WOCN® Wound, Ostomy, and Continence Nurses Society®

LOWER-EXTREMITY WOUNDS DUE TO VENOUS DISEASE, ARTERIAL DISEASE, OR DIABETES MELLITUS AND/OR NEUROPATHIC DISEASE

CLINICAL RESOURCE GUIDE

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Contributors

Originated By:

Wound Committee, Wound, Ostomy and Continence Nurses™ Society (WOCN®)

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Updated/Revised:

April 2013: Wound Committee, WOCN Society

September 2017: Phyllis A. Bonham, PhD, MSN, RN, CWOCN, DPNAP, FAAN
Clinical Editor, WOCN Society
Chair, Wound Guidelines Task Force, WOCN Society

November 2019: Phyllis A. Bonham, PhD, MSN, RN, CWOCN, DPNAP, FAAN
Chair, Wound Guidelines Task Force, WOCN Society

December 2021: Phyllis A. Bonham, PhD, MSN, RN, CWOCN, DPNAP, FAAN
Chair, Wound Guidelines Task Force, WOCN Society

Introduction

This Clinical Resource Guide (CRG) updates the previous document, *Venous, Arterial, and Neuropathic Lower-Extremity Wounds: Clinical Resource Guide* (WOCN, 2019a). The CRG is a synopsis of content derived from the WOCN Society's Clinical Practice Guideline Series for managing lower-extremity (LE) wounds due to venous disease, arterial disease, or diabetes mellitus (DM) and/or neuropathic disease (ND). The relevant sections of the CRG are updated along with each publication of a new/updated Clinical Practice Guideline.

Refer to the complete version of each of the WOCN Society's Clinical Practice Guidelines for more detailed, evidence-based information about the management of lower-extremity wounds (WOCN 2014, 2019b, 2021): The guidelines are available in print or electronically from the WOCN Society's Bookstore (www.wocn.org/bookstore):

- *Guideline for Management of Wounds in Patients with Lower-Extremity Arterial Disease* (2014).
- *Guideline for Management of Wounds in Patients with Lower-Extremity Venous Disease* (2019b).
- *Guideline for Management of Patients with Lower-Extremity Wounds Due to Diabetes Mellitus and/or Neuropathic Disease* (2021).

Purpose

This CRG provides an overview of key assessment parameters and typical clinical characteristics for the three most common types of LE wounds due to venous disease, arterial disease, or DM/ND including: history/risk factors; comorbid conditions; wound location, characteristics, and surrounding skin and nails; complications; perfusion/sensation (i.e., pain, peripheral pulses, common noninvasive vascular tests, and screening for loss of protective sensation [LOPS]). In addition, the CRG includes a summary of key management strategies: measures to improve venous return and tissue perfusion; measures to prevent trauma; goals, considerations, and options for topical therapy; adjunctive therapies; and indications for referral to other health-care providers for additional evaluation and treatment.

Lower-Extremity (LE) Wounds Due to Venous Disease, Arterial Disease, or Diabetes Mellitus (DM) and/or Neuropathic Disease (ND): Clinical Resource Guide

