

Diabetes Foot Care: Risk Assessment and Management

Persons with diabetes have a 25% lifetime risk of developing a foot ulcer. These foot ulcers progress to osteomyelitis and/or to lower extremity amputation in 15-20% of cases at a cost of \$27 billion/year. This will lead to a lifetime of significant disability.

Multiple factors contribute to the pathogenesis of diabetic foot ulcers:

- **Sensory neuropathy** results in a loss of protective sensation (LOPS) in the feet with subsequent callus formation and failure to recognize traumatic injury to the feet (eg., mechanical trauma from ill-fitting shoes). Callus and LOPS can lead to subcutaneous hemorrhage beneath the callus—a “pre-ulcer”—and subsequent ulceration if pressure is not relieved promptly.
- **Motor neuropathy** results in atrophy of the intrinsic muscles of the feet and secondary foot deformities which become sites for callus formation and subsequent ulceration.
- **Autonomic neuropathy** results in reduced sweating of the feet. The resulting dry skin may accelerate callus formation and/or may fissure leading to a foot ulcer.
- **Peripheral arterial disease** impairs the healing of foot ulcers and facilitates secondary infections. Subsequent deep soft tissue infection may lead to osteomyelitis and amputation.
- **Reduced visual acuity and/or obesity and generalized debility** may prevent patients from seeing or reaching their feet thereby impairing self-care and early detection of foot lesions. Up to 40-50% of diabetic patients cannot see and/or reach their feet.
- **Nephropathy** increases the risk of diabetes foot ulceration for uncertain reasons.
- **Major depression** is associated with a two-fold increased risk of a first foot ulceration.

Fortunately, comprehensive foot care programs can reduce foot ulcer and subsequent amputation rates by at least 50% and may even be a cost-saving intervention. Essential components of these programs include:

1. Identifying patients at increased risk for foot ulcer with frequent comprehensive foot evaluation.
2. Educating and motivating patients at increased risk to regularly care for their feet (see “Appendix B: Taking Care of Your Feet”). Effective education may require the services of a podiatrist or diabetes educator. Additional basic foot care patient education can be found at www.ndep.nih.gov/diabetes/pubs/FootTips.pdf and https://diabetes.niddk.nih.gov/dm/pubs/complications_foot
3. Referring patients at increased risk to podiatrists for prophylactic nail and skin care and provision of therapeutic footwear (socks, insoles, special shoes) when indicated, with frequency of podiatry follow-up determined by individual level of risk.
4. Detecting foot problems early by daily patient self-inspection (which may require the assistance of another person) and by inspection of the feet at every office visit in persons at increased risk of foot ulcer.

Patients at increased risk for foot ulceration can be identified and then risk-stratified by considering two historical features and four exam components. Risk stratification defines annual ulcer risk and determines management strategies (see Table 1 below).

Diabetes Foot Care: Risk Assessment and Management continued

Risk Level	Definition	% Ulcer/y	Education	Visual Inspection	Podiatry
3	Prior amputation or ulcer	20-30 %	DM educator Test knowledge	q visit	q 1-2 mo Insoles ± shoe gear; Vasc Surg if PAD
2	PAD ± LOPS	6%	DM educator Test knowledge	q visit	q 2-3 mo Insoles ± shoe gear; Vasc Surg if PAD
1	LOPS ± Deformity	4%	Enhanced pt education Footwear advice	q visit	q 3-6 mo Insoles ± shoe gear
0	No LOPS, PAD, or deformity	<2%	Basic patient education	annual exam*	Not needed

Diabetes Care: 2008 31:1679 *see appendix

Important components of risk include:

- **Prior amputation**
 - **Prior foot ulcer**
 - **Peripheral arterial disease (PAD):** absence of both dorsalis pedis *and* posterior tibial pulses on one or both feet
 - **Foot deformities:** hammer toes, claw toes, prominent metatarsal heads, bunions, overlapping toes or a collapsed plantar arch (Charcot foot)
 - **Loss of protective sensation (LOPS):** protective sensation is considered intact *if* patients accurately sense pressure from the Semmes-Weinstein 5.07, 10g monofilament (MF) *and* have a normal response to one of the three following tests. There are no consensus recommendations on how to best perform these sensory exams. Approaches suggested by the ADA and/or International Working Group on the Diabetic Foot are included below:
 - **Vibratory sensation** testing may be the most sensitive of the three tests.
 - 128 Hz tuning fork (TF) 128 Hz tuning fork—see the adjacent panel for a suggested technique.
 - Vibration perception threshold testing with a biothesiometer:
 - Place on pulp of great toe
 - Patient detects the mean of 3 readings ≤ 25 volts
 - **Ankle reflexes**
 - Sensate: reflexes present without/with reinforcement
 - **Pin prick sensation**
 - Apply disposable pin proximal to nail of great toe
 - Sensate: senses pressure sufficient to deform skin
- Patients with ≥ 1 abnormal sensory test have LOPS

Detect LOPS: Vibration Sense

1. Patient closes eyes
2. Apply 128Hz TF to wrist
3. Ask pt to distinguish vibration from pressure so pt knows what to expect
4. Apply TF perpendicularly to dorsum of great toe proximal to nail bed
5. Apply TF 3 times to each great toe: 2 times with vibration, one time with pressure
6. Ask the pt: "Pressure or vibration?"
7. Sensate: Correctly identifies $\geq 2/3$ applications

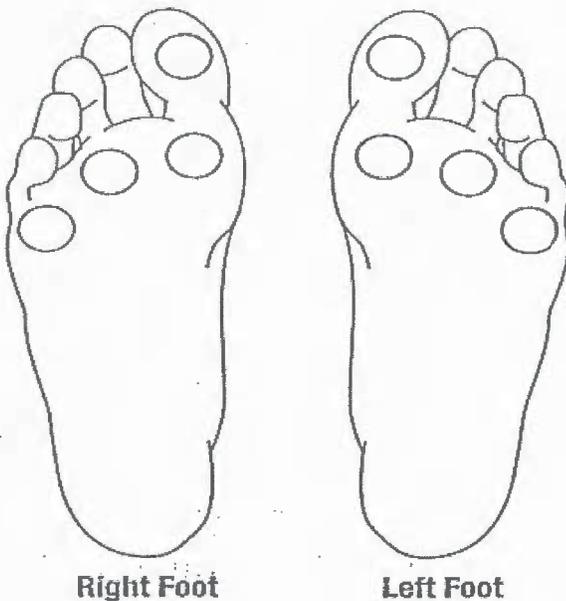
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Diabetes Foot Care: Risk Assessment and Management continued

Visual Inspection and Annual Comprehensive Foot Exam

See "Appendix A: Comprehensive Foot Exam" for a potential format for documenting care. Evaluate for:

- Signs of excess foot pressure: persistent erythema after shoe removal, callus, callus with subcutaneous hemorrhage ("pre-ulcer" requiring urgent podiatry referral);
- Dry skin and fissuring from autonomic neuropathy;
- Poor self-care: nail pathology, interdigital maceration with fungal infection;
- Proper footwear.



Using the 5.07/10gm MF

1. Demonstrate sensation on the forearm or hand.
2. Place monofilament perpendicular to test site.
3. Bow into C-shape for one second.
4. Test 4 sites/foot: Predicts 95% of ulcer formers vs. 8 sites
 - heel testing does not discriminate ulcer formers
 - avoid calluses, scars, and ulcers
5. Minimize bias
 - Test sites in random sequence
 - Test each site 3X
 - Sham test as 1 of 3
6. Ask "Do you feel it? Yes or no?"
7. Retest site if patient fails (misses 2/3 of responses).

Key Points

- Insensate at 1 site = insensate feet
- Pt may be falsely insensate due to edema, cold feet
- Test annually when sensation normal
- Use <math><100\times/d</math>; replace if bent; replace q 3 mo.
- Use calibrated MF



Photo courtesy of Dr. Scott Clark, DPM

DIABETES FOOT CARE QUESTIONNAIRE

Patient Name: _____ Date: ____/____/____ Clinician: _____

(*Note the changing order of Yes and No answers.)

