

Rapid Screen for Diabetic Foot

Nearly 1 out of 7 of the 30 million US diabetics will develop a foot ulcer with half of those patients having a recurrence in the next 2- to 5-years. Fifteen to 24% of recurrent ulcerations lead to amputations. (Singh 2005). Only a small percentage are adequately evaluated in a typical medical encounter (Armstrong 2016). Current guidelines from the combined Society for Vascular Surgery, the American Podiatric Medical Association and the Society for Vascular Medicine (Hingorani 2016) recommend that patients with diabetes undergo foot inspections at least annually (grade 1C recommendation)¹.

Suggested frequency for in-office screening (Hingorani 2016)

- Annual for diabetic patients with average risk
- Every 6 months if they have peripheral neuropathy
- Every 3 months if they have both neuropathy and a foot deformity or PAD
- Every 1-3 months if they have had a previous ulcer or amputation.

Patient History

Ask about the following: 1) the degree of glucose control (e.g., Hgb A1c results, patient's compliance with management plan, home glucose monitoring), 2) history of lower-extremity wounds, prior ulcerations, or amputations, 3) vascular procedures (e.g., angioplasty) and 4) tobacco use (because of the link to peripheral artery disease (PAD)), 5) patient's foot care practice (e.g., how and how often they check their feet).

The following brief assessment should be done in about 5:

- **History**
- **Foot inspection**
- **AROM, motion palpation**
- **Sensation tests (Semmes-Weinstein light touch, Ipswich Touch Test, or vibration)**
- **Palpate pulses, assess skin temp, (optional: venous filling time)**
- **Educate patient about foot care and glycemic control**

Physical Examination

Carefully examine the feet in all suspected or confirmed diabetics. The practitioner may wish to wear gloves during this procedure.

¹ Grade 1 recommendations from the panel are meant to identify practices for which benefit clearly outweighs risk. The C part of the grade represents the level of the evidence in which a C is considered low-quality (i.e., less supported by current data than A or B designations) and the more likely to be subject to change in the future.

Inspection

Both legs should be exposed up to the knees. Neuropathic ulcers are usually found under the metatarsal heads or on the plantar aspects of toes while ischemic ulcers typically are on the medial and lateral aspects of the feet as well as on the toes.

- Look for **deformities** such as bunions, hammertoes, enlarged bony prominences, Charcot deformities secondary to neuropathy (including midfoot collapse, described as a “rocker-bottom” deformity).
- Look for **tissue changes in the skin**:
 - **Ulceration** (which may be infectious or non-infectious) or **signs of infection** (redness, elevated skin temperature, swelling)
 - Other **trophic changes**: pressure points/callouses, dryness/flakiness, cracking, discoloration (e.g., reddish-bluish)
 - **Precursors to ulceration**: mild erythema, blister formation
 - Look for **altered hair growth patterns** on the leg (e.g., hair loss may signal peripheral artery disease).
- Inspect the toes for thick, long, or **ingrown nails** (i.e., a thickened nail fold).
- Check between the toes for any **calluses/fissures**.
- Check **shoes** for uneven wear.

Depending on the nature and severity of any abnormalities, consider a timely referral to a specialist (e.g., podiatrist, orthopedist, or diabetes specialist; alternatively, they could be referred back through their medical or other PCP).

Orthopedic assessment

Assess active ROM of the ankle. Limitation or restriction in range of motion of any joint in the foot and ankle may increase the risk for ulceration (Lavery 1998). As an option, include a brief motion palpation screen of the foot and ankle joints.

Neurologic Examination

Diabetics with peripheral neuropathy are >3.5x more likely to suffer from recurrent ulceration than other diabetics. (Hingorani 2016) *Loss of protective sensation* (LOPS) has been linked to 75% of all nontraumatic diabetic foot-related amputations (Armstrong 2013). Failure to identify these problems early could result in hospitalization and amputation.

