by John Kraft, MD

What procedures for regular foot assessment are recommended for diabetic patients?

Patients with diabetes are susceptible to peripheral neuropathy, bringing the danger that foot lesions will go unnoticed. Moreover, co-existent peripheral vascular disease can often slow healing in these patients.

Routine foot assessment of people with diabetes should be done at least annually, preferably at each visit, and include 5 steps:

Check peripheral pulses

Semmes Weinstein monofilament

Adapted from Canadian Association of Wound Care sensory testing monofilament — **www.cawc.net/open.boutique/boutique.html*

1. Routine foot care and diabetic patient education

- glycemic control
- hygiene
- appropriate footwear
  - ☐ awareness of neuropathy
  - ☐ loss of protective sensation
- peripheral vascular disease
- smoking cessation

2. Vascular testing

- peripheral pulses, including dorsalis pedis pulse
- capillary refill
  - ☐ compress the nailbeds and record duration of circulation return (normal is < 2-3 seconds)
- if inadequate, consider vascular studies including ankle brachial index (ABI), and referral to vascular surgery, if needed

3. Sensory testing

- screening questions for neuropathy
  - ☐ sharp, stinging, crawling sensation, burning or shock-like pain, worse at night?
  - ☐ numbness or loss of sensation of the involved area?
  - ☐ history of unsteadiness or falling?
- sensation testing
  - ☐ Semmes Weinstein 10 g monofilament*
    - ◆ position patient comfortably lying down
    - ◆ touch the 10 g monofilament to their fore-arm and ask if they can feel it. Explain you will be touching their feet in a similar manner. Ask them to say "yes" every time they feel it touching their feet
    - ◆ have them close their eyes
    - ◆ apply monofilament perpendicular until it just bends and hold for 2 seconds; if no response, repeat twice in same spot. Ten locations — 9 on sole, 1 dorsal:
      – toe pad of 1st, 3rd, 5th toes
      – metatarsal-phalangeal joints of 1st, 3rd, 5th toes
      – mid arch-medial and lateral
      – heel
      – centre of dorsal foot
      – *avoid testing over calluses*
    - ◆ record the number of positive test sites (out of 10)
    - ◆ failure in 4 or more sites, and history of neuropathic symptoms, is predictive of foot complications in patients with diabetes
- other sensory modalities to consider
  - ☐ vibration (vibrating 128 Hz tuning fork applied to the great toe), temperature, pin prick, Achilles tendon reflexes

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4. Skin examination

Have all patients with diabetes remove shoes and socks, preferably at each visit, and inspect soles, dorsa, web spaces, ankle, lower legs. Look for:

- deformities
- edema
- calluses
  - consider removal weekly
- ulcers
  - for etiology and aggravating factors, consider:
    - vascular supply, infection, pressure, systemic factors (e.g. malnutrition)
  - rule out osteomyelitis:
    - can you probe to bone?
    - need for imaging (x-ray, bone gallium scan)
- plantar warts
- tinea pedis
- nails
  - onychodystrophies
    - onychomycosis

5. Assess gait

Inspect footwear

- ensure adequate depth and width needed to protect the feet

Pressure offloading

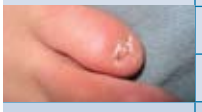
- removing pressure from the affected area and redistributing it to healthy skin, reducing mechanical stress
- consider referral to a podiatrist specializing in patients with neuropathy for pressure measurements and design of special footwear for offloading

If there are any suspicious lesions, such as an ulcer, or if lesions are not responding as expected to treatment, consider referral to a

- dermatologist
- endocrinologist
- neurologist
- vascular surgeon

What are the signs of infection in the diabetic foot?

Foot problems in patients with diabetes are often complicated by secondary infection. These can lead to worsening of the diabetic foot syndrome and hospitalization. Severe onychomycosis is a risk factor for development of diabetic foot ulcers, osteomyelitis, and gangrene. Fungal infections are also a common port of entry for cellulitis in the foot. Early recognition and prompt treatment of infection is essential.

Infection	Type or distribution	Signs	Differentials
Tinea pedis	Interdigital	– Classic athlete's foot	Unmistakable
	Moccasin distribution	– Soles, often extending above plantar surfaces to edge of foot	Frequently mistaken for dry skin
	Vesiculobullous, may be ulcerative	– Pustules or vesicles on the instep and plantar surfaces	Be sure to rule out cellulitis
Onychomycosis	Dermatophyte	– Nail plate thickening – Often, onycholysis (separation of nail plate from nail bed)	Psoriasis Lichen planus Nail trauma
	Non-dermatophyte		
	Candida		
Plantar warts	Caused by Human papillomavirus (HPV)	– Thick, hyperkeratotic, endophytic papules – Soles and lateral aspects of the feet are particularly susceptible – Unlike calluses, they interrupt natural skin lines – Red or black capillary dots are present – May become very painful during walking or running due to deep inward growth	Plantar clavi (corns); corns however lack punctate black dots, and warts, unlike corns, will bleed from superficially located dermal papillae
			

Eradicate infection or refer?