PRIOR FOOT PROBLEMS

- Previous amputation of leg or portion of foot? No Yes
- Previous foot ulcer? If Yes, Date: ____/____/____ No Yes
- Have you been told that you have reduced sensation in your feet? No Yes

CURRENT FOOT OR LEG PROBLEMS

- Ulcer, sore, or blister on your foot at this time? No Yes
- Blood or discharge noted in your socks? No Yes
- Callus build-up on your feet? No Yes
- Pain or cramping in your feet, calves, thighs, or buttocks when you walk? No Yes
- Numbness or tingling sensation in your feet? No Yes

PODIATRY (FOOT SPECIALIST) FOLLOW-UP

- Have you seen a podiatrist (foot specialist) in the past 6 months? Yes No
If Yes, Date of last visit: ____/____/____

FOOT CARE EDUCATION

- Have you been taught how to care for your feet? Yes No
- Have you read an educational hand-out about foot care? Yes No
- Have you read an educational hand-out about shoe selection? Yes No

ABILITY TO CARE FOR YOUR FEET

- Can you reach and see the soles of your feet? Yes No

HOW YOU CURRENTLY CARE FOR YOUR FEET

- Do you (or an assistant) inspect your feet daily for problems? Yes No
- Do you know to report any sores or blisters immediately to your clinician? Yes No
- Do you wash your feet every day? Yes No
- Do you dry thoroughly between the toes? Yes No
- Do you put moisturizing lotion on your feet daily (but not between the toes)? Yes No
- Do you have another person cut your toenails and trim your calluses? Yes No
- Do you wear shoes at all times, outdoors and indoors? Yes No
(that is, do you avoid walking stocking-footed or bare-footed even at night or in the shower?)
- Do you always test water temperature with your hand before putting your foot in? Yes No
- Do you avoid the use of corn plasters on your feet? Yes No
- Do you check your shoes for any objects that may have fallen into them before you put them on? Yes No

YOUR CURRENT FOOTWEAR

- Do you wear special shoes and/or protective inserts in the shoes? Yes No
- If yes, do you wear them at all times? Yes No
- Check the appropriate box to describe any shoes that you wear at any time.

<input type="checkbox"/> Broad, round toes	<input type="checkbox"/> Laces, buckles, Velcro	<input type="checkbox"/> Pointed toes	<input type="checkbox"/> Slip-ons	<input type="checkbox"/> Open toes
<input type="checkbox"/> Athletic shoes	<input type="checkbox"/> Leather or canvas	<input type="checkbox"/> High heels	<input type="checkbox"/> Plastic	
<input type="checkbox"/> Light color		<input type="checkbox"/> Cowboy boots	<input type="checkbox"/> Black color	

YOUR CURRENT PHYSICAL ACTIVITY

- Check all boxes that describe how your currently exercise.

<input type="checkbox"/> Treadmill	<input type="checkbox"/> No exercise
<input type="checkbox"/> Stair-step	<input type="checkbox"/> Bicycling
<input type="checkbox"/> Walking	<input type="checkbox"/> Swimming
<input type="checkbox"/> Jogging	

FOOT EXAM:

10 g MF Testing: (⊕ = sensate
⊖ = insensate)

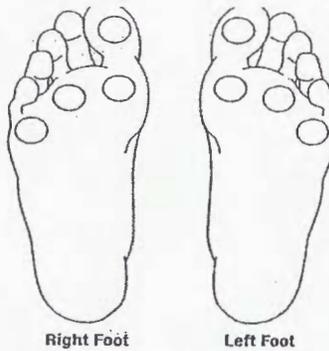
- Sensate
- Insensate (≥ 1 site)

Deformities:

- None
- Some:

	R	L
Hammertoes	<input type="checkbox"/>	<input type="checkbox"/>
Claw toes	<input type="checkbox"/>	<input type="checkbox"/>
Prom. MT heads	<input type="checkbox"/>	<input type="checkbox"/>
Bunion, 1 st MTP	<input type="checkbox"/>	<input type="checkbox"/>
Bunion, 5 th MTP	<input type="checkbox"/>	<input type="checkbox"/>
Collapsed arch	<input type="checkbox"/>	<input type="checkbox"/>
Limited Joint Mobility		
1 st MTP (<50° DF)	<input type="checkbox"/>	<input type="checkbox"/>
Ankle (< 100°DF)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Amputation:		
Level = _____		

Capable of reaching/seeing feet for self-inspection: Yes No



Nail Abnormalities:

- None
 - Some:
- | | R | L |
|------------|--------------------------|--------------------------|
| Hemorrhage | <input type="checkbox"/> | <input type="checkbox"/> |
| Ingrown | <input type="checkbox"/> | <input type="checkbox"/> |
| Fungus | <input type="checkbox"/> | <input type="checkbox"/> |
| ↑↑ length | <input type="checkbox"/> | <input type="checkbox"/> |

Pedal Pulses (0-2+):

	R	L
DP	_____	_____
PT	_____	_____

Venous Filling Time:

- Normal (≤ 20 sec)
- Increased (> 20 sec)

Skin Abnormalities:

- None
 - Some – see diagram
- C=callus D=dryness
 PU=pre-ulcer E=erythema
 F=fissure W=warmth
 M=maceration S=swelling
 U=ulcer [Go to FOOT ULCER EXAM SHEET]

SHOE EXAM:

- Inappropriate style? No Yes
- Lean to one side? No Yes
- Flattened insole? No Yes
- Inadequate fit? No Yes

VASCULAR ANKLE-BRACHIAL INDEX EXAM RESULTS

	Normal: <u>0.90-1.30</u>	Mild Obstruction: <u>0.70-0.89</u>	Moderate Obstruction: <u>0.40-0.69</u>	Severe Obstruction: <u>< 0.40</u>	Poorly Compressible: <u>> 1.30</u>
Right Leg _____					
Left Leg _____					

ASSESSMENT

PLAN

• Active cutaneous pathology:

- None
- Yes: _____

- No intervention needed
- Podiatry referral on: ___/___/___
- Other: _____
- 1. _____
- 2. _____
- 3. _____

a. Risk stratification:

- Low risk: no high risk features
- High risk: ≥ 1 risk factor
 - Insensate to 10 g MF
 - Foot deformity(ies)
 - No pedal pulses or claudication
 - ABI ≤ 0.9
 - Prior foot ulcer
 - Prior LEA

- Repeat comprehensive foot exam 1 yr
- Education brochure
- "High Risk" chart sticker
- Visual foot inspection every visit
- Podiatry referral: ___/___/___
- Refer for foot care education: _____
- Diabetes educator
- Other: _____
- Foot exams every ___ mo (q 1-6)
- ABI referral
- Vascular surgery referral (claudication at less than one block or ABI < 0.40-0.50)

• Education status for footcare:

- Prior formal education: Yes No
- Adequate self-care practices: Yes No

Patient counselled today on self-care deficiencies

• Footwear assessment:

- Wears appropriate shoes: Yes No
- Wears inserts: Yes No
- May require corrective footwear Yes No

- Patient counselled today on appropriate footwear
- Podiatry referral: ___/___/___
- Complete Medicare Certification Statement for Therapeutic shoes
- Pedorthist/Orthotist referral

• Barriers to footcare:

- None Depression Financial Social Isolation
- Can't reach feet Can't see feet

- Plan: _____
- 1. _____
- 2. _____

Comprehensive Foot Examination

History

Yes No

- Prior amputation
- Prior ulcer
- Claudication
- Paresthesia
- Can reach feet
- Can see feet
- Prior education
- Extensive walking
- Insoles for shoes
- Special shoes



Right Foot

Left Foot

PEDAL PULSES \oplus = sensate \ominus = insensate

R L

DP _____
PT _____

SKIN ABNORMALITIES

- None
- Some – see diagram

C=callus D=dryness
PU=pre-ulcer E=erythema
F=fissure W=warmth
M=maceration S=swelling
U=ulcer

NAIL ABNORMALITIES

- None
- Some:

	R	L
Hemorrhage	<input type="checkbox"/>	<input type="checkbox"/>
Ingrown	<input type="checkbox"/>	<input type="checkbox"/>
Fungus	<input type="checkbox"/>	<input type="checkbox"/>
↑↑Length	<input type="checkbox"/>	<input type="checkbox"/>

SHOE EXAM

- | | | |
|----------------------|------------------------------|-----------------------------|
| Inappropriate style? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Lean to one side? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Flattened insole? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Inadequate fit? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

10 G MF TESTING \oplus = sensate \ominus = insensate

- Sensate
- Insensate

VIBRATION TESTING

- Normal
- Abnormal

ANKLE REFLEXES

- Normal
- Absent

PIN PRICK SENSED

- Yes
- No

DEFORMITIES

- None
- Some:

	R	L
Hammertoes	<input type="checkbox"/>	<input type="checkbox"/>
Claw toes	<input type="checkbox"/>	<input type="checkbox"/>
Prom. MT heads	<input type="checkbox"/>	<input type="checkbox"/>
Bunion, 1st MTP	<input type="checkbox"/>	<input type="checkbox"/>
Bunion, 5th MTP	<input type="checkbox"/>	<input type="checkbox"/>
Collapsed arch	<input type="checkbox"/>	<input type="checkbox"/>
Limited Joint Mobility	<input type="checkbox"/>	<input type="checkbox"/>
1st MTP (<50° DF)	<input type="checkbox"/>	<input type="checkbox"/>
Ankle (< 100° DF)	<input type="checkbox"/>	<input type="checkbox"/>

- Amputation: Level =

Taking Care of Your Feet

- Inspect your feet daily! This may require a mirror, magnifying glass, or the help of another person.
- Call your doctor if you have redness that doesn't go away, a growing callus, or a bleeding callus.
- Test your bath water temperature with your hand, not your foot.
- Wash and dry your feet daily.
- Apply lotion or petroleum jelly to your feet every day, but not between your toes.
- Do NOT use a pumice stone or other instrument to file a nail or remove a callus, especially if your vision is bad or you have lost feeling in your feet. See a podiatrist or other health professional.
- If you've lost sensation in your feet, do appropriate exercise.
- Never walk around barefoot or wearing just socks, even when you are at home.
- Always wear optimal footwear—at all times!

TO KEEP YOUR FEET HEALTHY AVOID:

- Pointed toes
- Slip-ons
- Open toes/ High heels
- Plastic
- Black color
- Too small

INSTEAD, CHOOSE:

- Broad, round toes
- Adjustable (laces, buckles, Velcro)
- Athletic shoes or walking shoes
- Leather or canvas
- White/light colors
- ½" between longest toe end of shoe



Foot Care Tips

Take Care of Your Feet for a Lifetime.

1. **Take care of your diabetes.**
 - Work with your health care team to keep your blood sugar within a good range.
2. **Check your feet every day.**
 - Look at your bare feet every day for cuts, blisters, red spots, and swelling.
 - Use a mirror to check the bottoms of your feet or ask a family member for help if you have trouble seeing.
3. **Wash your feet every day.**
 - Wash your feet in warm, not hot, water every day.
 - Dry your feet well. Be sure to dry between the toes.
4. **Keep the skin soft and smooth.**
 - Rub a thin coat of skin lotion over the tops and bottoms of your feet, but not between your toes.
5. **Smooth corns and calluses gently.**
 - If your feet are at low risk for problems, use a pumice stone to smooth corns and calluses. Don't use over-the-counter products or sharp objects on corns or calluses.
6. **If you can see and reach your toenails, trim them each week or when needed.**
 - Trim your toenails straight across and file the edges with an emery board or nail file.
7. **Wear shoes and socks at all times.**
 - Never walk barefoot.
 - Wear comfortable shoes that fit well and protect your feet.
 - Feel inside your shoes before putting them on each time to make sure the lining is smooth and there are no objects inside.
8. **Protect your feet from hot and cold.**
 - Wear shoes at the beach or on hot pavement.
 - Wear socks at night if your feet get cold.
 - Don't test bath water with your feet.
 - Don't use hot water bottles or heating pads.
9. **Keep the blood flowing to your feet.**
 - Put your feet up when sitting.
 - Wiggle your toes and move your ankles up and down for 5 minutes, 2 or 3 times a day.
 - Don't cross your legs for long periods of time.
 - Don't smoke.
10. **Be more active.**
 - Plan your physical activity program with your doctor.
11. **Check with your doctor.**
 - Have your doctor check your bare feet and find out whether you are likely to have serious foot problems. Remember that you may not feel the pain of an injury.
 - Call your doctor right away if you find a cut, sore, blister, or bruise on your foot that does not begin to heal after one day.
 - Follow your doctor's advice about foot care.
12. **Get started now.**
 - Begin taking good care of your feet today.
 - Set a time every day to check your feet.
 - Complete the "To Do" list on the back of this page and...

**take care of your feet
for a lifetime.**