LE Wounds Due to Venous Disease (WOCN, 2019)	LE Wounds Due to Arterial Disease (WOCN, 2014)	LE Wounds Due to DM/ND (WOCN, 2021)
Assessment: History/Risk Factors		
● Older age (> 50 years of age). ● High body mass index (BMI); obesity. ● Female sex; pregnancies (multiple or close together). ● Simultaneous insufficiency of two out of three venous systems; venous reflux/obstruction. ● Previous leg surgery; leg fractures. ● Impaired calf muscle pump. ● Restricted range of motion of the ankle; greater dorsiflexion of the ankle. ● Varicose veins. ● Family history of venous disease. ● Previous venous leg ulcer (VLU). ● Systemic inflammation. ● Venous thromboembolism (VTE): pulmonary embolus, deep vein thrombosis (DVT), thrombophlebitis, post-thrombotic syndrome. ● Injection drug use. ● Sedentary lifestyle or occupation; reduced mobility; prolonged sitting or standing. ● Triggers for VLUs: Cellulitis; trauma (e.g., penetrating injury, burns); contact allergic dermatitis; rapid onset of leg edema; dry skin/itching; insect bites.	● Advanced age. ● Tobacco use. ● DM ● Hyperlipidemia. ● Hypertension. ● Elevated homocysteine. ● Chronic renal insufficiency. ● Family history of cardiovascular disease. ● Ethnicity. ● Persistent *Chlamydia pneumoniae* infection. ● Periodontal disease.	● Long duration of DM (> 5 or 10 years). ● Age > 45 years; male sex. ● Poor glycemic control, elevated hemoglobin A1c (HbA1c), insulin use, and use of insulin plus hypoglycemic drugs. ● Loss of protective sensation (LOPS), foot deformities, Charcot foot/fracture, footwear trauma, previous history of diabetic foot ulcer (DFU), and improper foot care and callus management. ● LEAD. ● Underlying infection; onychomycosis. ● Limited range of motion of the metatarsophalangeal joint and ankle; altered gait; increased plantar pressure. ● Amputation of the contralateral leg; transtibial amputation/wearing a below-knee prosthesis. ● Hypertension, cardiovascular autonomic dysfunction, prior stroke, nephropathy, retinopathy, and elevated BMI. ● Tobacco use. ● Depression. ● Biomarkers associated with the risk of DFUs: Elevated cystatin and osteoprotegerin. ● Biomarkers associated with increased wound severity and risk of amputation: Elevated levels of fibrinogen, C-reactive protein (CRP), white blood cells (WBCs), and neutrophils; decreased bilirubin levels.
Assessment: Comorbid Conditions		
● Cardiovascular disease. ● Hypertension. ● Lymphedema.	● Cardiovascular disease; cerebrovascular disease; vascular procedures or surgeries. ● Sickle cell anemia.	● Peripheral neuropathy. ● LEAD. ● Kidney disease; renal failure.

● Rheumatoid arthritis. ● Lower-extremity arterial disease (LEAD). ● DM.	● Obesity; metabolic syndrome. ● Arthritis; spinal cord injury; migraine; atrial fibrillation; human immunodeficiency virus. ● Low testosterone.	● Obesity. ● Cardiac disease.
Assessment: Wound Location		
The most typical location is superior to the medial malleolus, but wounds can be anywhere on the lower leg including back of the leg/posterior calf.	Areas exposed to pressure, repetitive trauma, or rubbing from footwear are the most common locations: ● Lateral malleolus. ● Mid-tibial area (shin). ● Phalangeal heads, toe tips, or web spaces. ● Heels.	Common locations include: ● Pressure points/sites of painless trauma/repetitive stress; over bony prominences (e.g., heels). ● Plantar foot surface is the most typical location. ● Forefoot: o Dorsal and distal aspects of toes, interdigital areas, and interphalangeal joints, particularly the hallux. o Metatarsal heads (commonly first metatarsal head). ● Midfoot plantar surface: Collapse of midfoot structures with “rocker-bottom foot” suggests Charcot fracture.
Assessment: Wound Characteristics		
● Base: Ruddy red; granulation tissue and/or yellow adherent fibrin or loose slough may be present. ● Size: Variable; can be large. ● Depth: Usually shallow. ● Edges: Irregular; epibole (rolled edges) may be present; undermining or tunneling are uncommon. ● Exudate: Moderate to heavy; character of exudate varies. ● Infection: Not common.	● Base: Pale; granulation rarely present; necrosis common; eschar may be present. ● Size: Variable; often small. ● Depth: May be deep. ● Edges: Rolled; smooth; punched-out appearance; undermining may be present. ● Exudate: Minimal. ● Infection: Frequent (signs may be subtle). ● Pain: Common. ● Nonhealing; wound often precipitated by minor trauma.	● Base: Pale or pink; necrosis/eschar may be present. ● Size: Variable. ● Depth: Varies; partial thickness to bone involvement. ● Edges: Typically well-defined; smooth; epibole may be present; undermining may be present. ● Shape: Usually round or oblong; might resemble a laceration, puncture, or blister if from trauma, shearing, or heat; fissures. ● Exudate: Usually small to moderate; large amount of exudate may indicate venous disease, heart failure, renal failure/insufficiency, or infection; foul odor and purulence indicate infection.
Assessment: Surrounding Skin		
● Edema: Pitting or nonpitting; worsens with prolonged standing or sitting with legs dependent. ● Scarring from previous wounds. ● Ankle flare; varicose veins. ● Hemosiderosis (i.e., brown staining); hyperpigmentation; lipodermatosclerosis.	● Pallor on elevation. ● Dependent rubor. ● Shiny, taut, thin, dry, and fragile. ● Hair loss on the LE. ● Atrophy of skin, subcutaneous tissue, and muscle. ● Edema: Atypical of arterial disease;	● Anhidrosis; xerosis; fissures; maceration; tinea pedis. ● Callus over bony prominences (might cover a wound) and/periwound; hemorrhage into a callus indicates ulceration underneath. ● Musculoskeletal/structural foot and toe deformities. ● Erythema and induration may indicate

