



Indian Health Service

**Division of Diabetes
Treatment and Prevention**



Diabetic Foot Care Strategies for Primary Care

Part 2: Podiatry Care and Basic Wound Management

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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.

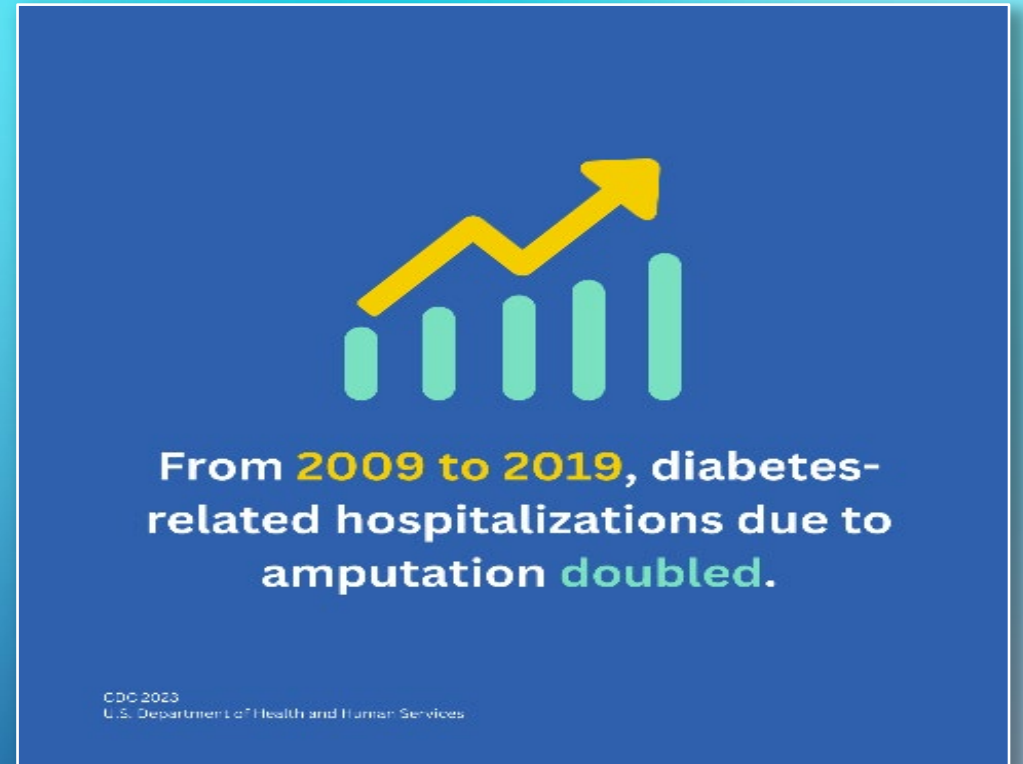
For review: Complete Foot Care Exam video

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.



Preventing Diabetes-Related Complications: Lower Limb 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.



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(CDC Prevent Diabetes Complications-Foot Health. <https://www.cdc.gov/diabetes/library/features/amputations.html>)



Principles of Podiatry Care for People with Diabetes

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



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(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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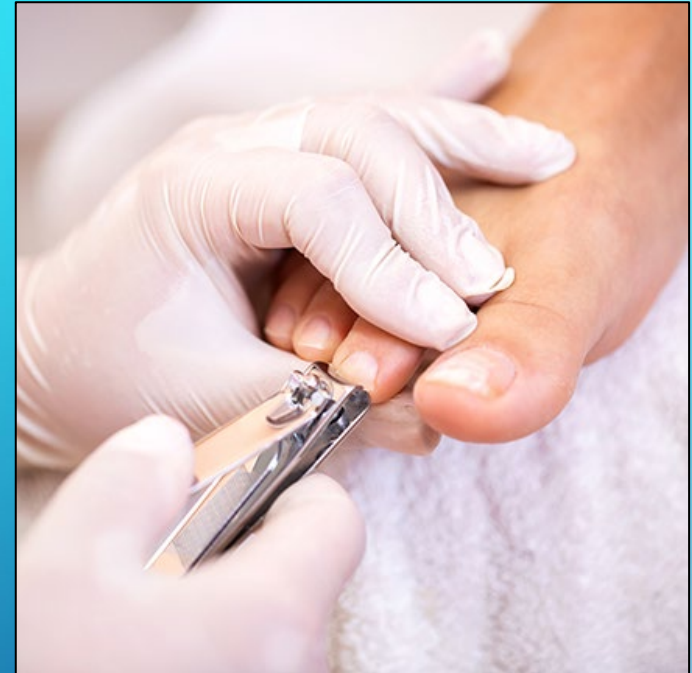
Lubricate Dry Skin

