

Diabetes Amputation Program: a structured systematic approach

M McGill, V Nube, T Clingan, M Constantino, T Bolton, E Palmer, D Yue

ARTICLE POINTS

1 The lack of multidisciplinary foot clinics and clear referral pathways make it difficult to establish an organised and systematic approach to diabetic foot care in Australia.

2 The Royal Prince Alfred Hospital Diabetes Centre initiated a programme to address the problem of diabetic foot disease management in the Central Sydney Area Health Service.

3 A standardised area-wise stratified approach to care of the diabetic foot was introduced and a referral pathway developed.

4 Data can now be collected, entered into a centralised database and analysed.

KEY WORDS

- **Multidisciplinary foot clinic**
- **Referral pathway**
- **Stratified system**
- **Education**
- **Integrated care**

Margaret McGill, Manager; Tazmin Clingan, Podiatrist; Maria Constantino, Data Manager; Thyra Bolton, Foot Clinic Coordinator; Eva Palmer, Podiatrist, Diabetes Centre, Royal Prince Alfred Hospital; Dennis K Yue, Professor and Director; and Vanessa Nube, Podiatrist, Diabetes Centre, Royal Prince Alfred Hospital and the Discipline of Medicine, University of Sydney.

Introduction

Although health professionals in Australia may be trained in the techniques of treating the diabetic foot, various factors make it difficult to establish a service. The Royal Prince Alfred Hospital Diabetes Centre has initiated a programme to address the problem of diabetic foot disease management in the Central Sydney Area Health Service (CSAHS), the administrative structure in charge of healthcare in our region. This article describes some of our experiences.

D iabetic foot disease is a major contributor to diabetes-related morbidity and mortality (Edmonds et al, 1996). Healthcare professionals worldwide recognise that this is a serious issue, yet despite numerous attempts to reduce the rate of lower limb amputation the incidence in many countries continues to rise (Armstrong and Harkless, 1998). Two critical elements are required to address the problem: a good level of clinical skill to manage these high-risk individuals and an organised and systematic approach to ensure effective and sustained healthcare delivery. In our experience, up-skilling health professionals in the management of diabetic foot disease (although a major challenge) is comparatively straightforward and not the crux of the problem. What is considerably more complex is addressing organisational and resource issues. It is not uncommon for health professionals to be trained in the techniques of treating diabetic foot disease and then be unable to establish a service; their enthusiasm then gradually fades away. The major factors contributing to this in Australia are the lack of multidisciplinary foot clinics and the lack of clear referral pathways.

Lack of multidisciplinary foot clinics

Substantial evidence exists to indicate that treatment of people with diabetes who have foot ulceration by a skilled multidisciplinary team is the most effective clinical setting for reducing amputation rates (Apelqvist and Larsson, 2000). Despite this, few multidisciplinary foot clinics exist in Australia. A commonly held but mistaken belief by

Australian health professionals is that a podiatry service equates with a diabetes high-risk foot clinic. However, managing active diabetic foot pathology requires the involvement of many disciplines.

Unlike their counterparts in the US, Australian podiatrists are not legally permitted to prescribe antibiotics, refer patients for most diagnostic tests or perform surgical procedures. A podiatrist-only clinic could therefore not be expected to treat infection adequately, or rectify problems of vascular supply or bony structural abnormalities, should these be playing a substantial role in delaying healing of the foot ulcer.

In Australia, a visit to a podiatrist is not funded by the universal healthcare insurance system, and many patients with foot ulceration are cared for by doctors without assistance from podiatrists or nurses. Skills such as application of contact cast, biomechanical assessment, pressure offloading and optimal wound care are therefore not available.

It is often erroneously accepted that a multidisciplinary footcare system is in place if the various disciplines of health professionals are available. In many cases they are not truly integrated and the team is a group of individuals who work at different sites or different times, have individualised approaches to their work and little interdisciplinary interaction. Poor communication and isolation can lead to a lack of trust and understanding of the other disciplines' skills and roles. The consequence is that progress in treatment is hindered and patients' confidence in the

overall management of their condition may be undermined.