● Atrophie blanche (i.e., smooth white plaques). ● Maceration; crusting; scaling; itching. ● Temperature: Normally warm to touch. ● Localized elevation of skin temperature (1.2 °C higher), measured with a noncontact infrared thermometer, may indicate inflammation.	localized edema may indicate infection. ● Temperature: Skin feels cool to touch.	infection/cellulitis. ● Edema: Might be related to heart failure, nephropathy, or venous insufficiency. Unilateral edema with increased erythema, warmth, and a bounding pulse may indicate Charcot fracture. ● Temperature: Localized elevation of skin temperature > 2 °C, measured with an infrared dermal thermometer, compared to an unaffected site indicates inflammation. (Continued) ● Cutaneous manifestations of DM may occur on legs (i.e., diabetic dermopathy, necrobiosis lipoidica, bullosis diabeticorum).
Assessment: Nails		
N/A	● Dystrophic.	● Atrophy or hypertrophy. ● Onychomycosis; paronychia.
Assessment: Complications		
● Venous eczema/dermatitis (e.g., erythema, itching, vesicles, weeping, scaling, crusting, afebrile). ● Infection/Cellulitis (e.g., pain, erythema, swelling, induration, bullae, desquamation, fever, leukocytosis); tinea pedis. ● Variceal bleeding. ● VTE, DVT. ● Mixed venous and arterial disease.	● Infection/Cellulitis (e.g., pain, edema, periwound fluctuance; or only a faint halo of erythema around the wound). ● Osteomyelitis. ● Gangrene.	● Infection/Cellulitis. ● LEAD. ● Osteomyelitis. ● Charcot fracture: Swelling, erythema, localized temperature elevation ≥ 2 °C compared to an unaffected area/contralateral limb; pain may or may not be present; and in the absence of LEAD, pulses are present and may be bounding. ● Gangrene.
Assessment Perfusion/Sensation of the LE: Pain		
● Leg pain may be variable (e.g., severe, throbbing). o Pain may be accompanied by complaints of leg heaviness, tightening, or aching. o Leg pain worsens with dependency. o Elevation relieves pain. ● Differentiate venous claudication from arterial, ischemic claudication: o Venous claudication: Exercise-related leg pain due to venous outflow obstruction; occurs in the absence of arterial disease; is relieved by leg elevation.	● Intermittent claudication: Cramping, aching, fatigue, weakness, and/or pain in the calf, thigh, or buttock that occurs after walking/exercise; is typically relieved with 10 minutes rest; is a classical sign; indicates 50% vessel occlusion. ● Resting, positional, or nocturnal pain may be present; resting pain indicates 90% of the vessel is occluded. ● Leg elevation exacerbates pain. ● Leg dependency relieves pain. ● Neuropathy and paresthesia may occur	● Pain may be superficial or deep, constant aching or stabbing, dull or sharp, burning or cool burning, and/or with shooting sensations. ● Altered sensation not described as pain (e.g., numbness, warm, cool, prickling, tingling, pins-and-needles sensations, electric shock sensation) may occur in a “stocking glove” pattern. ● Nocturnal pain in LEs may occur. ● Allodynia or intolerance to touch: Abnormal or increased sensitivity to normally painless stimuli (e.g., bed sheets touching legs). ● Hyperalgesia: An abnormally exaggerated response