- 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



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



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



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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



Evaluating Patients with DFU SINBAD Classification

Category	Definition	Score
Site	Forefoot	0
	Midfoot and hindfoot	1
Ischemia	At least one palpable pulse	0
	No pulse palpable or signs of reduced perfusion	1
Neuropathy	Intact monofilament sensation	0
	Absent monofilament sensation	1
Bacterial Infection	None present	0
		1
Area	Ulcer < 1 cm ²	0
	Ulcer ≥ 1 cm ²	1
Depth	Ulcer with skin and subcutaneous tissue	0
	Ulcer reaching muscle, tendon, or deeper tissue	1

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



Wound, Ischemia, and Foot Infection (WIFI) Classification of Limb Threat

Figure 2. Wound, Ischemia, and Foot Infection (WIFI) Classification of Limb Threat



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.^a

Wound (W)		
Grade	Ulcer	Gangrene
0	None	None
1	Small, shallow	None
2	Deep with exposed bone, joint, or tendon	Limited to digits
3	Extensive, deep, and involving forefoot and/or midfoot with or without calcaneal involvement	Extensive and involving forefoot and/or midfoot Full thickness heel necrosis with or without calcaneal involvement

Foot infection (fi)	
Grade	Clinical manifestation
0	No symptoms or signs of infection
1	Infection indicated by ≥ 2 of the following: <ul style="list-style-type: none"> 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)
2	Infection as described above with: <ul style="list-style-type: none"> Erythema >2 cm around ulcer Involving structures deeper than skin and subcutaneous tissues (eg, abscess, osteomyelitis, septic arthritis, fasciitis) No signs of systemic inflammatory response (see below)
3	Infection as described above with ≥ 2 signs of systemic inflammatory response syndrome: <ul style="list-style-type: none"> Temperature >38 °C or <36 °C Heart rate >90/min Respiratory rate >20/min or PaCO₂ <32 mm Hg White blood cell count >12 000/μL or <4000/μL or 10% immature forms

Ischemia (I)		
Grade	Ankle-brachial index Ankle systolic pressure	Toe pressure or transcutaneous oximetry
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.

^a A higher score on the Wifi scale³⁸ is associated with lower extremity amputation and morbidity and can be used to determine the need for revascularization. Wifi scores of 1, 2, 3, and 4 were associated with 1-year amputation rates of 0%, 8%, 11%, and 38%, respectively.³⁹ See also Figure 3.



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



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



Table 2. Assessing Ischemia in the Presence of a Diabetic Foot Ulcer

Test	Definition	Sensitivity and specificity (wound healing)	Additional notes
Palpation of pulses ⁴⁵	Palpation of anterior tibial or posterior tibial pulse	35% sensitive; 100% specific	Pedal pulses that are palpable are associated with high probability of healing (relative risk, 2.26; 95% CI, 2.05-2.49).
Ankle-brachial index ⁴⁴	Ankle pressure compared with arm pressure	48% sensitive; 52% specific; diagnostic odds ratio, 1.02 ^a	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.
Toe systolic blood pressure ^{46,47}	Measurement of systolic blood pressure at the toe	86% sensitive; 58% specific	Toe systolic blood pressure <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).
Transcutaneous oximetry ⁴⁴	Measurement of oxygen tension at the skin surface	72% sensitive; 86% specific; diagnostic odds ratio, 15.81 ^a	Transcutaneous oxygen pressure ≥25 mm Hg is associated with higher rates of ulcer healing and high accuracy in predicting ulcer healing and limb amputation.
Skin perfusion pressure ⁴⁵	Measurement of blood pressure required to restore microvascular blood flow after occlusion		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.

