Diabetic Foot Care
Strategies for Primary Care

Part 2: Podiatry Care and Basic Wound Management

Presented by
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Veterans Health Administration
Objectives

1. Identify and evaluate foot abnormalities in people with diabetes
2. Examine basic principles of diabetic foot care and wound management
3. Utilize an interprofessional team strategy to improve foot care outcomes
Summary: Part 1 of Diabetic Foot Care Strategies: Complete Foot Evaluation

We:
1. Identified factors and findings that increase risk of diabetic foot complications.
2. Demonstrated how to perform a complete diabetic foot examination.
3. Introduced strategies to prevent diabetic foot complications in the primary care setting.

For review: Complete Foot Care Exam video

A complete diabetic foot examination should be performed at diabetes diagnosis and at least annually thereafter to identify people at risk for foot ulcers and amputation.
Lower-limb amputations (LLA), which is surgery to remove a toe, foot, or leg, are increasing in the US, and 80% are a result of complications from diabetes.

From 2009 to 2019, diabetes-related hospitalizations due to amputation doubled.
Principles of Podiatry Care for People with Diabetes

- Treat fungal skin infections
- Lubricate skin
- Trim nails
- Reduce callus

(Boulton, 2018; International Working Group on the Diabetic Foot [IWGDF] Practical Guidelines, 2023)
Treat Fungal Skin Infection

- Use topical antifungals for tinea pedis (athlete’s foot)
- Consider oral antifungal medications for onychomycosis (nail fungus), and tinea pedis not responding to topical treatment

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Lubricate Dry Skin

- Autonomic neuropathy contributes to dry skin
- Instruct patients to apply a moisturizing lotion daily
  - Oil or water-based lotions are a matter of patient preference
- Caregiver may need to assist
- Do not apply lotion between toes

(Boulton, 2018; IWGDF Practical Guidelines, 2023)
Nail Trimming: Normal Nails

- Ensure good lighting and a comfortable position; use safety glasses or face shields
- Use nail nippers, straight or curved
- Stabilize the toe with one hand, cut with the other
- Start at one edge and follow the curve
- File any sharp edges with emery board

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Nail Trimming: Curved Nails

- Ensure good lighting and a comfortable position; use safety glasses or face shields
- Use nail nippers, straight only
- Stabilize the toe with one hand, cut with the other
- Start at one edge and follow the curve
- Avoid cutting into corners
- File any sharp edges with emery board
Nail Trimming: Thick Mycotic

Nails tend to be very brittle.

- Use nail nippers to trim off sharp edges
- Consider referring to Podiatrist or Certified Foot Care Nurse

(Boulton, 2018; IWGDF Practical Guidelines, 2023)
Callus Trimming

- Ensure good lighting. Use gloves, alcohol swabs, and a #15 disposable scalpel.
- Wipe with alcohol swab, callus tissue will turn white.
- Shave or pare down callus gradually.
- Palpate intermittently to feel when you are close to pliable “normal” tissue, then stop trimming.

(Boulton, 2018; IWGDF Practical Guidelines, 2023)
Wound Management

• Assessing foot wounds
• Classifying foot wounds
Evaluating Patients with Diabetic Foot Ulcer (DFU)

- Evaluate and classify ulcer with attention to wound characteristics as described in the SINBAD Classification System.
- Use SINBAD Score or other (DFU) classification system to communicate information with podiatrist, other clinicians, or consultants.

(Boulton, 2018; IWGDF Classification Guidelines, 2023)
Evaluating Patients with DFU SINBAD Classification

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>Forefoot</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Midfoot and hindfoot</td>
<td>1</td>
</tr>
<tr>
<td>Ischemia</td>
<td>At least one palpable pulse</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>No pulse palpable or signs of reduced perfusion</td>
<td>1</td>
</tr>
<tr>
<td>Neuropathy</td>
<td>Intact monofilament sensation</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Absent monofilament sensation</td>
<td>1</td>
</tr>
<tr>
<td>Bacterial Infection</td>
<td>None present</td>
<td>0</td>
</tr>
<tr>
<td>Area</td>
<td>Ulcer &lt; 1 cm²</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Ulcer ≥ 1 cm²</td>
<td>1</td>
</tr>
<tr>
<td>Depth</td>
<td>Ulcer with skin and subcutaneous tissue</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Ulcer reaching muscle, tendon, or deeper tissue</td>
<td>1</td>
</tr>
</tbody>
</table>

SINBAD scores range from 0 to 6. A value of 3 or greater increases the risk of non-healing and amputation.