o Arterial, ischemic claudication/pain: Cramping, aching, fatigue, weakness, and/or pain in the calf, thigh, or buttock that occurs after walking/exercise, and is typically relieved with 10 minutes rest; pain is increased by leg elevation and alleviated by dependency of the limb.	from ischemic nerve dysfunction. ● Acute limb ischemia: A sudden onset of the 6 P's (i.e., pain, pulselessness, pallor, paresthesia, paralysis, and polar [coldness]) indicates an acute embolism; warrants an immediate referral to a vascular surgeon. ● Critical limb ischemia (CLI): Chronic rest pain; rest pain of the forefoot/toes. Ischemic nonhealing wounds or gangrene are limb threatening with a high mortality rate and warrant referral to a vascular surgeon.	to painful stimuli. ● Sensation of pain in head, neck, and trapezius region (coat-hanger ache) related to orthostatic hypotension from autonomic neuropathy. ● Numbness and LOPS with inability to sense pain or temperature changes may occur.
Assessment Perfusion/Sensation of the LE: Peripheral Pulses		
● LE pulses are present and palpable. ● *Note:* Presence of palpable pulses does not rule out LEAD, nor does absence of palpable pulses indicate LEAD; especially, if edema is present, which makes palpation difficult and often inaccurate	● LE pulses are absent or diminished (i.e., dorsalis pedis, posterior tibial). ● Femoral or popliteal bruits may be heard. ● *Note:* Presence of palpable pulses does not rule out LEAD, nor does absence of palpable pulses indicate LEAD; especially, if edema is present, which makes palpation difficult and often inaccurate.	● LE peripheral pulses are generally present and palpable; can be bounding in the acute phase of Charcot foot. ● If coexisting LEAD is present: LE pulses (i.e., dorsalis pedis, posterior tibial, femoral, popliteal) are absent or diminished. ● *Note*: Presence of palpable pulses does not rule out LEAD, nor does absence of palpable pulses indicate LEAD; especially, if edema is present, which makes palpation difficult and often inaccurate.
Assessment Perfusion/Sensation of the LE: Common Noninvasive Vascular Tests		
● Capillary refill: Delayed capillary refill may be present (> 3 seconds). ● Venous refill time may be prolonged (> 20 seconds). ● Ankle-brachial index (ABI): Commonly within normal limits (1.00–1.30). ● Duplex scanning with ultrasound: Most reliable noninvasive test to diagnose anatomical and hemodynamic abnormalities and detect venous reflux.	● Capillary refill: Abnormal (> 3 seconds). ● Venous refill time: Prolonged (> 20 seconds). ● ABI values/interpretation: o Noncompressible arteries: Unable to obliterate the pulse signal at cuff pressure > 250 mmHg; indicates calcified arteries. o Elevated: > 1.30. o Normal: ≥ 1.00 o LEAD: ≤ 0.90. o Borderline perfusion: ≤ 0.60–0.80. o Severe ischemia: ≤ 0.50. o Critical ischemia: ≤ 0.40. ● Transcutaneous oxygen (TcPO2): < 40 mmHg is hypoxic; < 30 mmHg is CLI. ● Toe brachial index (TBI): < 0.64 indicates	● LEAD often coexists with DM/ND disease. ● ABI can be elevated > 1.30, or arteries can be noncompressible. In such cases, a TP or TBI is indicated. ● TBI: TBI cutoff values indicating LEAD vary from < .60 to < .70; < 0.64 is a commonly cited indicator of LEAD based on early studies and angiography. ● TP: < 30 mmHg indicates severe ischemia/CLI, and is associated with failure to heal. ● TcPO2: < 40 mmHg is hypoxic; < 30 mmHg indicates severe ischemia/CLI. ● Pulse volume recordings: o Normal signals are triphasic. o Abnormal signals are biphasic, monophasic, nonpulsatile, or absent in presence of LEAD.