^a 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 6. Treatment of Diabetic Foot Ulcers in Cases of Peripheral Artery Disease

Treatment of ischemia	Description	Outcome/benefit
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: ≥ 2 cm of cellulitis and involving subcutaneous tissue
 - Severe: systemic response with signs of fever and leukocytosis
 - Diabetic Foot Osteomyelitis: infection of underlying bone



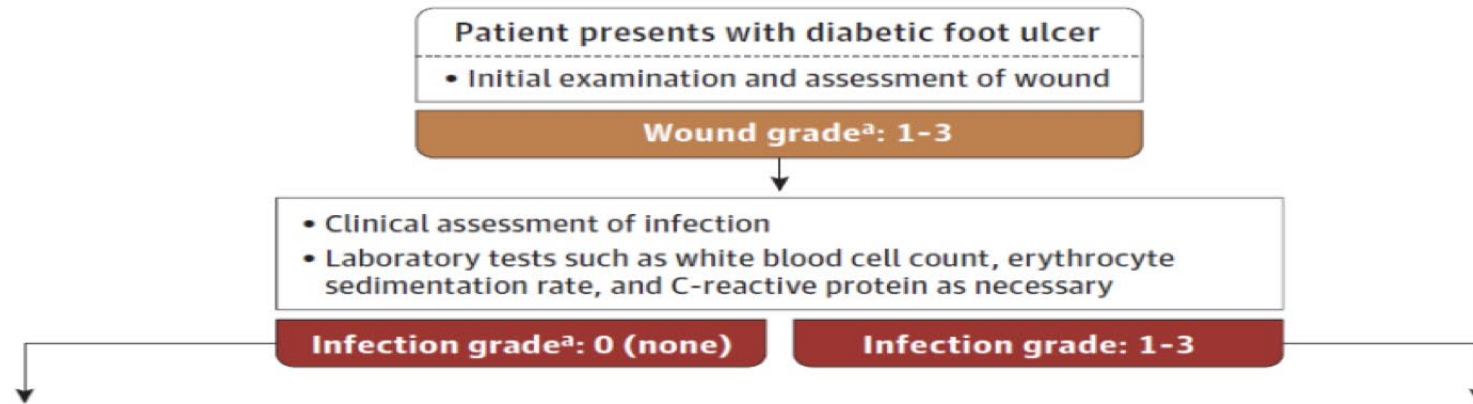
Treat Bone and Soft-Tissue Infection (continued)

- 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.