There are three recommended methods of testing for LOPS. Testing light touch with a Semmes-Weinstein 10-g monofilament has been suggested as the test of choice (Grade 1B recommendation², Hingorani 2016). However, if that is not available, performing the Ipswich Touch Test (IpTT) or vibration are other acceptable options (Miller 2014).

In **Semmes-Weinstein testing** of the foot, a 10-g monofilament is applied to the first toe and first, second, and 5th metatarsal head of each foot. The patient indicates yes or no that they can feel the stimulus. Test failure consists of one or more negative responses.

To perform the **IpTT**, the patient is asked to close their eyes while the practitioner lightly places an index finger one at a time on the tips of the first, third, and fifth toes for 2 seconds on each foot. The patient is to respond "yes" when they feel the examiner's touch. *A positive test is ≥ 2 "no" responses out of the 6 locations tested.* This method has been found to be as sensitive and specific as Semmes-Weinstein monofilaments for detecting LOPS with a +LR of 15 and -LR of 0.05 (Sharwa 2014). A previous study reported a 7.6 +LR and 0.26 -LR. (Rayman 2011).

² A Grade 1B recommendation suggests that the benefit clearly outweighs risk based on moderate quality evidence.

Vibration testing with the on-off method is also specific for diabetic peripheral neuropathy. Using a 128 Hz tuning fork on each great toe, note the patient's ability to identify the presence and cessation (via dampening by the examiner) of vibration. (Perkins 2001)

Vascular Examination

- Palpate the posterior tibial and dorsalis pedis pulses. A diminished or absent pulse may indicate significant vascular compromise and should prompt further palpation of the femoral and popliteal pulses. Note that there is a congenital absence of the DP pulse in about 10% of the normal population.
- Assess skin temperature and edema of both lower extremities.
- Optionally, venous filling time can be done as well. A prominent vein on the top of the foot is identified. The supine patient's leg is then raised to 45 degrees for 1 minute. The patient then sits up with the leg dangling off the table and the practitioner times how long it takes for the test vein to rise above the level of the skin surface. Greater than 20 seconds is abnormal with a +LR 3.6 for PAD. Note that capillary refill times are not considered to be accurate. (McGee 2012)

Periodically referral for a more accurate assessment of circulation should be done. The ABI (ankle-brachial index) or toe-brachial index are the methods of choice with a reported sensitivity of 63% and specificity of 97% in detecting significant blood flow compromise. (Hingorani 2016)

Patient Education

The lack of diabetes education can increase recurrent ulcer risk by 90%. Educate the patient regarding appropriate foot hygiene, skin and nail care (based on a grade 1C recommendation). Unfortunately, there have been very few studies measuring the impact of patient education in this arena, and those that have been done report only modest outcomes. (Hingorani 2016)

Self Exam

Diabetics should check their feet daily. If they cannot see their feet, they should place a mirror on the floor or use a mirror with a long handle. It is very important to keep the feet clean and dry, especially between the toes, and the nails clipped to the contours of the toes with any sharp edges filed smooth.

The patient can also be shown how to do the Ipswich Touch test at home so they can be periodically tested by a family member. Any change in the usual test results should result in the patient immediately contacting their PCP. Even when performed by a non-health care provider, the test performed similarly to when done in a PCP's office (excellent concordance, $k=0.98$) with a 12.9 +LR and 0.23 -LR.

Foot Care

Diabetics with peripheral neuropathy should not cut their own nails. Feet should be washed and kept clean and moisturizer applied if skin is dry. The space between the toes, however, must be kept dry. Patients with diabetes should test bath water temperature with their hand before entering the tub. They should avoid walking barefoot even at home, especially if they already have peripheral neuropathy.

Foot Wear

The use of proper foot wear may help reduce injuries that may lead to foot ulceration. (Pham 2000) Advice as simple as shaking out one's shoes and feeling inside before putting them on may help prevent foreign objects from leading to sores and calluses, especially in a foot with diminished sensitivity.

