

Diabetic Foot:

A Step-by-Step Approach



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Foot complications account for 20% of all diabetes-related admissions in the North American population. They are a major cause of morbidity and mortality in patients with diabetes and of increasing health-care costs.

Appropriate interventions can prevent diabetic foot ulcers and, thereby, reduce mortality and the rate of amputation.¹

Finding high-risk patients

A history and physical examination can reveal much about a patient's risk. Previous foot ulceration (relative risk [RR] 1.6), prior lower extremity amputation (RR 2.8), a diabetes history longer than 10 years (odds ratio [OR] 3.0), a hemoglobin A1c (HbA1c) > 9% (OR 3.2), impaired vision defined by an acuity < 20/40 (RR 1.9), feet structural abnormalities (*e.g.*, calluses and claw toes), increasing pressure points, diminished joint mobility, fissured skin, onychomycosis, tinea and inappropriate shoes increase the risk.^{2,3}

Screening for sensitive neuropathy helps target the group that is unaware of tissue injury because of lack of painful feedback. This is one of the major risk factors (RR 2.2 to OR 15.2) contributing to multiple repetitive injuries and postponing the discovery of the lesion.^{2,3} Loss of protective sensation can be easily assessed by monofilament and a tuning fork. Absent ankle and patellar reflexes can suggest a neuropathy.

The 5.07 Semmes-Weinstein monofilament is made of nylon. It applies a 10-g pressure when the filament bulges, and inability to perceive it is indicative of a clinically significant large-fibre neuropathy. The patient is asked if he feels the monofilament bulging on his foot in a “yes” or “no” fashion. It should be used in at least four spots (pulp of the great toe and the plantar surface of the first, third and fifth metatarsal heads). Testing 10 sites evaluates all dermatomes (the four aforementioned

Charles's Feet

- Charles, 76, a smoker with a 10-year history of Type 2 diabetes, has come to your office for his regular three-month appointment.
- Last year, he had a bad ulcer on his left foot that took months to heal.



As you ask him how he is feeling, you wonder what you can do to help him avoid another foot complication related to his diabetes.

For more on Charles, go to page 84.

Loss of protective sensation is a major risk factor contributing to multiple repetitive injuries.



Figure 1. Ten spots of monofilament testing.

spots plus the pulp of the third and fifth digits, between the first and second toe on the dorsal side, the calcaneum, the mid-lateral and mid-portion of the plantar side) (Figure 1). When the monofilament is imperceptible in four or more spots, neuropathy is present with a sensitivity superior to 90% and a specificity of approximately 80%. Having one or more insensitive spots keeps the sensitivity in the same range, but diminishes specificity to approximately 60%.⁴ This makes the monofilament one of the best predictors of wound.

The tuning fork provides an easy way to evaluate another aspect of diabetic neuropathy. An abnormal response is defined by the

loss of vibratory sensation while the examiner still feels it. The tuning fork should be applied on a bony surface from the toe to the knee to evaluate the extension of the disease. Loss of vibration is the first modality to appear in diabetic neuropathy. Electromyography can be helpful in some cases to determine the presence of a neuropathy.

Peripheral vascular disease is a good predictor of the risk of foot ulceration, but also of the likelihood of healing. A history of intermittent claudication and weak pulses at physical examination should prompt further evaluation of vasculopathy. The ankle-brachial index is a simple test to detect arterial obstruction. It represents the ratio of systolic blood pressure at the ankle to that at the brachial artery. An index below or equal to 0.9 suggests peripheral vascular disease.

Preventing ulcers in high-risk patients

Educating the patient is the milestone of prevention. They should know how to take care of their feet and what to avoid. They should look in their shoes before putting them on and examine their feet regularly to detect small wounds or redness (signs of irritation and friction). Patients should avoid humid environments, avoid applying excessive heat and walking barefoot. They should also take great care when they are cutting their nails and a homemade callus remover should be proscribed.

A frequent evaluation of the foot by a physician to detect possible structural abnormalities, entry sites for infection, small wounds, neuropathy and peripheral vascular disease should be conducted. The recommended time between the inspections



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varies, depending on individual risk and the expert committee recommendations. Patients with structural foot abnormalities should be seen by a specialized care team to diminish the likelihood of complications.

The Diabetes Control and Complications Trial Research Group trial demonstrated that optimal glycemic control can prevent neuropathy with a 57% to 69% risk reduction at five years between the intensively versus conventionally treated group (HbA1c difference of 1.9%).⁵ The UK Prospective Diabetes Study also showed a reduction in microvascular complications with lowering of the HbA1c. This also helps reduce macrovascular complications and improve leukocyte functions. Smoking cessation is another way to help reduce peripheral vascular disease.

Diabetic foot ulcers are a complication arising from multiple sources. Time must be spent to address each factor in order to prevent them. Education of the patient is part of the solution, just as individual risk assessment is. Table 1 summarizes what should be done by clinicians to help diabetic patients live happily on their feet.

Table 1

Interventions for diabetic foot prevention

- Assessing the risk of ulcers
- Foot examination on a regular basis
- Evaluation of neuropathy
- Evaluation of peripheral vascular disease
- Patient education
- Optimizing glycemic control
- Smoking cessation

Helping Charles

Charles's examination reveals weak pulses of the distal arteries of his legs, but no feet structural abnormalities or wounds. Six spots out of 10 were not noticed by Charles on either foot.

His hemoglobin A1c at last week's blood test was 6.1%.

While prescribing the arterial Doppler, you remind Charles of the importance of taking great care of his feet.

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