

Performing Foot Screening for Diabetic Patients

Amputation of a lower limb is a devastating complication for patients with diabetes. Effective prevention begins with competent assessment and patient education.

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When you see Joe Roja at your outpatient clinic, he tells you that he's concerned about some swelling in his right foot. Mr. Roja has just resumed his walking and self-care program within the past three days. He'd significantly curtailed his regular exercise and other activities for about a month after an acute exacerbation of his heart disease. Knowing that Mr. Roja has had diabetes for a long time, you include a thorough evaluation of his feet in your assessment.

Foot problems are the major cause of amputation and physical disability in patients with diabetes. Yet studies have shown that simple techniques such as identifying patients at risk for foot ulcers, educating patients about foot care, and glucose control can prevent this serious complication.

The key to preventing diabetic foot problems is to carefully monitor patients' feet on a regular basis. The foot screening form on the opposite page facilitates this. It's adapted from one we've used at the Gillis W. Long Hansen's Disease Center (GWL-HDC) for several years, and we'll be referring to it in this article. But first let's take a look at the types of foot problems that can develop in diabetic patients.

Foot ulcers and neuropathic fractures

The two major foot problems to be prevented are foot ulcers and neuropathic fractures (commonly referred to as Charcot's

foot). Foot ulcers have a neuropathic or mixed neuropathic-angiopathic etiology.

Neuropathic ulcers typically are red, warm, painless, circular lesions surrounded by callus and located over bony plantar areas of the foot. Deformity, muscle weakness, limited range of motion, tight shoes, heavy callus, and dry skin have all been associated with neuropathic ulcers.

Mixed neuropathic-angiopathic ulcers are often irregularly shaped necrotic lesions located over nonplantar areas of the foot. They are usually pale, cool, and sometimes painful, depending on the patient's degree of neuropathy. Patients with mixed neuropathic-angiopathic foot problems are vulnerable to ulceration and secondary infection from minor trauma resulting from poorly fitting shoes, toenail problems, pressure, or thermal injuries.

In its early stages, a neuropathic fracture is often experienced as a swollen, warm foot, with little or no pain due to peripheral neuropathy. Because patients can continue walking on the foot, these bony lesions, if left untreated, can progress to severe foot deformities—often with midfoot collapse—which can also lead to ulceration. Neuropathic fractures can be caused by relatively minor traumas, especially after periods of immobility.

How to conduct a step-by-step exam

A main goal of foot screening is to identify patients at risk for developing foot problems before serious conditions occur. It's necessary because those patients who develop neuropathies may not feel pain and may fail to report foot problems early.

After you update your patient's recent history, and note his reports of symptoms and care measures, complete the exam

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FOOT MANAGEMENT BASED ON RISK LEVELS

Risk 0: Examine feet annually. Teach good skin care. Teach selection of properly fitting shoes with soft inserts and soles.

Risk 1: Examine feet and shoes every six months. Reinforce teaching about good skin care and properly fitting shoes.

Risk 2: Examine feet and shoes every three months. Reinforce teaching about good skin care and properly fitting shoes. Recommend prescription footwear such as custom molded orthotics as necessary.

Risk 3: Examine feet and shoes monthly. Reinforce teaching about good skin care, properly fitting shoes, and recommend prescription footwear.

Source: Adapted from Bluke, J. A., and Sims, D. S., 1995.

and fill out the diabetic foot screening form. The results will help you choose interventions such as giving appropriate patient education, recommending protective footwear, or making a referral to a foot specialist.

The foot screening form includes the following categories:

- **History of foot ulcers.** Ask about current or previous foot ulcers. Patients with a history of foot ulcers are more likely to develop subsequent ulcers at the same location. If you see redness developing on an old ulcer site, refer the patient to a foot care specialist as soon as possible.

- **Toe deformity.** Look for such toe deformities as claw toes, characterized by hyperextension at the metatarsophalangeal joints and flexion at the proximal interphalangeal joints (see Figure 1 on the opposite page). In patients with diabetes, this can be a sign of distal motor neuropathy and muscle atrophy. Along with claw toes, you may also see distal displacement of the fat pad under the ball of the foot, high pressures over the prominent metatarsal heads, and evidence of pressure from tight-fitting shoes on the dorsal aspects of the toes.

