Neuropathy screening: can we achieve our ideals?

Matthew Young and Clare Matthews

ARTICLE POINTS

1 Foot ulceration is the most prevalent serious complication of diabetes.

2 Ideally, neuropathy screening should be performed routinely at all new appointments and annually thereafter.

3 Foot screening at annual review is at best sporadic and at worst non-existent.

4 Foot screening is necessary because the majority of neuropathy is asymptomatic.

5 Monofilament testing is now the main standard for screening for neuropathic foot ulcer risk in all settings.

6 The availability of proven screening methods means there is now no excuse for failing to diagnose neuropathy or to take preventive measures.

KEY WORDS
- **Foot ulceration**
- **Peripheral neuropathy**
- **Neuropathy screening**

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Introduction

The publication of the St Vincent Workgroup Report (1996) and Scottish Intercollegiate Guideline Network guidelines (SIGN,1997) on the care of diabetic feet, in England and Wales and in Scotland respectively, highlight the need for regular, accurate and reliable screening methods for peripheral neuropathy. Such messages are not new and yet they are consistently repeated in guidelines and review articles because no single method of screening has been adopted across the country. Furthermore, individual units are failing to screen routinely and uniformly within themselves. The inevitable consequences of these failures are that preventive measures are not employed appropriately, ulcers continue to occur and amputations continue to be performed in neuropathic patients.

Recent reports reaffirm that foot ulceration is still the most prevalent serious complication of diabetes (Currie et al, 1998). In initial reports of foot clinic series it was accepted that 90% of ulcers had a principal neuropathic component (Edmonds et al, 1986; Thomson et al, 1991). It is the general opinion of many in specialist foot clinics that the balance between purely neuropathic and neuroischaemic or ischaemic ulcers has changed, and that there is now a preponderance of ischaemic and neuro-ischaemic ulcers. However, there is little published evidence to support this view.

Despite this, the majority of secondary and tertiary referrals to specialist diabetic foot clinics are principally for neuropathic ulcers and it is always assumed that the prevalence of neuropathic ulceration can be reduced by adequate screening and footcare programmes. While this has yet to be formally proven, effective screening for neuropathy must be given greater priority in diabetes care.

Reasons for inadequate foot screening

There are a number of reasons why neuropathy screening is not performed. At present the lack of a single accepted 'gold standard' screening methodology means that many professionals use no method at all. In hospital and general practice settings the size of the diabetic patient population means that foot screening is at best sporadic and at worst omitted altogether from annual reviews.

Similarly, the weight of numbers in community chiropody clinics, which are so often led by numbers of patients treated and not clinical effectiveness, can mean that patients are often inadequately assessed. As a result, they continue with regular chiropody in the absence of any recognised additional risk factors. This in turn reduces the opportunities for assessing and treating higher risk patients.

The standard screening examination can take less than 5 minutes. Omitting to remove the patient's shoes and socks is the main barrier to effective screening, although even when patients are presented barefoot to doctors, their feet are not always examined (Cohen, 1983). When appointment times are limited, foot examination is often perceived as an unnecessary refinement. The question 'Are your feet OK?' is frequently substituted by those who fail to grasp the significance of painless neuropathy.

The screening examination should be performed at all new appointments, and at least annually thereafter. Practitioners need

Table 1. Symptoms of peripheral neuropathy

Positive symptoms
- Paraesthesiae
- Shooting pains down the legs
- Lancinating pain
- Sensation of overtight skin
- Hyperaesthesia
- Allodynia
- Metatarsalgia
- Sensations of cold or warmth

Negative symptoms
- Numbness or absence of feeling

Table 2. How to recognise the neuropathic foot

- Claw toes
- Prominent metatarsal heads
- Intrinsic muscle wasting
- Prominent foot veins
- Marked callus formation
- Bounding pulses

to remember that retinopathy, nephropathy and peripheral neuropathy with foot ulceration can all be present at the first diagnosis of type 2 diabetes. All patients identified as being at risk should have their feet examined at each clinic visit.

Why screen for neuropathy?

Foot screening is necessary because the majority of neuropathy is asymptomatic. Symptomatic peripheral neuropathy affects around 10% of diabetic patients at any one time and is characterised by the typical combination of positive and negative symptoms shown in *Table 1*.

This symptom complex is usually present in the feet, worse at night and relieved by walking, in contrast to intermittent claudication. Positive symptoms are usually reported spontaneously by patients; up to 25% of all diabetic patients, however, have negative symptoms or asymptomatic neuropathy, and neuropathy in these patients will only be detected by clinical examination or screening tests (Young et al, 1993).

The value of clinical screening in identifying patients at risk is not in doubt, even if not yet formally proven in ulcer prevention trials. Those practitioners who are familiar with the neuropathic foot will easily recognise the signs (*Table 2*). Ulceration in the absence of pain is also a clear sign of peripheral neuropathy.

Neuropathy screening tests

In addition to the above signs on inspection, a number of clinical tests including tuning fork vibration perception, pin-prick (blunt ended, e.g. Neurotip, Owen Mumford, UK) and light touch sensation are employed. Some authorities include muscle strength in clinical examination (Dyck et al, 1985). Each sensory modality has its detractors, particularly in the elderly (Thomson et al, 1992), and a combination of sensations and reflexes with a clinical scoring system is the best way to reliably diagnose peripheral neuropathy (Young et al, 1994; Consensus Statement, 1995).

While nerve conduction velocities are the best correlates of pathological damage in peripheral nerves, and are very reproducible, the time and cost of performing neurophysiological studies will militate against their use for screening.