(Ince, 2008; Monteiro-Soares, 2020)
Wound, Ischemia, and Foot Infection (WIfI) Classification of Limb Threat

![Classification System Diagram]

The Wound, Ischemia, and Foot Infection (WIfI) classification system consists of 3 components graded separately from 0 (none) to 3 (severe). One component may be dominant but the specific combination of scores is used to estimate the risk of limb amputation at 1 year and the need for or benefit of revascularization.

### Wound (W)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Ulcer</th>
<th>Gangrene</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>1</td>
<td>Small, shallow</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>Deep with exposed bone, joint, or tendon</td>
<td>Limited to digits</td>
</tr>
<tr>
<td>3</td>
<td>Extensive, deep, and involving forefoot and/or midfoot with or without calcaneal involvement</td>
<td>Extensive and involving forefoot and/or midfoot Full thickness heel necrosis with or without calcaneal involvement</td>
</tr>
</tbody>
</table>

### Foot Infection (fI)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Clinical manifestation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No symptoms or signs of infection</td>
</tr>
</tbody>
</table>
| 1     | Infection indicated by ≥2 of the following:  
• Local swelling or induration  
• Erythema 0.5-2.0 cm around ulcer  
• Local tenderness or pain  
• Local warmth  
• Purulent discharge (thick, opaque to white, or sanguineous) |

### Ischemia (I)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Ankle-branchial index</th>
<th>Toe pressure or transcutaneous oximetry</th>
</tr>
</thead>
</table>
| 0     | ≥0.80  
>100 mm Hg | ≥60 mm Hg |
| 1     | 0.60-0.79  
70-100 mm Hg | 40-59 mm Hg |
| 2     | 0.40-0.59  
50-69 mm Hg | 30-39 mm Hg |
| 3     | ≤0.39  
<50 mm Hg | <30 mm Hg |

In diabetic foot disease, tissue loss, ischemia, and infection frequently overlap. However, one is frequently more dominant than the other at different times in the life cycle of an acute-on-chronic event. Here, the amount of tissue loss, ischemia, and foot infection can be ordinarily graded to help predict outcome and assist in communicating a plan of action.

* Armstrong, 2023

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Indian Health Service Division of Diabetes Treatment and Prevention
Standard Care of Diabetic Foot Ulcers

• Ensure good vascular supply
• Treat soft-tissue and bone infection
• Initial excisional debridement and maintenance debridement as indicated
• High quality off-loading

(Boulton, 2018; IWGDF Practical Guidelines, 2023)
Ensure Good Vascular Supply

- Assess circulation with ankle brachial index (ABI) and one other test
  - Examine for skin perfusion pressure, toe pressure, or transcutaneous oxygenation pressure measurement
  - Consider use of hand-held doppler or skin temperature sensor, if above tests are not available
- Consider vascular surgery consultation if there is any concern for peripheral artery disease

(Boulton, 2018; IWGDF PAD Guidelines, 2023)
## Table 2. Assessing Ischemia in the Presence of a Diabetic Foot Ulcer

<table>
<thead>
<tr>
<th>Test</th>
<th>Definition</th>
<th>Sensitivity and specificity (wound healing)</th>
<th>Additional notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palpation of pulses(^5)</td>
<td>Palpation of anterior tibial or posterior tibial pulse</td>
<td>35% sensitive; 100% specific</td>
<td>Pedal pulses that are palpable are associated with high probability of healing (relative risk, 2.26; 95% CI, 2.05-2.49).</td>
</tr>
<tr>
<td>Ankle-brachial index(^4)</td>
<td>Ankle pressure compared with arm pressure</td>
<td>48% sensitive; 52% specific; diagnostic odds ratio, 1.02(^4)</td>
<td>Less useful in patients with diabetes, kidney disease, and diabetic foot ulcers due to falsely elevated ankle pressure from medial calcinosis; low prognostic accuracy for ulcer healing.</td>
</tr>
<tr>
<td>Toe systolic blood pressure(^4)</td>
<td>Measurement of systolic blood pressure at the toe</td>
<td>86% sensitive; 58% specific</td>
<td>Toe systolic blood pressure &lt;30 mm Hg is associated with 2.09-fold higher relative risk of nonhealing after partial foot amputation compared with values ≥30 mm Hg (relative risk, 2.09; 95% CI, 1.37-3.20; (P = .001)).</td>
</tr>
<tr>
<td>Transcutaneous oximetry(^4)</td>
<td>Measurement of oxygen tension at the skin surface</td>
<td>72% sensitive; 86% specific; diagnostic odds ratio, 15.81(^4)</td>
<td>Transcutaneous oxygen pressure ≥25 mm Hg is associated with higher rates of ulcer healing and high accuracy in predicting ulcer healing and limb amputation.</td>
</tr>
<tr>
<td>Skin perfusion pressure(^4)</td>
<td>Measurement of blood pressure required to restore microvascular blood flow after occlusion</td>
<td></td>
<td>Skin perfusion pressure ≥40 mm Hg is associated with higher rates of ulcer healing; positive likelihood ratios range from 4.86 to 6.40 and corresponding negative likelihood ratios from 0.03 to 0.40.</td>
</tr>
</tbody>
</table>