Early treatment is key when patients with diabetes develop foot infection. Seemingly minor foot infections increase the risk for more severe secondary infections and other complications such as gangrene. If in any doubt, don't hesitate to refer to a dermatologist for diagnosis and management.


Mild vesiculobullous


Ulcerative vesiculobullous

What treatments are recommended for diabetic foot infections?

General foot care

- daily foot inspection by patients before and after putting on/taking off stockings, remove debris — e.g. gravel stuck on feet
- daily skin care for the feet
  - ☐ creams and lotions
  - ☐ use moisturizers with keratolytics (lactic acid, urea) if there's rough, dry skin
- trim toenails very carefully

Ulcers

- correct reversible factors (the **VIP** approach)
  - ☐ **V**ascular supply is adequate
  - ☐ **I**nfection control is achieved
  - ☐ **P**ressure offloading/downloading

Vascular

- optimize medical management of peripheral vascular disease; control cardiac risk factors and blood sugar control, and encourage good nutrition — it can make a real difference to peripheral circulation; consider if patient is a candidate for vascular surgery

Infection

- minimize clinical infection by using antibacterial wound care products (topical antibiotics, betadine, silver-containing dressings)
- no systemic antibiotics are needed unless there are clinical signs of infection
- ask: is it superinfected ulcer or benign colonization?
  - ☐ red flags
    - ◆ increased wound bed temperature
    - ◆ wound edge redness
    - ◆ increasing/purulent wound exudates
- if there's clinical evidence of infection
  - ☐ antibiotic choice is guided by culture and sensitivity of swab from the wound bed
  - ☐ initial treatment, prior to culture results, for diabetic soft tissue infections usually includes ciprofloxacin and clindamycin
  - ☐ duration depends on type of infection:
    - ◆ soft tissue- 1-2 weeks
    - ◆ osteomyelitis- at least 6 weeks
- diligent wound care, including homecare nursing if needed, with instructions for regular dressing changes

Pressure

- offloading
- appropriate footwear
- minimize mechanical sheer stress

Plantar warts

First-line therapies

- salicylic acid preparations (patches, solutions, creams, ointments)
- occlusive methods (duct tape)

Second-line therapies

- liquid nitrogen cryotherapy — be cautious in patients with neuropathy

Third-line therapies

- curettage
- cautery
- surgery
- laser
- intralesional bleomycin
- immunotherapy

What are the investigations and treatment options for fungal infection on the toenail?

Nail clippings should be obtained for examination and culture to confirm a fungal infection before treating, especially if considering oral antifungals. If negative, the culture can be repeated. If positive, treat for onychomycosis.

Onychomycosis

Azoles: potential drug interactions

- HMG-CoA reductase inhibitors (statins)
- glyburide
- metformin
- calcium channel blockers
- digoxin
- warfarin
- carbamazepine, phenytoin
- cyclosporine

Collection of nail specimens

- infected nail should be washed with alcohol or soap/water and allowed to dry
- cut the nail as short as the patient will allow
- collect any subungual debris by scraping under the trimmed nail
- send samples to the lab in a sterile container

Topical treatment option

Ciclopirox olamine 8% nail lacquer, the only topical agent approved for treating onychomychosis, is applied nightly for one week, removed with alcohol weekly and repeated. Treatment requires prolonged daily use for 9-12 months. The long treatment period is due to minimal penetration of the drug into the nail and the slow growth of toenails. It's generally well-tolerated and extremely safe. Only rarely is there local burning or itch during application. With meticulous, prolonged use, cure rates are roughly 30%. Topical ciclopirox nail lacquer is a good option for patients in whom systemic antifungals are contraindicated or do not wish systemic treatments and their possible side effects.

Systemic antifungal treatment

Systemic antifungal agents (e.g. terbinafine, itraconazole) are much more effective, with cure rates from 60 to 80% with only 3-4 months of treatment.

Although systemic antifungals have the potential for relatively serious side effects (i.e. hepatotoxicity), they can be safely used with careful monitoring (i.e. following liver enzymes and blood counts before and during treatment). Another precaution when using systemic antifungals is to review the patient's medications and to be aware of possible drug-drug interactions. Antifungals inhibit various P450 enzymes. Azoles inhibit CYP 3A4, terbinafine inhibits CYP 2D6.

Dosage

- terbinafine: 250 mg daily for 12 weeks for toenail infection
- itraconazole: 200 mg b.i.d. for 7 days, 3 weeks off (one pulse for fingernails and three pulses for toenails)

Removal of dermatophytomas

Removing subungual pockets of densely packed fungi can improve nail response to oral antifungals.

Talk to your patients

- preventative measures should be considered
  - ☐ antifungal or absorbent powders
  - ☐ cotton socks with protective foot wear
  - ☐ discard old footwear
- remind the patient that improvement will not likely be seen until after 9 months, as it takes time for the healthy nail to grow in.
- toe nail infections are particularly challenging and can be frustrating to treat. Recurrence of toenail disease is relatively common, especially in patients with diabetes.

Further reading:

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