- **Elevated skin temperature.** Check for elevated skin temperature by feeling both feet simultaneously, then feel each foot with the same hand to find a warm area or "hot spot." Compare any hot spot to the rest of the foot. A cold foot may indicate circulation problems.

When you can detect a temperature difference with your hands, it could be an indication that a significant problem—an ulcer, infection, or neuropathic fracture—has developed. A temperature difference of more than 2°C between the right and left feet is clinically significant and can be detected with your hands.

- **Swelling or abnormal foot shape.** Swelling in the entire lower leg, especially bilaterally, could indicate heart, kidney, or venous stasis problems. But localized swelling of the foot area can indicate infection or an early neuropathic fracture.

Examine both feet not only for abnormal shape but for lack of symmetry between the right and left feet. Note abnormali-

ties such as midfoot collapse—indicating previous arthropathy—as well as bunions, flat or high arches, and signs of past surgeries. When swelling or an abnormal shape is associated with increased skin temperature, order X-ray studies promptly to rule out a neuropathic fracture (see Figure 2c).

- **Thick or ingrown toenails.** Deformities of the toenails are often signs of previous problems and can also cause more problems to develop. For example, thick (hypertrophic) toenails are often caused by fungal infections and may injure the toe with the infected nail as well as adjacent toes, especially if the toes are squeezed together in tight shoes. Toenails that are ingrown or too long can cause ulceration. Refer patients with hypertrophic, ingrown, or long toenails to a foot specialist. Warn patients not to clip their own toenails because it can result in injury and infections.

- **Callus build-up.** Significant callus build-up is another sign of a previous problem that can cause additional ones. Callus commonly forms on the toes or plantar surface of the foot in response to high stress resulting from bony prominences or tight shoes.

As callus continues to build, it can create pressure—even acting as a foreign body. In a patient with nerve-damaged, insensitive feet, ulcers can develop beneath untreated calluses without his awareness. So if you find heavy callus build-up, refer the patient to a foot specialist for treatment.

In the appropriate section of the foot diagram, draw any callus or ulcerous conditions, noting the width and estimated depth in centimeters. Also label the diagram with the appropriate symbols to indicate any dryness, redness, bruising, or maceration (a whitish, wrinkled, prune-like condition from excess moisture in the skin).

- **Muscle weakness.** Weakness in muscles that control the feet is a sign of marked motor neuropathy and can be associated with gait abnormalities, foot deformity, and increased pressure. Assess weakness by having patients sit and asking them to lift and lower one foot at a time with maximum effort while you push against the foot with your hand.

People with normal foot muscles can resist strong force. But people with weak muscles won't be able to raise and lower their feet against resistance. Patients with diabetes often develop weakness in the anterior muscles of their legs, the muscles that lift the foot up (ankle dorsiflexion). Weakness of these muscles may be associated with high pressure in the forefoot, a foot-drop gait, or limited motion upward—sometimes called equinus deformity.

- **High pressure.** In neuropathic feet, plantar ulcers develop over areas of highest pressure, and evidence of high pressure is a strong predictor of future ulceration. Plantar callus is a predictable sign that the foot is experiencing high pressure.

A pressure mat test is a simple and relatively inexpensive method to identify areas of high pressure on the plantar surface of the foot. Foot Imprinter—which costs approximately \$146 for a kit that does several foot tests—is available from

the AliMed Company in Dedham, MA (telephone: 1-800-225-2610).

To use the device, put paper over the freshly inked surface of the pressure mat and place the mat approximately 12 inches ahead of the foot to be tested. Ask the patient to walk forward and take a smooth, regular step onto the mat until weight is fully transferred to that foot.

Have your patient take practice steps onto plain paper to ensure that a normal, smooth step is measured. But pressure testing isn't needed if a patient has signs of a current foot ulcer or injury.

- **Absent pulses.** Check each foot for the presence of dorsal pedal and posterior tibial pulses. Refer patients with absent pulses to a peripheral vascular specialist for further evaluation of circulation.

- **Inability to render self-care.** One of the most important aspects of a self-care program for people with diabetes-related foot problems is daily inspection of the plantar and dorsal surfaces of the feet. Some patients may not be able to inspect their feet because of obesity or poor eyesight. In these instances, teach patients to use a mirror or teach a friend or family member to do the inspection.