	LEAD. ● Toe pressure (TP): < 30 mmHg indicates CLI.	
Assessment Perfusion/Sensation of the LE: Screening for LOPS		
● Test for LOPS using a 10-g monofilament. ● Assess the ability to sense/perceive vibration using a 128-Hz tuning fork. ● Check deep tendon reflexes at the ankle and knee with a reflex/percussion hammer. ● Inability to feel the monofilament, diminished perception of vibration, and diminished reflexes indicate a LOPS and an increased risk of wounds.	● Test for LOPS with a 10-g monofilament. ● Assess the ability to sense/perceive vibration using a 128-Hz tuning fork. ● Check deep tendon reflexes at the ankle and knee with a reflex/percussion hammer. ● Inability to feel the monofilament, diminished perception of vibration, and diminished reflexes indicate a LOPS and an increased risk of wounds.	● Test for LOPS with a 10-g monofilament. ● Assess the ability to sense/perceive vibration using a 128-Hz tuning fork. ● Check deep tendon reflexes at the ankle and knee with a reflex/percussion hammer. ● Inability to feel the monofilament, diminished perception of vibration, and diminished reflexes indicate LOPS and an increased risk of wounds.
Measures to Improve Venous Return	**Measures to Improve Tissue Perfusion**	
● Use compression therapy: 30–40 mmHg compression at the ankle if ABI is ≥ than 0.80: o Multicomponent compression systems are more effective than single-component systems; systems with an elastic bandage are more effective than those with only inelastic components. o Use highest level of compression that patients can tolerate and comply with. o Consider intermittent pneumatic compression for patients who are immobile, need higher levels of compression than can be provided by wraps or stockings, or are intolerant of stockings or bandaging systems. o Do not rely on antiembolism stockings/hose that provide low pressure (≤ 20 mm Hg) and are not designed for therapeutic compression to prevent or treat LEVD or VLUs. ● Instruct patient/caregivers to: o Use life-long compression to reduce/prevent VLUs and VLU	● Revascularize if possible. ● Use antiplatelets to improve blood cell movement through narrowed vessels. ● Instruct patient/caregivers to: o Change lifestyle: Stop tobacco use; avoid secondhand smoke, restrictive garments, and cold temperatures. o Maintain proper hydration/nutrition. o Maintain legs in a neutral or dependent position. o Increase physical activity: Walking; supervised exercise 30–45 minutes, three times per week. o Control or reduce weight if obese.	● Revascularize if ischemic. ● Consider medications, as indicated, such as an antiplatelet (cilostazol). ● Instruct patient/caregivers to: o Stop tobacco use. o Maintain tight glucose/glycemic control; control hypertension. o Reduce weight if overweight or obese. o Perform Buerger's exercise. o Wiggle the toes and rotate the ankles up and down two to three times per day. o Engage in moderate exercise such as walking that is adapted to prevent injury (150 minutes per week).