PAGE POINTS

1 Monofilaments are a relatively cheap method of measuring sensory thresholds.

2 Test sites should avoid areas of callus, but include areas that are likely to ulcerate.

3 Patients who detect eight or less of the applied stimuli are held to have failed the test.

4 Previous ulceration or amputation increases the risk of subsequent ulceration 78-fold whether or not the stimuli are perceived.

Table 3. How to perform monofilament testing

1. Apply the monofilament to the palm of the tester two or three times before applying it to the patient, to allow any extra stiffness to be removed
2. Apply it to the test site on the patient, perpendicular to the surface to be tested
3. Keep it applied until the monofilament bends by around 1 cm
4. Remove the monofilament pressure
5. Allow a couple of seconds to pass before applying the monofilament to the next test site

Vibration perception threshold

Quantitative sensory tests are easily adaptable to routine screening. Studies of vibration perception thresholds were among the first of the large trials to clearly demonstrate an increased risk of ulceration in insensate groups of patients. Although there are a number of different devices for measuring vibration perception threshold, most trials have been performed using the Biothesiometer (Biomedical Inc., Newbury Ohio, USA) and more recently the Neurothesiometer (Scientific Laboratories Supplies, UK). These measure the mean of three ascending threshold values.

Measurements in diabetic patients have consistently demonstrated that vibration perception thresholds greater than 25 V are associated with foot ulceration in both cross-sectional and prospective studies. Patients with vibration perception thresholds greater than 25 V have a seven-fold increased risk of ulceration compared with those with a vibration perception threshold less than 15 V over four years. Similar figures have been obtained in other studies (Young et al, 1994).

Monofilaments are considerably cheaper than neurothesiometers in terms of unit cost, but are less durable and usually need replacing with regular use. The testing of sensory thresholds using monofilaments has not been standardised and no two studies have used the same methodology or assessed pressure perception at the same sites.

Monofilaments should be applied as described in *Table 3*.

Test sites should avoid areas of callus, but include areas that are likely to ulcerate. We, and others, have advocated the use of the great toe and the metatarsal heads 1, 2, 3 and 5, but testing routines in various studies have included heels and the dorsum of the foot. In general, the subject should be considered to have failed the test if he/she detects eight or less of the applied stimuli for a given filament.

Monofilaments from different manufacturers deliver different forces from the same rated filament and may even vary within batches. The compliance of nylon varies with temperature and humidity. Manufacturers need to state the variance within filaments to allow valid comparisons between filaments for research purposes. This is less important in routine screening, but may explain some of the wide variation in odds ratios — from 2.5:1 to 10:1 — reported in the main papers that have used monofilaments for predicting foot ulceration in diabetic patients (Rith-Najarian et al, 1992; Litzelman et al, 1997).

The most recent paper on the use of monofilaments to reduce foot ulceration advocates the use of self-testing for neuropathy (Birke and Rolfson, 1998). In diabetic clinics, however, where it is difficult to get patients to accept that they are at risk of ulceration, or indeed to attend when ulceration occurs, this is unlikely to be effective. Further confirmatory studies are required before this approach can be adopted widely.

Monofilament testing can comprise a whole spectrum of applied forces, but in

most diabetes services the 1 g, 10 g and 75 g rated filaments are most commonly used. Evidence from clinical trials suggests that the 10 g monofilament is the best of the range for discriminating between diabetic patients at risk of foot ulceration and those not at risk. For this reason, monofilament testing is now the main standard for screening for neuropathic foot ulcer risk in many hospital and community settings.

Rith-Najarian et al (1992) demonstrated that monofilaments used alone can identify an insensate group of patients who are up to 10 times more likely to ulcerate over a given time period than patients who can feel the filament. Combining monofilament testing with clinical examination for deformity and palpation of pulses enables the identification of patients who are 32 times more likely to ulcerate. However, it should be remembered that previous ulceration or amputation is associated with a 78-fold increased risk of subsequent ulceration irrespective of whether or not the patient can perceive a 10 g filament (Rith-Najarian et al, 1992).

Suggestions for implementing neuropathy screening

In an overbusy community chiropody clinic the temptation is to leave the foot examination to another day and attend to the task in hand. Such a strategy is a false economy, however, as it leads to chiropody clinics full of patients attending for what are merely pedicures, and wastes a highly trained resource. Coupled with similar failures in hospital and general practice clinics, this results in increased ulceration, inpatient stays and amputation.

Neuropathy assessment will never be implemented evenly in medical clinics until foot screening is afforded an importance on a level with eye screeing.

Repeated education of non-foot specialist diabetologists and junior staff may improve this deficiency in the future. In general practice, if the GP is unable or unwilling to perform foot screening then community chiropodists could possibly be contracted to provide annual screening of feet in the same way that many opto-metrists are providing eye assessments.

In community chiropody clinics, designated screeners should review all new patient referrals with approval, to prevent the routine follow-up of low-risk patients. Arrangements for emergency care would need to be in place for those found to have ulcers, but appointments could be opened up by freeing up space from clinics that will only routinely see medium- and high-risk patients.

The existence of proven screening methods means that there can be no excuse for failing to diagnose neuropathy or to take appropriate preventive measures to achieve the St Vincent target for amputation in all areas and not just a few specialist centres. ■

PAGE POINTS

1 Community chiropodists could be contracted to provide annual screening of feet.

2 Foot screening in community chiropody clinics could free up appointments in diabetic foot clincs for medium- and high-risk patients.

3 There exist proven screening methods for detecting peripheral neuropathy.

4 Routine screening for peripheral neuropathy should enable the St Vincent target for amputation to be achieved in all areas of diabetes care.

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