patients		7		10		8	
MCIC not met (number of patients)		5		5		7	
n.		27		27		27	29

SD; Standard deviation. MCIC; minimal clinically important change – met if post intervention score is 13 points lower than pre-intervention score. MCIC not met if score change is less than 30 points. Deterioration; If the post-intervention score is greater than the pre-intervention score. PSQ-10; Patient satisfaction Questionnaire 10.

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