



# Prioritising assessment of ‘at-risk’ feet in diabetes: individualising foot care

SARAH McCOSKER BPod

THYRA BOLTON RN

STEPHEN TWIGG MB BS(Hons I), PhD, FRACP

*All patients with diabetes should have their feet assessed to determine their level of risk for foot complications. Foot care and education should be individualised accordingly.*

## Key points

- **One of the most cost-effective practices any health professional can perform in patients with diabetes is to examine their feet with their shoes removed.**
- **The risk of foot ulceration is doubled in patients with diabetes who also have peripheral neuropathy or peripheral arterial disease (PAD).**
- **Actively screening patients with diabetes for loss of protective sensation of the feet is of utmost importance as it often occurs without symptoms.**
- **Although peripheral neuropathy is the leading risk factor for foot ulceration, a pivotal event such as trauma from footwear will often precipitate the ulceration.**
- **In the assessment of PAD it is important to ask patients about symptoms of intermittent claudication or rest pain; however, those who have dense peripheral neuropathy and/or immobility are unlikely to report such symptoms.**
- **General foot care advice should be provided to all people with diabetes but foot care education should be tailored to the individual’s risk of complications.**

ENDOCRINOLOGY TODAY 2012; 1(2): 32-35

Ms McCosker is a Senior Podiatrist and Ms Bolton is Coordinator at the Diabetes Centre Multidisciplinary High Risk Foot Service, Department of Endocrinology, Royal Prince Alfred Hospital, Sydney. Professor Twigg is an Adult Endocrinologist and Medical Head of the Diabetes Centre Multidisciplinary High Risk Foot Service, and Professor of Medicine, Sydney Medical School, The University of Sydney, NSW.

**F**oot complications in people with diabetes are very common and patients often ‘fall through the cracks’ in healthcare as there is no specific discipline to manage all aspects of diabetes foot care. Although not all people with diabetes are at risk of developing foot complications, the risk of foot ulceration is doubled in those who also have peripheral neuropathy or peripheral arterial disease (PAD). Up to 25% of people with diabetes will develop a foot ulcer during their lifetime.

Foot ulceration is a predictor for not only morbidity but also mortality. In Australia about 3500 amputations occur annually, mainly subsequent to foot ulceration or infection, and it is generally deemed that at least half of these are preventable. In our experience, a lack of knowledge about foot care and how to access referral pathways to high-risk foot clinics reduces otherwise optimal outcomes.

Recent local survey data reflect that only 50% of people with diabetes have their feet examined annually. One of the most cost-effective practices any health professional can perform in patients with diabetes is to examine their feet with their shoes off. Performing a foot assessment will provide a guide in making decisions about the provision of care and education for patients.

This article provides an overview of the assessment of feet in people with diabetes in light of the 2011 NHMRC *National Evidence Based Guideline on Prevention, Identification and Management of Foot Complications in Diabetes*<sup>1</sup> and the experiences of the High Risk Foot Service at the Royal Prince Alfred Hospital in Sydney. The care of diabetic foot complications will be the subject of a forthcoming article in *Endocrinology Today*.

## What are the key principles in foot assessment?

All people with diabetes should have their feet assessed to determine their level of risk for foot complications. Any suitably trained health care professional – for example, GP practice nurse or podiatrist – may perform the foot-risk assessment. Performing a foot assessment requires a structured approach as shown in the box below.

### Standard foot assessment

- Take a thorough medical history, including previous foot ulcer, amputation or infection
- Assess for the following risk factors:
  - peripheral neuropathy, including symptoms
  - peripheral arterial disease, including symptoms
  - foot deformity (e.g. claw toe deformity, bunions, chronic Charcot’s arthropathy deformity)
- Also assess for:
  - skin and nail conditions (e.g. tinea pedis, corns, callus, nail mycosis)
  - footwear (e.g. style, condition, suitability for patient’s feet)
  - self-care ability
  - patient’s understanding of foot care required and its rationale

### Assessment for peripheral neuropathy

Actively screening for loss of protective sensation of the feet is of utmost importance as this often occurs without symptoms, leaving the patient unaware of its presence.

Although many patients with peripheral neuropathy report pain, most will present with no symptoms at all. The peripheral neuropathy is bilateral and symmetrical and follows a 'stocking and glove' distribution. People with a painful form of neuropathy will often describe symptoms of burning, stabbing, pins and needles, numbness, or 'ants crawling' on the skin. Symptoms may also become proximal and appear to increase in intensity nocturnally.

Although peripheral neuropathy is the leading risk factor for foot ulceration, a pivotal event such as trauma from footwear will often precipitate the ulceration. An audit at the Royal Prince Alfred High Risk Foot Service found that about half of the cases of new onset foot ulceration in patients presenting to the foot service could be attributed to recent trauma from footwear.