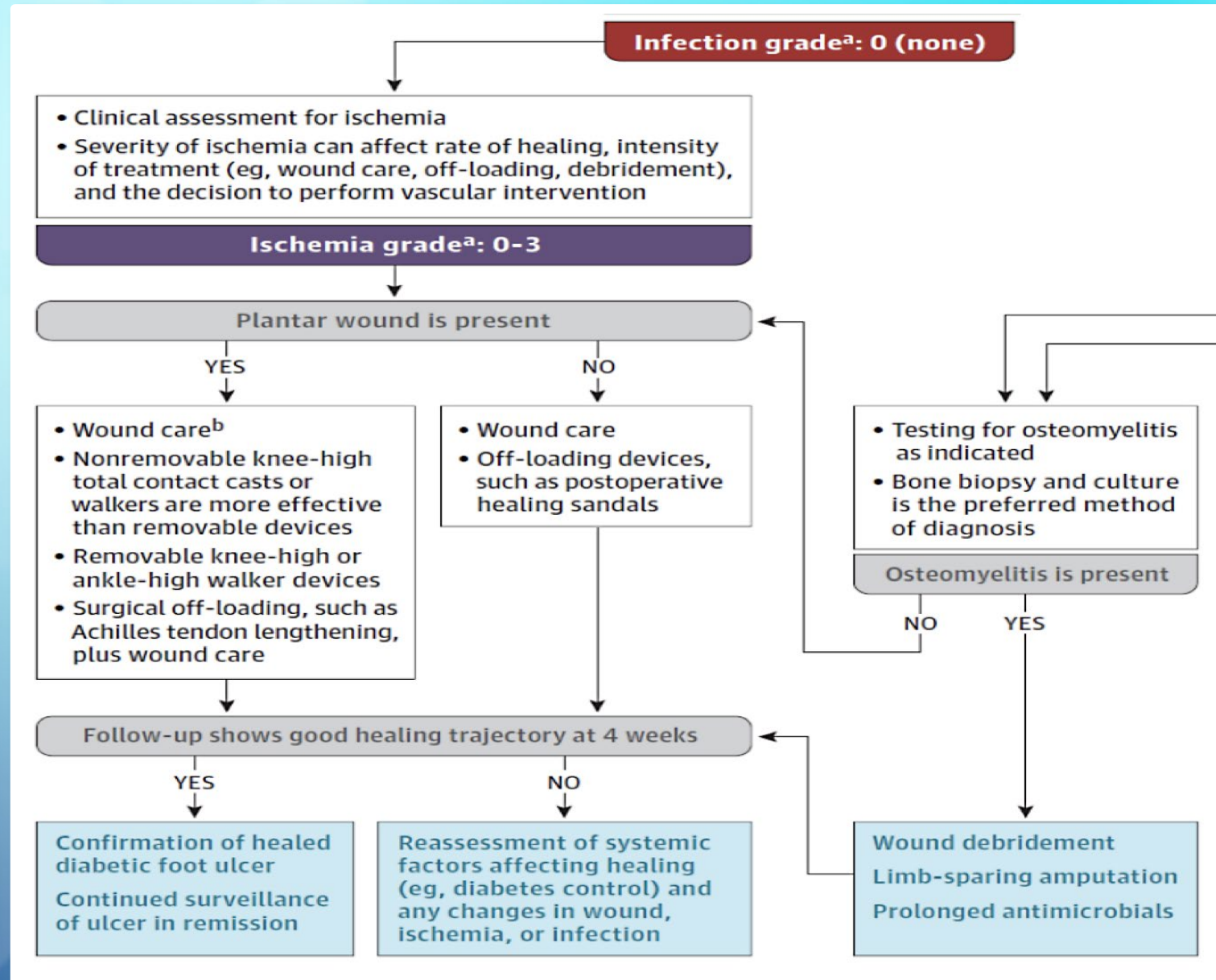


Management of Active Diabetic Foot Complications

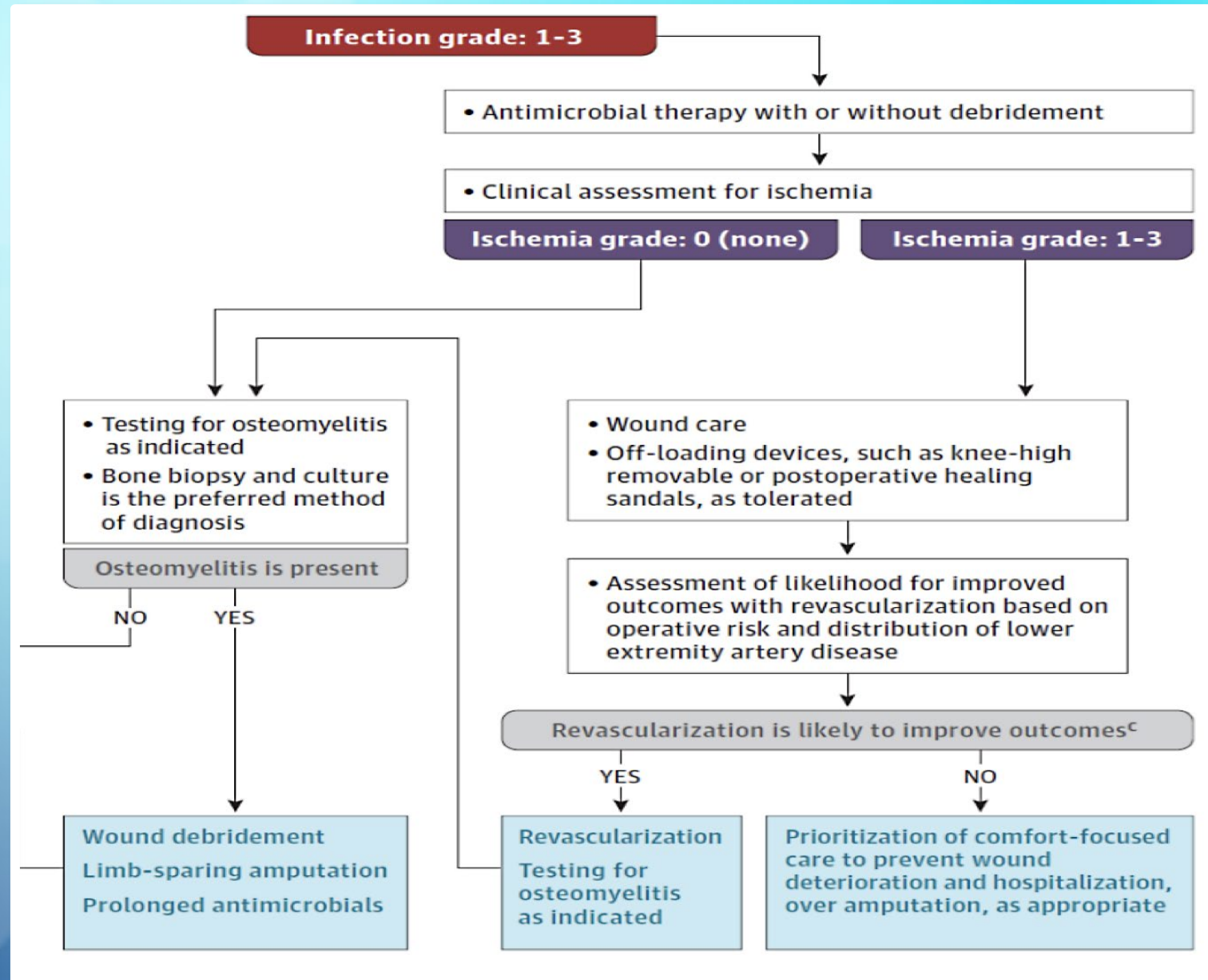
Figure 3. Management of Active Diabetic Foot Complications



Management of Active Diabetic Foot Complications (continued)



Management of Active Diabetic Foot Complications (continued)



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



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



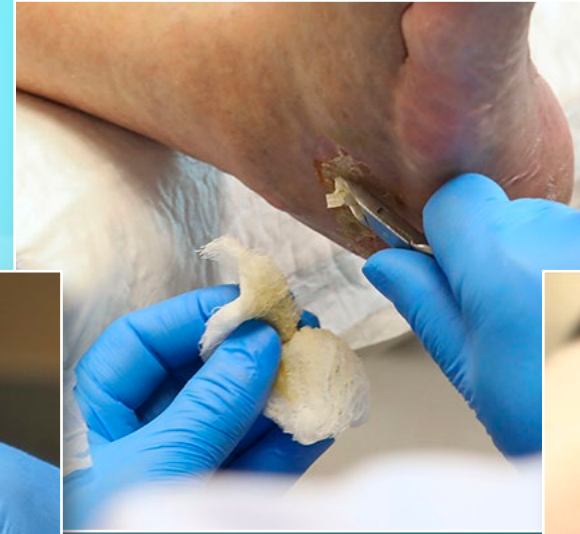
Debridement Steps



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



Wound Dressing Options

Hydration
agents less
to more



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



Wound Dressing Options (continued)