Lack of clear referral pathways

Unlike other complications of diabetes where there is a clear referral pathway (such as a person with retinopathy being referred to an ophthalmologist) there is not a readily identifiable diabetic foot doctor. There are too many possible points of entry into the healthcare system for a patient with foot disease, in every conceivable combination and permutation: (the ever-rotating) resident doctors in the emergency department; vascular surgeons; orthopaedic surgeons; general surgeons; GPs; community nurses; podiatrists; and diabetologists.

Often the specialist most commonly involved with treating diabetic foot ulceration is a vascular surgeon, irrespective of the underlying aetiology of the wound. Vascular surgeons often treat neuropathic ulcers in the presence of bounding pedal pulses where the major underlying problem is neuropathy and foot deformity. In other cases the orthopaedic surgeon may be referred a patient whose problem cannot be resolved until blood supply is restored. Consequently, the patient is often referred to multiple health professionals and the unfortunate time delay greatly increases the risk of amputation.

An efficient system that provides treatment and rapid triaging to the appropriate specialist(s) is needed but seldom available. The diabetologist is in many ways the best person to be responsible for coordinating such a system. In real life, burdened by the increasing number of patients in the diabetes clinic and bombarded from different directions by the need to detect the milder cases of diabetes, achieve tighter glycaemic control and correct every facet of the metabolic syndrome, diabetologists (in our experience) are often not adequately trained or willing to take on such a role.

A significant contributor to the complexities of establishing successful footcare services are patients themselves. Patients often have co-morbidities that not only complicate their management but may also limit their ability to attend appointments. Too often, patients are oblivious to the seriousness of foot problems because of a lack of pain sensation, and overall become prime

candidates to be lost in a complex healthcare system, until hospitalisation and amputation.

Priority Health Care Diabetes Amputation Prevention Program

Recognising that public hospitals are increasingly being forced to focus on acute diseases or those requiring sophisticated technology in treatment, the NSW Health Department initiated a Priority Health Care Program for Chronic Disease to tackle the problems of chronic and complex diseases.

It was not precisely specified which chronic diseases were eligible, and diabetes was not one of the disciplines notified by our hospital. We discovered the programme incidentally. Diabetic foot disease was selected to be one of the four programmes accepted for funding in CSAHS, together with cardiac failure, stroke and chronic airways disease. The amount of funding was enough for us to employ four health professionals for 3 years, continuation being subject to satisfactory progress. There were considerable arguments at every step about how much funding was actually being made available and how much should be allocated for administrative purposes.

The CSAHS is situated in inner-city of Sydney and serves a population of approximately 500 000. In the Australian healthcare system patients are free to move from one area to another. In the CSAHS, there are three independent hospitals: the Royal Prince Alfred Hospital (710 beds), Canterbury Hospital (425 beds) and Concord Hospital (175 beds). Each hospital provides its own version of diabetes services to the community and the diabetes foot care offered differed greatly between hospitals.

Royal Prince Alfred Hospital

In the Royal Prince Alfred Hospital there was already a full-time multidisciplinary foot clinic which only cared for diabetes patients with acute foot problems such as ulceration and infection. This clinic was funded by revenue generated from various activities such as conducting clinical trials, not by the hospital. The two or three podiatrists who worked in the foot clinic were employed on 'soft money', with the constant fear that funding interruption could lead to the demise of the most established foot clinic in Australia.

PAGE POINTS

1 Unlike other complications of diabetes where there is a clear referral pathway, there is not a readily identifiable diabetic foot doctor.

2 The patient is often referred to multiple health professionals and the unfortunate time delay greatly increases the risk of amputation.

3 Patients are often oblivious to the seriousness of foot problems, owing to a lack of pain sensation, and overall become prime candidates to be lost in a complex healthcare system, until hospitalisation and amputation.

4 The CSAHS is situated in the inner-city area of Sydney and serves a population of approximately 500 000, although in the Australian healthcare system patients are free to move from one area to another.

5 Each hospital provides its own version of diabetes services to the community, and the diabetes foot care offered differed greatly.

PAGE POINTS

1 A simple calculation of numbers convinced most stakeholders that it was not possible to provide routine podiatry care to all people with diabetes.

2 Patients with no neuropathy or peripheral vascular disease were considered to be at low risk of developing significant foot problems.