Other neurological considerations in assessing the foot include visual inspection for related structural abnormalities. These may include neuropathy leading to secondary soft tissue and bony changes, including callus, corns, clawed digits, increased prominence of the metatarsal heads, and altered joint range of motion potentially leading to increased pressure and callus formation (Figures 1a and b and 2a and b). Identification of haemorrhagic callus should result in prompt referral to a podiatrist or high-risk foot service, as this indicates localised increased pressure and often underlying ulceration (Figures 3a and b). Foot deformity may also be present due to chronic Charcot's arthropathy. Skin changes secondary to autonomic neuropathy may result in dry skin and fissuring.

The most effective and efficient method of examination testing for neuropathy is by using the 10 gram monofilament. The box on page 34 and Figure 4a illustrate the correct monofilament testing method. We suggest three sites be tested as recommended by the International Diabetes Federation: the plantar aspect of the hallux, and the first and fifth metatarsal heads.

The Neuropathy Disability Score (NDS) may also be used to examine peripheral nerve damage. This system is based on vibration perception and temperature and pinprick sensation, as well as ankle reflexes, and will require tools including a tuning fork (Figure 4b), neurological pin and a tendon hammer.

### Assessment for peripheral arterial disease

To determine if PAD is present, it is important to question whether the patient has symptoms of intermittent claudication or rest pain. Questions should elicit the distance the patient can walk, whether pain is experienced on climbing stairs or walking up hills or inclines, and, if pain does occur, whether it is relieved over some minutes when walking is ceased. Nocturnal pain due to PAD is often relieved by patients hanging their feet in a dependent position. Questioning about sleeping location and position can also help to identify rest pain; typically patients with true rest pain are unlikely to sleep in a bed, and more often will prefer to sleep in a chair.



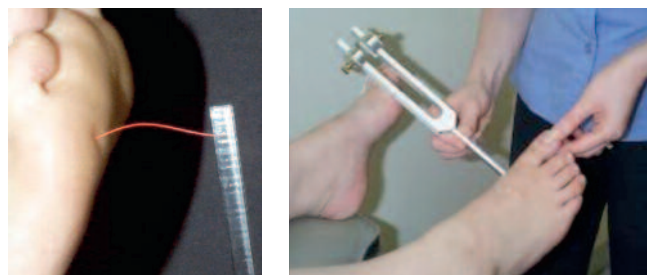
Figures 1a and b. Common foot soft tissue abnormalities in diabetes. a (left). A callus. b (right). An interdigitally placed corn.



Figures 2a and b. Common foot bony deformities. a (left). Clawed toes in diabetes due to peripheral neuropathy. b (right). An arthritis-related bunion.



Figures 3a and b. Extensive plantar callus. a (left). The callus has been left without podiatric care and become haemorrhagic due to excessive shearing forces; as a consequence it will have an underlying ulcer as shown after debridement. b (right). After debridement, ulceration is seen under the haemorrhagic callus.



Figures 4a and b. Tools used in foot neuropathy assessment. a (left). Testing foot sensation with the 10 gram monofilament. b (right). The tuning fork method used to test vibration sensation.

**Detecting loss of protective sensation using the 10 gram monofilament**

- Familiarise the patient with the sensation of the monofilament on his or her hand or arm.
- Ask the patient to close his or her eyes and say 'yes' when he or she feels the monofilament on his or her foot.
- Depress the monofilament perpendicular to the skin for 2 seconds at each site, giving the patient a few seconds to respond before moving to the next site. Avoid areas of callus, which will impair the ability to feel the monofilament.
- Repeat the test on the other foot.
- Ability to feel all three sites on each foot indicates that protective sensation is intact. If even one site cannot be felt, the patient should be considered at increased risk of ulceration on the basis of impaired sensation. If you are unsure about the patient's response, either repeat the test once or ask him or her to tell you where he or she felt the filament. Do not test multiple times in one session.

**Interpretation of the ankle brachial pressure index (ABPI)**

ABPI	Clinical correlate
>1.2	Artefactual finding
1.0-1.1	Normal
0.9-1.0	No or few symptoms
0.5-0.9	Claudication
0.3-0.5	Rest pain
<0.3	Tissue loss/gangrene

**Stratification of foot ulceration and amputation risk in diabetes**

**Low risk**

No risk factors for foot ulceration/amputation

**Intermediate risk**

One risk factor only (i.e. neuropathy, peripheral arterial disease [PAD] or foot deformity) and no previous history of foot ulceration or amputation

**High risk**

Two or more risk factors (i.e. neuropathy, PAD or foot deformity), or previous foot ulceration or amputation, or current active foot ulcer, or of Aboriginal or Torres Strait Islander descent with diabetes

Patients presenting with dense peripheral neuropathy and/or immobility are unlikely to report experience symptoms of claudication or rest pain.

Careful palpation of dorsalis pedis and posterior tibialis foot pulses is essential (Figure 5a). If pedal pulses are impalpable, use of a hand held Doppler ultrasound can be useful to establish arterial flow (Figure 5b). If pedal pulses are impalpable or reduced/absent on hand-held Doppler, the ankle brachial pressure index (ABPI) should be calculated.