recurrence. o Elevate legs above heart level: 30 minutes, four times per day; increase exercise (e.g., walking, calf muscle exercise, toe lifts, ankle flexion). o Avoid constricting garments, crossing legs, prolonged standing, and high-heeled shoes. o Stop tobacco use; manage weight; healthy nutrition.		
Measures to Prevent Trauma		
● Screen patients for LEAD by Doppler-derived ABI prior to application of compression stockings/bandages/wraps. ● Mixed venous/arterial disease: o Use reduced compression (23–30 mmHg) for patients with LEVD, wounds, and edema if ABI is < 0.80 and ≥ 0.50. (Continued) o Do not apply compression if ABI is < 0.50, ankle pressure is < 70 mmHg, or TP is < 50 mmHg.	● Use reduced compression (23–30 mmHg) for mixed venous/arterial disease if the ABI is < 0.80. ● Do not apply compression if ABI is < 0.50, ankle pressure is < 70 mmHg, or TP is < 50 mmHg. (Continued) ● Instruct patient/caregivers to: o Use proper footwear; wear socks/stockings with shoes; obtain professional nail/callus care. o Use pressure redistribution/offloading products/devices for heels, toes, and bony prominences; especially, if bedbound or chairbound. o Avoid chemical, thermal, and mechanical injury (e.g., no bare feet even in the house; no hot soaks or heating pads; no medicated corn pads). o Self-inspect the lower extremities daily; promptly report injuries to the health-care provider.	● Off-load/ protect the foot with an ulcer with an appropriate modality according to the location of the wound and the presence of any contraindicating factors. o Plantar ulcer: Use a nonremovable total contact cast (TCC) or an instant TTC (i.e., a removable cast walker rendered nonremovable). (Continued) If a nonremovable knee-high off-loading device is contraindicated/not tolerated, consider a removable knee-high or ankle-high off-loading device. o Nonplantar ulcer: Use footwear that relieves pressure off the ulcer (i.e., surgical sandal, heel-relief shoe, removable ankle-high off-loading device, footwear modifications, toe spacers, orthoses). ● Avoid nonremovable, off-loading devices, or use them with caution along with close monitoring in the following circumstances: o Severe LEAD (ABI < 0.50, TcPO2 < 20 mmHg, history of revascularization). o Active wound infection/sinus tract with deep extension into the foot, which requires daily access for wound care. o Elderly or those at risk for falls or unstable gait. o Individuals with cast claustrophobia, a history of

		nonadherence to treatment, fluctuating leg edema, or active skin disease. o A lack of adequately trained/experienced staff for application of nonremovable devices. ● Instruct patient/caregivers to: o Obtain routine professional nail/callus care. o Use pressure redistribution/offloading products/devices for heels, toes, and bony prominences; especially, if bed or chairbound. o Always wear proper footwear with socks/stockings. o Avoid chemical, thermal, and mechanical injury: No barefoot walking; no hot soaks/heating pads, or medicated corn pads. o Self-inspect the legs/feet daily; promptly report any injuries to the health-care provider. o Self-monitor skin temperature of feet for signs of inflammation with an infrared dermal thermometer. If the difference is > 2 °C between similar regions on the feet on two consecutive days: Reduce ambulation, off-load the affected foot, and notify the health-care provider for further diagnosis and treatment. (Continued) o Self-assess for LOPS using a 10-g monofilament. Test at least four sites (i.e., first, third, and fifth metatarsal heads, and plantar surface of the distal hallux) on each foot. o If monofilaments are not available, instruct patient to determine if they can feel 1–2 seconds of light touch from a caregiver's index finger on the tips of the first, third, and fifth toes of each foot.
Topical Therapy: Goals		
● Reduce and control edema. ● Promote wound healing; prevent recurrence. ● Maintain moist wound surface. ● Attain/maintain intact skin: Protect the periwound skin from drainage;	● Prevent trauma/injury. ● Prevent, promptly identify, and manage complications (e.g., infection/cellulitis, etc.). ● Promote wound healing. ● Minimize pain. ● Preserve limb.	● Protect the wound. ● Prevent, minimize trauma/injury. ● Promote wound healing. ● Control exudate and odor. ● Prevent maceration. ● Control pain and promote comfort.