Drying agents less to more



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



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



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



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



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



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



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



Patient

Primary Care Provider

Clinical Nurse Specialist

Physical Therapist

Podiatrist

Vascular Surgeon

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



American Foot Care Nurses Association Certified Foot Care Specialist (CFCFS)

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



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

- Armstrong DG, Tan T, Boulton AJM, Bus SA. Diabetic Foot Ulcers: A Review. *JAMA*. 2023;330(1):62–75. doi:10.1001/jama.2023.10578 <https://jamanetwork.com/journals/jama/fullarticle/2806655>
- Boulton AJM, Armstrong DG, Kirsner RS, et al. *Diagnosis and Management of Diabetic Foot Complications*. Arlington, Va., American Diabetes Association, 2018. <https://www.ncbi.nlm.nih.gov/books/NBK538977/>
- Canada's Drug and Health Technology Agency (CADTH). *Off-loading devices for people with diabetic neuropathic foot ulcers: a rapid qualitative review*. Ottawa. CADTH; 2020 Jun. (CADTH rapid response report: summary with critical appraisal) <https://www.cadth.ca/loading-devices-people-diabetic-neuropathic-foot-ulcers-rapid-qualitative-review>
- IWG on the Diabetic Foot (IWGDF). *IWGDF Guidelines on the prevention and management of diabetic foot disease. Classification Guidelines*. 2023. www.iwgdfguidelines.org <https://iwgdfguidelines.org/classification-2023/>
- IWG on the Diabetic Foot (IWGDF). *IWGDF/IDSA Guidelines on the prevention and management of diabetic foot disease. Infection Guidelines*. 2023. www.iwgdfguidelines.org <https://iwgdfguidelines.org/infection-guideline-2023/>
- IWG on the Diabetic Foot (IWGDF). *IWGDF Guidelines on the prevention and management of diabetic foot disease. Off-loading Guidelines* 2023. www.iwgdfguidelines.org <https://iwgdfguidelines.org/offloading-guideline-2023/>
- IWG on the Diabetic Foot (IWGDF). *IWGDF Guidelines on the prevention and management of diabetic foot disease. PAD Guidelines*. 2023 www.iwgdfguidelines.org <https://iwgdfguidelines.org/pad-guideline-2023/>
- IWG on the Diabetic Foot (IWGDF). *IWGDF Guidelines on the prevention and management of diabetic foot disease. Practical Guidelines*. 2023. www.iwgdfguidelines.org <https://iwgdfguidelines.org/practical-guidelines-2023/>
- IWG on the Diabetic Foot (IWGDF). *IWGDF Guidelines on the prevention and management of diabetic foot disease. Wound Healing Guidelines* 2023. www.iwgdfguidelines.org <https://iwgdfguidelines.org/wound-healing-2023/>



Part 2-References

- Ince P, Zulfiqarali GA, Lutale JK, et al. *Use of the SINBAD Classification System and Score in Comparing Outcomes of Foot Ulcer Management on Three Continents. Diabetes Care* 2008;31:964-967. <https://doi.org/10.2337/dc07-2367>
- Lazzarini PA, Jarl G, Gooday C, et al. *Effectiveness of off-loading interventions to heal foot ulcers in persons with diabetes: a systematic review. Diabetes Metab Res Rev.* 2020;36(S1):e3275. <https://doi.org/10.1002/dmrr.3275>
- Monteiro-Soares M, Russell D, Boyko EL et al on behalf of the IWG on the Diabetic Foot (2020) *Guidelines on the classification of diabetic foot ulcers (IWGDF 2019). Diab Metab Res Rev* 36(S1); e3273 <https://onlinelibrary.wiley.com/doi/10.1002/dmrr.3273>
- Sorber R, Abularrage CJ. Diabetic foot ulcers: *Epidemiology and the role of multidisciplinary care teams. Semin Vasc Surg* 2021;34:47-53. <https://doi.org/10.1053/j.semvascsurg.2021.02.006>