3 Those with an active foot problem such as infection, ulceration or Charcot's arthropathy were clearly high risk and were managed in one of the multidisciplinary high-risk foot clinics.

4 Once the philosophy of stratifying care according to level of risk was accepted, the staff freed from the routine management of low-risk diabetes patients were re-directed to treat patients with a higher risk profile.

Canterbury Hospital

Canterbury Hospital had five hospital/community-employed podiatrists working in relative isolation, but no foot clinic. The podiatrists provided podiatry-only services to community patients or inpatients without formal assessment criteria. A lack of discharge policy contributed to a clinic so overburdened with routine treatments that patients with more severe foot pathology could wait weeks for an appointment.

Concord Hospital

In the Concord Hospital, there was a hospital-funded foot clinic one day a week, staffed by a podiatrist and a physician.

A standardised area-wide stratified approach

Key stakeholders from the CSAHS came together to discuss reorganisation of service provision for diabetic foot disease. A simple calculation of numbers convinced most stakeholders that it was not possible to provide routine podiatry care to all people with diabetes.

A system that provides people services according to their level of risk for ulceration/amputation was introduced (Figure 1), and clinical protocols were developed to underpin this graded approach to care. Accordingly, those patients with no neuropathy or peripheral vascular disease were considered to be at low risk of developing significant foot problems. They would not qualify for routine podiatry care and their footcare education was kept simple and given by diabetes educators.

People regarded as being at moderate risk had no active foot problem but had insensate diabetic neuropathy (defined by an abnormal biothesiometer reading or the inability to feel the 10g monofilament) and/or decreased

blood flow in the lower limb (defined by absent pedal pulses, standard clinical criteria and, if necessary, assisted by measurement of the ankle-brachial index). This group was offered more intensive footcare education and practical self-care skills taught by a podiatrist. People in this group were advised to seek routine podiatry care, either privately if they were in a financial position to do so, or through a regular community or hospital podiatry service.

Those with an active foot problem such as infection, ulceration or Charcot's arthropathy were clearly high risk and were managed in one of the multidisciplinary high-risk foot clinics.

Once the philosophy of stratifying care according to level of risk was accepted, the staff freed from the routine management of low-risk diabetes patients were re-directed to treat patients with a higher-risk profile. Together with the extra staff funded by the Priority Health Care Program, it became possible to establish more foot clinics in the CSAHS. A decision was made to establish a new high-risk foot clinic at Canterbury Hospital, to expand the one at Concord Hospital and to provide more security of tenure for the staff at the Royal Prince Alfred Hospital. The specific format of each clinic was organised to suit the resources available at each particular hospital, and so the composition of the three teams and the emphasis are different.

While the stratified approach may seem rational in the context of limited resources, implementation was not without difficulties. Some low-risk individuals who had been attending the podiatrist for many years for general treatment complained when this did not continue. Hospital administrators were understandably sensitive to criticism of the lack of podiatry service previously available.

Education of staff

Underpinning the implementation of changes was staff education staff. It was important for all staff to have a clear understanding of the common philosophical approach, the new entry criteria to services, referral pathways, clinical protocol guidelines for treatment and approaches to patient education.

Education sessions consisted of a number of interactive workshops and

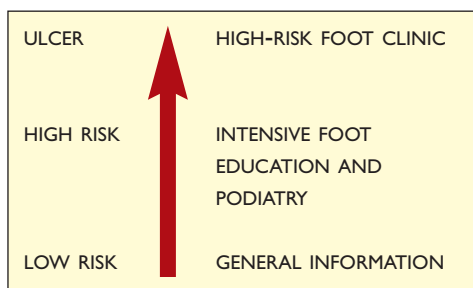


Figure 1. A stratified system that provides people services according to their level of risk for amputation was developed.

case discussions. They provided an environment that generated interaction and improved the interface between the hospital and the community. Despite this, some of the staff who were accustomed to the provision of routine podiatry care found the upskilling and working together with nurses and medical specialists to treat more medically complicated patients very demanding. A few left the hospital system voluntarily. Interestingly, new podiatrists were attracted to the clinic for the same reasons.

Integrating medical staff

It became apparent that the conversion from podiatry clinic to foot clinic greatly increases the need for medical support.