\(^4\) Diagnostic odds ratio is defined as odds of a positive test result in people with disease relative to the odds of a positive test result in those without disease.
<table>
<thead>
<tr>
<th>Treatment of ischemia</th>
<th>Description</th>
<th>Outcome/benefit</th>
</tr>
</thead>
</table>
| Timely revascularization[^81,82]                        | Restores pulsatile arterial flow to the foot in chronic limb-threatening ischemia | In a study of 478 patients with diabetic foot ulcers, faster wound healing for patients undergoing revascularization within 56 d (hazard ratio, 1.96; 95% CI, 1.52-2.52; \( P < .001 \))[^81]  
In a study of 246 limbs with chronic limb-threatening ischemia, reduced risk of major amputation for patients with revascularization within 14 d (odds ratio, 3.1; 95% CI, 1.4-6.9)^[82]  |
| Primary lower extremity amputation (without salvage attempt)[^49] | Appropriate in selected patients, including patients nonambulatory at baseline and patients with severe frailty | Offers alternative treatment for patients who are not suitable candidates for revascularization (expert consensus). |
| Surgical bypass vs endovascular therapy[^84]           | Both open surgery and endovascular therapy are used for chronic limb-threatening ischemia | In a randomized clinical trial of 1434 patients who were candidates for either surgery bypass (including single-segment great saphenous vein for bypass) or endovascular treatment (71.8% had diabetes), surgical bypass appeared superior to endovascular therapy in patients with adequate great saphenous vein (hazard ratio, 0.68; 95% CI, 0.59-0.79) for composite outcome of a major adverse limb event (amputation above ankle, major limb intervention, or death) (42.6% vs 57.4%). |
Treat Bone and Soft-Tissue Infection

• Assess for infection:
  • Mild: <2cm of surrounding skin and superficial tissue
  • Moderate: ≥2cm of cellulitis and involving subcutaneous tissue
  • Severe: systemic response with signs of fever and leukocytosis
  • Diabetic Foot Osteomyelitis: infection of underlying bone

(Boulton, 2018; IWGDF/IDSA Infection Guidelines, 2023)
Prescribe appropriate antibiotics, if infection is present:

- Obtain tissue culture (surface cultures are unreliable)
- Provide empiric coverage for the most common bacteria, usually gram positive cocci (e.g., *streptococcus* and *staphylococcus*, including *methicillin-resistant strains, if indicated*) for mild infections

- Severe infections and/or deep wounds will require a more complex approach, such as hospitalization, surgical debridement and IV antibiotics.
Management of Active Diabetic Foot Complications

Figure 3. Management of Active Diabetic Foot Complications

- Patient presents with diabetic foot ulcer
  - Initial examination and assessment of wound
  - Wound grade: 1-3

- Clinical assessment of infection
- Laboratory tests such as white blood cell count, erythrocyte sedimentation rate, and C-reactive protein as necessary

- Infection grade: 0 (none)
- Infection grade: 1-3
Management of Active Diabetic Foot Complications (continued)

Infection grade: 0 (none)

Ischemia grade: 0-3

Plantar wound is present

YES

Wound care
Nonremovable knee-high total contact casts or walkers are more effective than removable devices
Removable knee-high or ankle-high walker devices
Surgical off-loading, such as Achilles tendon lengthening, plus wound care

Follow-up shows good healing trajectory at 4 weeks

YES

Confirmation of healed diabetic foot ulcer
Continued surveillance of ulcer in remission

NO

Reassessment of systemic factors affecting healing (eg, diabetes control) and any changes in wound, ischemia, or infection