The results of the ABPI can be falsely elevated in the presence of arterial calcification – for example, in chronic kidney disease. The normal range for ABPI is 0.9 to 1.2 (see the box on this page). However, an ABPI of less than 0.6 is a true reflection of underlying significant PAD. Patients who have an ABPI of less than 0.6 with either a foot ulcer or symptoms of claudication, should be referred promptly to a vascular specialist for assessment.

Subsequent to ABPI testing, noninvasive arterial duplex studies are recommended to determine the level of PAD and identify any stenoses and their anatomical location. In our experience, the ABPI with arterial duplex studies should, if possible, be performed prior to consultation with a vascular specialist, as this will streamline the patient's management.

Other clinical indicators of PAD include pallor, cold feet, poor capillary return, dystrophic skin and nails, and ulceration that tends to occur at the periphery of digits (Figures 6a and b). In severe cases of PAD a dependent rubor may be evident.



Figures 5a and b. Methods used in peripheral artery disease assessment. a (left). Palpating the left dorsalis pedis foot pulse. b (right). Hand-held Doppler ultrasound method to examine blood flow.



Figures 6a and b. a (left). An ischaemic foot with ulcers on the tips of digits. This foot complication requires specialised multidisciplinary care. b (right). An ischaemic foot with extensive ulceration and gangrene that requires surgery and ongoing specialised multidisciplinary care.

### Characteristics of preferred footwear for people with diabetes

- Correct length: a thumb's width longer than the longest toe
- Correct width: the sides of the shoe should not bulge over the sole
- Sole thickness at least 1 cm for cushioning
- An enclosed heel
- Fasteners with lace or Velcro to reduce forward slip of the foot within the shoe
- The upper made of leather or breathable material

Figures 7a and b. Suitable footwear for people with diabetes. a (right top). A preferred generic shoe for people with diabetes. b (right bottom). An example of a personalised orthotic to reduce plantar pressure.



Note: For people with reduced sensation, walking or sports shoes are a good option as they possess the necessary safe footwear features. The generic footwear described above is for people who do not have an active foot ulcer. In addition, people with major foot deformity will require specially designed custom-made footwear, rather than the shoe described here.

### How can foot risk status be determined?

Following assessment of the foot status of the person with diabetes, risk stratification should be categorised as low-, medium- or high-risk for ulceration or amputation (see the box on page 34).

### How should foot care and education be tailored to foot risk status?

Comprehensive, individualised, patient-focused education on foot care is ideal for patients with diabetes. Good educational resources are available from the national and state- and territory-based diabetes consumer bodies and the Australian Podiatry Council. These educational materials provide patients with useful information in caring for their feet.

Education should be tailored according to the recommendations listed below.

- People identified as being at low risk require basic foot care information and annual foot assessment.
- People assessed as being at intermediate risk should be offered a program that includes foot care education, podiatry review and footwear assessment.
- People assessed as having high-risk feet should be offered a

program that includes foot care education, podiatry review and footwear assessment. The frequency of podiatry review will be most intensive for people within this group and will need to be individualised.

Foot care education should be provided to all people with diabetes to assist with prevention of foot complications. This will typically be more general advice in those at low risk, and increasingly focused and more intensive in those at intermediate and high risk.

People with diabetes should be made aware of how to minimise the risk of foot complications through desirable self-care, including daily foot examination, maintaining good foot hygiene, hydrating the skin, and wearing appropriate socks and footwear.

Patients with peripheral neuropathy and/or PAD are advised to protect their feet with footwear at all times and not to walk bare-foot. If any trauma, injury or wound occurs and does not resolve after general first aid principles, patients should seek help promptly from a health care professional, ideally within 24 to 48 hours. Discussion regarding cessation of smoking is advisable.

Podiatry review and continuity of care to help prevent foot ulceration is an important component of foot care in those at intermediate and high risk. Podiatry treatment will include debridement of callus, corns and fissures and provision of nail care. Podiatrists can also perform biomechanical assessments to determine the prescription of orthoses and footwear (see the box on this page and Figures 7a and b).

### How often should foot assessment and risk stratification be undertaken?

In people with diabetes stratified as having low-risk feet, foot examination should occur annually. In those with intermediate-risk or high-risk feet but without having current active foot complications, foot examination should occur at least every three to six months.

### What if a person with diabetes presents with a new onset foot ulcer?

People identified with active foot ulceration, infection or acute Charcot's arthropathy should be promptly referred, ideally to a multidisciplinary high-risk foot service. Care of these complications will be addressed in a subsequent article.

### Conclusion

Performing a foot assessment is of prime importance in people with diabetes. The assessment will determine the patient's level of risk, and foot care and education should be individualised accordingly. **ET**

### Reference

1. Baker IDI Heart & Diabetes Institute. National Evidence-Based Guideline on Prevention, Identification and Management of Foot Complications in Diabetes (Part of the Guidelines on Management of Type 2 Diabetes) 2011. Melbourne Australia: Baker IDI Heart & Diabetes Institute; 2011. Available online: <http://www.nhmrc.gov.au/guidelines/publications/di21> (accessed September 2012).

COMPETING INTERESTS: None.