It is tempting, in a busy schedule, to assign a junior doctor to be in charge of the foot clinic. However, diabetic foot diseases are usually not taught well in university, and it takes time to become familiar with the management of the disease, let alone the multidisciplinary team. In our experience it is not adequate to roster a junior doctor for this purpose. Re-organisation was undertaken so that one of the senior doctors on the permanent staff was in close proximity and available during operation of the foot clinic.

Time management

The doctor's time need not be completely occupied by the foot clinic. The procedural nature of foot ulcer treatment means that the podiatrist and nurse often spend one hour treating a patient, whereas the doctor is only needed for 5 minutes. With appropriate organisation the doctor can continue with other activities while still being readily available for foot clinic consultations, ensuring cost-effectiveness as far as medical manpower is concerned. It should be noted that changing a podiatry-only clinic to a high-risk foot clinic with medical involvement raises the stake of medical litigation.

Role of the surgeon

In addition to needing management by an endocrinologist, people with foot disease also need the expert advice of surgeons. Their expertise is best utilised when all members of the footcare team can share their knowledge and be involved in decision-making. Instead of referring patients to another clinic, our clinic coordinator organises a group of patients

who need a surgical opinion to attend clinic within a designated time period. All of the foot clinic staff are involved in the case discussion with the surgeon.

Referral pathway

A referral pathway based on the stratification of risk model described earlier was distributed to all health disciplines across the CSAHS. Information was distributed to GPs, posters were placed in emergency departments and wards and the programme staff were informed about the availability of the diabetes foot clinics. The referral pathway was emphasised and discussed at each health professional education session. As a result, uptake of the new referral pathway by GPs, community nurses and podiatry staff has been satisfactory. Naturally, there are still entrenched referral practices that are difficult to change. We were philosophical about the inability to completely change referral practices as it would be beyond our capacity to deliver care to every patient who required it anyway.

Data collection and communication

To collect meaningful data, it was important for an area-wide standardised foot disease form to be introduced. This posed unique challenges. For example, it is not uncommon for a patient to have more than one ulcer present concurrently. Each ulcer may require different treatment, can be at a different stage of healing and needs clearly defined, separate documentation. Work practice has to be organised to avoid the possibility of incorrect data being entered onto the clinical form while, at the same time, not being so complicated as to be impossible to implement.

Another issue is when to write to the referring doctor regarding the patient's progress. Unlike most medical consultations, which may be one off or at most repeated over several weeks or months, consultations involving people with neuropathic ulceration often take place weekly. It is difficult, from a workload point of view, to write letters that adequately cover the patient's treatment and progress with sufficient frequency and rapidity as to keep up with treatment changes.

Outcome

One of the important advantages of better coordinated care is that each foot clinic

PAGE POINTS

1 Re-organisation occurred so that one of the senior doctors on the permanent staff was in close proximity and available when the foot clinic was being conducted.

2 With appropriate organisation it is possible for the doctor to continue with other activities while still being readily available for consultations in the foot clinic, ensuring cost-effectiveness as far as medical manpower is concerned.

3 Instead of referring patients to another clinic, our clinic coordinator organises a group of patients who need a surgical opinion to attend within a designated time period.

4 A referral pathway based on the stratification of risk model was distributed to all health disciplines across the CSAHS.

Figure 2. The rate of healing for the different types of foot ulcers in the Central Sydney Area Health Service.

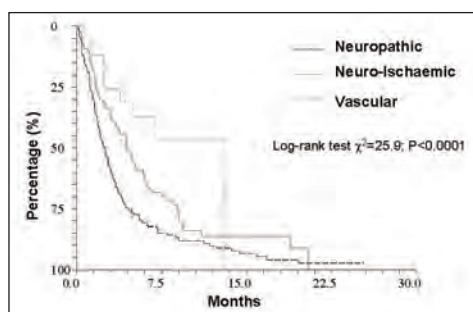
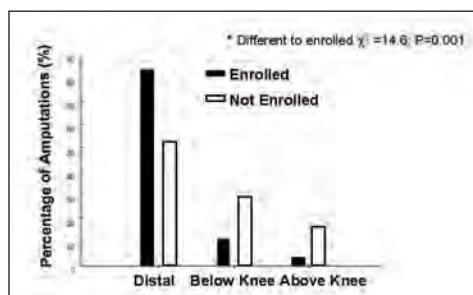


Figure 3. Differences in minor and major amputation rates between people enrolled and not enrolled in the Priority Health Care Program.



across the CSAHS now collects standardised data which are entered into a centralised database. In the first 12 months of the Priority Health Care Program, 283 patients with 534 foot ulcers were treated, requiring a total of 3116 occasions of service. Analysis of these data has allowed us to obtain the rate of healing for the different types of diabetic foot ulcers across the whole of the CSAHS for the first time (Figure 2).