- **Improperly fitting footwear.** Tight shoes can cause problems—especially in neuropathic feet. Check the patient's shoes to ensure that they fit properly and that the laces or Velcro closures allow them to be easily put on or off.

For the diabetic foot, the toe box should be curved or squared, not pointed. The material of the toe box should be loose enough so that a small amount can be pinched.

The upper shoe should be free of seams or designs that might cause pressure and the sole should be soft. The length of the shoe should be approximately a half-inch beyond the longest toe; the heel should offer firm support. You can have the patient stand on a sheet of paper while you trace one or both feet to determine if his shoes fit the shape of his foot. Always do the tracing while the foot is bearing weight and if the shoes don't fit the shape you've drawn, have a foot care specialist help your patient find the right shoes.

- **Level of sensation.** When the sense of touch is lost, a protective mechanism for avoiding ulcer-causing irritation is also lost. So to check for sensory loss, we use Semmes-Weinstein nylon filaments. (For sensory filaments and training tapes, contact GWL-HDC, LEAP Program, 5445 Point Clair Road, Carville, LA 70721, or fax 504-642-4738.)

The best places to apply the filaments are on the plantar surfaces of the large toes and the first, third, and fifth metatarsal heads, and the ball of the foot. To use the filaments, ask patients to close their eyes and respond with "yes" when they feel a light touch. Then apply the filaments in one smooth movement, perpendicular to the skin at an approximate rate of a one-second touch, one-second hold, and one-second lift. Note that sensation is present when the patient correctly identifies the touch on at least two out of three tries. On the form,



Figure 1. Claw toe deformity

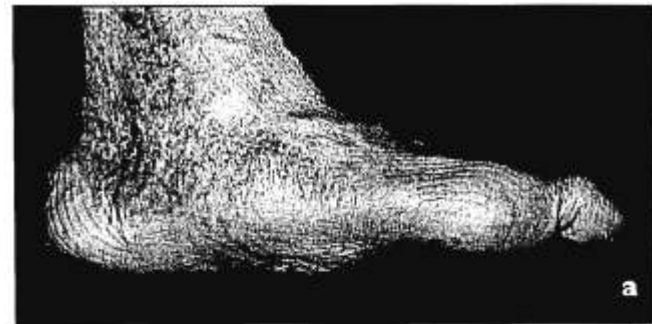


Figure 2. (a) midfoot collapse, lateral view; (b) midfoot collapse, plantar view; (c) X-ray study of midfoot collapse, lateral view, showing evidence of previous neuropathic fracture (arrow).

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use a plus sign to indicate sensation and a negative sign to indicate no sensation.

In a study of 118 patients with diabetes and neuropathy, our clinicians discovered that 102 (86%) lost sensation in the great toe before any other part of the foot. The other 16 patients had sensation in the great toe but had lost it at the first, third, or fifth metatarsal heads.

Managing risk by category

All patients with diabetes need annual foot screening and recent results compared with past records to determine any changes in status. After you determine your patient's risk category, you can plan patient education, footwear recommendations, specialist referrals, and frequency of follow-up care. (See *Foot Management Based on Risk Levels* on page 34.) Now let's see what the findings of Mr. Roja's exam indicated.

In assessing Mr. Roja's feet, you noted that he had a flat right foot, indicating an old fracture. He had swelling, redness, and an increased temperature in the midfoot area of his right foot. He couldn't feel the filament at any of the sites where it was applied.

Fortunately, you recognized the swelling, redness, and increased temperature as signs of an acute inflammatory process. Knowing Mr. Roja's history, the inflammation after a period of immobility made you think that he could be developing another neuropathic fracture. You immediately arrange for an X-ray study and for Mr. Roja to be referred to a foot specialist. □

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CE 2.5 hours

CONTINUING EDUCATION

After reading this article and taking the test on the next page, you'll be able to:

- Describe four pathologic foot conditions common in diabetic patients.
- Evaluate a diabetic patient's risk category for foot problems and plan appropriate screening intervals.
- Discuss five components of a thorough foot assessment.
- Plan four interventions aimed at preventing foot problems in diabetic patients.

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