Osteomyelitis is present

NO

YES

Testing for osteomyelitis as indicated
Bone biopsy and culture is the preferred method of diagnosis

Wound debridement
Limb-sparing amputation
Prolonged antimicrobials

(Armstrong, 2023)
Management of Active Diabetic Foot Complications (continued)

Infection grade: 1-3

- Antimicrobial therapy with or without debridement
- Clinical assessment for ischemia

Ischemia grade: 0 (none)  Ischemia grade: 1-3

Testing for osteomyelitis as indicated
- Bone biopsy and culture is the preferred method of diagnosis

Osteomyelitis is present

Wound debridement
- Limb-sparing amputation
- Prolonged antimicrobials

Revascularization
- Testing for osteomyelitis as indicated
- Prioritization of comfort-focused care to prevent wound deterioration and hospitalization, over amputation, as appropriate

Wound care
- Off-loading devices, such as knee-high removable or postoperative healing sandals, as tolerated

Assessment of likelihood for improved outcomes with revascularization based on operative risk and distribution of lower extremity artery disease

Revascularization is likely to improve outcomes

- YES
- NO

(Armstrong, 2023)
Initial Excisional and Maintenance Debridement as Indicated: Uncomplicated Wounds

- Clean and moist environment
- Wound debridement
- Regular dressing changes
- Off-loading
- Oral antibiotics directed by culture
- Monitoring of size
- Outpatient management appropriate
- May need to hospitalize for off-loading

(Boulton, 2018; IWGDF Practical Guidelines, 2023)
Uncomplicated Wound: Debridement

- Removal of devitalized tissue to:
  - Make way for healthy tissue
  - Decrease external pressure on the wound
  - Mitigate infections that reside in the tissue
Debridement Steps

1) Clean

2) Remove dead or infected tissue

3) Clean and make way for healthy tissue

4) Apply agents to mitigate infection
Wound Dressing Principles

• Adsorbent compounds are useful for soupy wounds
• Hydrocolloid gels and occlusive dressings have a role in dry wounds
• Enzymatic debridement may be useful to soften eschar

(Boulton, 2018; IWGDF Wound Healing Guidelines, 2023)
## Wound Dressing Options

<table>
<thead>
<tr>
<th>Hydration</th>
<th>Class/category</th>
<th>Indications</th>
<th>Caution/Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrocolloid</td>
<td>Occlusive, Fluid-trapping, minor burns and pressure ulcers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silicone</td>
<td>hypertrophic and Keloid scars; elderly</td>
<td>Silicone</td>
<td></td>
</tr>
<tr>
<td>Films</td>
<td>Retain moisture; graft, surgical dressing</td>
<td>Only for non-exudative wounds</td>
<td></td>
</tr>
<tr>
<td>Hydrogel</td>
<td>Rehydration; promote autolytic debridement, promote granulation</td>
<td>May cause over hydration; Urgent Referral to Vascular</td>
<td></td>
</tr>
</tbody>
</table>

Hydration agents less to more

*(Boulton, 2018; IWGDF Wound Healing Guidelines, 2023)*
## Wound Dressing Options (continued)

<table>
<thead>
<tr>
<th>Drying</th>
<th>Class/category</th>
<th>Indications</th>
<th>Caution/Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Foam (w/wo silicone)</td>
<td>moderately to highly absorbent:</td>
<td>Not recommended for dry eschar nor arterial ulcers</td>
</tr>
<tr>
<td></td>
<td>Alginates</td>
<td>Highly absorbent; exudate</td>
<td>Clean: change &lt; 7days; infected: change QD</td>
</tr>
<tr>
<td></td>
<td>Hydrofibers</td>
<td>Highly absorbent; exudate</td>
<td>Similar to alginates</td>
</tr>
<tr>
<td></td>
<td>Iodophors</td>
<td>Used where infection is of concern</td>
<td>Possibly disrupts Bio-Burden in Wounds</td>
</tr>
<tr>
<td></td>
<td>Cadexemer Iodine</td>
<td>Moderately absorbent</td>
<td>Caution with Thyroid Disease; Non-cytotoxic</td>
</tr>
<tr>
<td></td>
<td>Providine Iodine</td>
<td>Maintain aseptic and dry</td>
<td><strong>Consider Urgent referral to Vascular;</strong> caution with Thyroid Disease; Cytotoxic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>environment for stable eschar</td>
<td></td>
</tr>
</tbody>
</table>