Awareness of the programme has been demonstrated by a decrease in the number of visits made by patients to different health professionals before being referred to the foot clinics, from a median of three visits (interquartile range [IQR] 1–8) in the first 6 months of the programme to one visit (IQR 1–3) in the subsequent period ($z = 3.4$; $P < 0.0006$). This decrease is reflected in the shorter duration of the ulcer leading up to initial presentation to foot clinic, from a median of 2.2 (IQR 1.0–4.4) to 1.3 months ($z = 2.7$; $P < 0.007$).

Treating people with diabetes and foot ulceration without admissions to hospital resulted in substantial cost savings. Of the patients enrolled in the programme, 204 had ulcers graded at a level of Texas grading 1B or worse. In many instances, if they had presented to a hospital emergency department it would have resulted in unnecessary admissions to hospital for intravenous therapy. Only 36 were admitted. By preventing 168 admissions (with an average stay of 18 days at \$450 per day) a cost saving of approximately AUD \$1.3 million was achieved.

Over the same period, 307 patients were admitted to one of the three hospitals on 454 occasions for diabetic foot disease. This gave us the opportunity to examine the differences between patients enrolled and not enrolled in the programme. It is apparent that enrolled patients required fewer major amputations in comparison with their counterparts who presented to hospitals directly (Figure 3). For the patients enrolled in the programme, less major surgery also translated into a significantly shorter stay in hospital (a median of 8 vs 16 days, $z = -3.0$; $P < 0.02$).

It is ethically impossible to conduct randomised clinical trials to test the efficacies of such an Amputation Prevention Program, as we could not randomise this group to placebo. Much of our data are therefore observational in nature. Nevertheless, collection of such data and the preliminary findings speak for the efficacies of the system. Knowing that valuable and encouraging outcomes are being obtained is important for boosting the morale of staff working on the programme. No doubt this will help in the struggle to obtain more funding for this purpose against many competing needs.

Conclusions

Treatment of diabetic foot disease poses management challenges to patients, clinicians and health administrators. Patients are sick, immobile and often suffer co-morbidities. Clinicians are constrained by decreasing resource availability in an environment where numbers of patients with diabetes are increasing. Moreover, high-risk footcare services are not common. They are resource hungry in terms of human and financial costs, and by their very nature are a high-risk activity. In an ideal world, all people with diabetes would have access to footcare services from diagnosis, but this is unrealistic. Stratification according to the level of risk is the only means by which those who truly need care can access what they require. Although there are still limitations, we believe that this Priority Health Care Diabetes Amputation Prevention Program has begun to address the barriers to care. It is an example of how good leadership from the top, good management in the middle, and dedicated workers at the patient–healthcare interface can be translated into a win-win situation. ■

ACKNOWLEDGMENT: The authors would like to thank the significant contribution made to the Program by Ms Anna Jane Harding, Mr David Wong, Dr Tom Karplus, Dr Tom Cromer, Dr Roger Chen and the community and hospital staff from CSAHS.

Apelqvist J, Larsson J (2000) What is the most effective way to reduce the incidence of amputation in the diabetic foot? *Diab Metab Res Rev* 16(Suppl 1): S75–83
 Armstrong DG, Harkless LB (1998) Outcomes of preventative care in a diabetic foot specialty clinic. *Journal of Foot and Ankle Surgery* 37(6): 460–66
 Edmonds M, Boulton AKM, Buckenham T, Every N et al (1996) Report of the diabetic foot and amputation group; St Vincent and improving diabetes care specialist UK workgroup reports. *Diabetic Medicine* 13: S27–42