Hingorani et al. (2016) recommend against prescribing specialized therapeutic footwear for the average-risk diabetic patient (grade 2C). However, footwear choices should reduce friction or pressure and include broad, square toe box,

laces with 3-4 eyes per side or Velcro straps (avoid slip on shoes), padded tongue, low heels low (<5 cm), lightweight materials, and a size large enough to accommodate a cushioned in-sole. In an RCT of 400 patients there was no effect on re-ulceration at 2 years among those with therapeutic shoes with custom cork inserts or therapeutic shoes with polyurethane inserts versus usual footwear. Although the study did include patients with foot insensitivity, it did not include those with foot deformities or prior amputations. In a Cochrane review (2000), however, non-removable, pressure-relieving casts were found more effective in healing diabetes related plantar foot ulcers than removable casts, or dressings alone.

In the case of patients at high risk (e.g., significant neuropathy, foot deformities, previous amputation), custom therapeutic footwear is recommended (Grade 1B).

Glycemic control

At this and/or subsequent visits when more time is allotted, the patient should be provided with advice about healthy lifestyle and diet choices to help manage their hyperglycemia. A goal is to keep Hgb A1c targets < 7%. The practitioner can also update the health care record on the patient's medications, current medical PCP, treatment goal, and plans to achieve those goals. If the patient is a smoker, they should again be advised to stop and offered therapeutic options.

Routine ongoing assessment during chiropractic visits

Once the initial assessment described in this protocol has been done, briefer assessments can be done periodically. These would include doing a 30 second observational assessment of the foot and, less frequently, an Ipswich Touch Test, vibration testing, pulse check, and checking on the patient's compliance with their glycemic control plan.

Referral for further assessment and management

Management options when making a medical referral include assessment by plain film and MRI if a soft-tissue abscess or osteomyelitis is suspected, debridement for all infected ulcers, unloading ulcers with a total contact cast or irremovable fixed-ankle walking boot, and specific types of pressure-relieving footwear for other lesions or healed ulcers. Diabetic patients over 50 who have not had a formal vascular evaluation should be referred for an Arm-Brachial Index assessment³ or toe blood pressure⁴ (grade 2C recommendation,⁵ Hingorani 2016).

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³ Generally, special equipment is required for accurate readings. The ABI number is obtained by dividing the blood pressure in the ankle by the blood pressure in the arm. A value of 0.9 or greater is normal. A lower value suggests compromised blood supply to the lower extremity.

⁴ Measurements are made with a digital pneumatic cuff and a photoplethysmograph.

⁵ Grade 2 recommendations are made when the benefits are judged to be at least somewhat more favorable than the risks and are more likely to vary based on specific clinical scenarios

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For a video demonstration of the Semmes Weinstein filament testing, go to
<https://www.youtube.com/watch?v=TFNDs79mQIE>

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Diabetic Care and Foot Ulcers

7 Dos and Don'ts

1. Check your feet daily. If necessary, place a mirror on the floor or use a mirror with a long handle.
2. Keep your feet clean and dry, *especially between the toes*.
3. If your feet tend to be dry, apply lotion to them (except for between the toes).
4. Keep your nails clipped close to your toes. File any sharp edges smooth. ***If you have a sensory loss, you should not cut your own nails.***
5. Before entering the bath tub, test the water with your hand to make sure it isn't too hot.
6. Avoid walking barefoot even at home.
7. Have your doctor show you how to test your feet for sensation.



If you notice any changes, don't wait. See your doctor.

Foot wear

- Proper care and proper foot wear can help reduce injuries that may lead to foot ulcers.
- Shake out your shoes and feel inside to remove pebbles or other debris before wearing them.
- Wear shoes that have
 - broad, square toe boxes,
 - laces with 3-4 eyes per side or Velcro straps (avoid slip on shoes),
 - a padded tongue,
 - made of lightweight materials
 - are a size large enough to accommodate a cushioned in-sole.

Glycemic control

Follow your and your doctor's plan to control your glucose levels. Stick with your medications, exercise plan and diet recommendations.