Drying agents less to more
Wound Dressing Steps

1) Make way for healthy tissue
2) Assess and classify the wound for dressing selection
3) Apply agents to mitigate infection
4) Apply dressing
Adjunctive Wound Healing Therapy
Evidence-Based Strategies

- Cell and tissue-based products
  - Cell-based therapies
  - Acellular matrices
  - Placental-derived membranes

- Recombinant growth factors
- Platelet-rich plasma
- Negative pressure wound therapy
- Hyperbaric and topical oxygen

(Boulton, 2018; IWGDF Wound Healing Guidelines, 2023)
Nutrition and Diabetic Foot Ulcers

• Important to address nutritional deficits
• Nutritional interventions may be beneficial
  • Optimize glucose control
  • Ensure adequate protein intake
• Concrete or unified recommendations regarding nutritional supplements are limited due to conflicting published evidence

(Armstrong, 2023; IWGDF Wound Healing Guidelines, 2023)
Off-loading Interventions for Healing Diabetic Foot Ulcers

Off-loading devices and methods

• Non-removable: total contact cast (TCC) or “locked” removable cast walkers (instant TCC)
• Removable: Removable cast walkers; knee high or ankle
• Footwear: half shoes; shoes with modified insoles

(Canada’s Drug and Health Technology Agency [CADTH], 2020)
Total Contact Cast for Off-loading Diabetic Foot Ulcers

• Cast applied and wound assessed every 1-2 weeks
• Caution if PVD, 10% risk of new ulcer
• Healing rates for TCC (70-95%), removable cast boots (22-79%) and half shoes (58%) in Grade 1 or 2 diabetic ulcers

(Boulton, 2018; CADTH, 2020; Lazzarini, 2020; IWGDF Off-loading Guidelines, 2023)
Off-loading Interventions for Healing Diabetic Foot Ulcers

Non-removal off-loading devices are more effective than removal off-loading devices; plantar forefoot or midfoot ulcer healing rate and “time to healing”

- Healing rates for TCC (70-95%), removable cast boots (22-79%) and half shoes (58%) in Grade 1 or 2 diabetic ulcers
- Healing rates with knee-high removable walkers versus ankle-high removable walkers are similar, but patients were less adherent to knee-high walker use

(Boulton, 2018; CADTH, 2020; Lazzarini, 2020; IWGDF Off-loading Guidelines, 2023)
Off-loading Interventions for Healing Diabetic Foot Ulcers (continued)

Barriers to using effective off-loading devices:

- Limited activity, restricted daily activities (restoring normalcy)
- Image and patient preferences
- Cost
IHS Multidisciplinary Foot Care Team

- Health Care Administrator
- Diabetes Educator
- Dietitian / Nutritionist
- Public Health Nurse
- Community Health Representative
- Clinic Receptionist
- Primary Care Provider
- Clinical Nurse Specialist
- Physical Therapist
- Podiatrist
- Vascular Surgeon

Patient

Note: The availability of members of the Foot Care Team may vary among IHS clinics. Referral may be needed for some services or specialists.
Wound, Ostomy and Continence Nurses Certification Board (WOCNB) Certified Foot Care Nurse (CFCN)

- Eligibility Requirements
  - Current RN license, with bachelor’s (or higher) degree
  - Minimum of 24 CE/CME credits specific to foot care within previous 5 years and
  - Minimum of 40 clinical hours under direct supervision of foot care expert
- Certifying exam required

(https://www.wocncb.org/certification/foot-care-certification/eligibility)
American Foot Care Nurses Association
Certified Foot Care Specialist (CFCS)

Available for DNP, NP, BSN, RN, LPN/LVN, OT, PT, DPT, MD, DO

• Continuing education requirement – at least 25 CEs in programs directly related to foot care, within the preceding 2 years
• Completion of 30 hours of direct Hands-on patient foot care, verified by
  • Podiatrist/Proctor
  • Certified Foot Care Nurse Proctor
  • Portfolio Presentation (10 client/patient case studies completed by applicant)
• Successful completion of exam

(https://afcna.org/Certification)
Clinical Pearls of DFU Treatment

• Treat the patient, not the wound.
• Off-loading is the cornerstone of DFU treatment
• Frequent debridement may be necessary to enhance healing
• Recurrent ulcers are common, and often seen at the same location, so it is important to provide ongoing surveillance and appropriate protective footwear
• Multidisciplinary Foot Care Team provides optimal management for wound healing
Part 2-References

  https://jamanetwork.com/journals/jama/fullarticle/2806655


Part 2-References