absorb/manage exudate. ● Prevent trauma/injury. ● Prevent, promptly identify, and manage complications (e.g., venous eczema/dermatitis, infection/cellulitis, variceal bleeding, etc.). ● Reduce pain. ● Improve functional status and quality of life.		● Promptly identify and treat infection. ● Promote self-care practices. ● Improve functional status and quality of life. ● Promote limb preservation.
Topical Therapy: Considerations/Options		
● Treat infection: Use culture-guided antibiotic/antimicrobial therapy. o Consider topical antimicrobial/antiseptics for localized, superficial infection (i.e., silver-based dressings; cadexomer iodine). o Deep tissue infection/cellulitis warrants culture-guided systemic treatment. ● Remove devitalized tissue with an appropriate method of debridement. ● Consider debridement if biofilm is suspected. ● Cleanse wound and skin with noncytotoxic cleansers. ● Use absorptive dressings to control exudate. ● Avoid known skin irritants and allergens, tapes, and adhesives in patients with venous eczema/ dermatitis. (Continued) ● Patch test individuals with known sensitivities and delayed healing prior to use of new products. ● Consider use of barrier products to protect the periwound skin from excessive drainage and maceration. ● Identify and treat venous eczema/dermatitis (i.e., topical steroid 1–2 weeks). ● Use emollients to manage dry, scaly skin. ● Consider topical anesthetics for painful	● Avoid occlusive dressings: Use dressings that permit easy, frequent visualization of the wound. ● Aggressively treat infection. ● *Dry, noninfected wounds with stable, fixed eschar, necrosis; or a stable blister*: o Maintain, keep dry, protect, no debridement. o Assess perfusion status and signs of infection. ● *Infected, necrotic wounds*: o Refer for revascularization/surgical removal of necrotic tissue and antibiotic therapy. **o** Do not rely on topical antibiotics as the sole therapy to treat infected, ischemic wounds. (Continued) **o** Promptly institute culture-guided systemic antibiotics for patients with CLI and evidence of limb infection or cellulitis, and/or infected wounds. ● *Open/draining wounds with necrotic tissue:* Consider a closely monitored trial of autolytic or enzymatic debridement. ● *Open/draining wounds with exposed bones or tendons:* Consider a carefully monitored	● Use dressings that maintain a moist wound surface, absorb exudate, and allow easy visualization of the wound. ● Consider use of collagen or hyaluronic acid dressings that might promote healing. ● Avoid prophylactic or routine use of systemic or topical antimicrobials and antiseptics. ● Aggressively treat diabetic foot infection (DFI) and cellulitis: o Use culture-guided antibiotic/antimicrobial therapy. o Consider a short course of a topical antimicrobial agent to decrease bacterial levels for ulcers with > 10^5 colony forming units per gram of tissue after debridement; discontinue the antimicrobial agent after the bacteria load is decreased to minimize cytotoxic effects and the emergence of resistant organisms. (Continued) o Consider a short course of treatment with silver-based dressings for patients with clinical signs/symptoms of a localized wound infection. o Use systemic antibiotics for acute DFIs not confined to the wound with deep tissue infection or cellulitis. ● Debride focal callus to reduce pressure. ● Debride avascular/necrotic tissue after adequate perfusion has been established with an appropriate method of debridement. Provide appropriate pain

wound care/debridement (i.e., lidocaine; lidocaine and prilocaine mixture). ● Consider use of analgesic-containing dressings to reduce wound pain such as ibuprofen-releasing dressings.	trial of moist, nonocclusive, absorbent, dressings. ● *Open/draining, nonnecrotic wounds:* Consider moist wound healing with nonocclusive, absorbent dressings.	management for debridement if the patient has intact sensation. ● Maintain dry, stable eschar on non-infected, ischemic wounds. ● Provide biofilm-based wound care if indicated (i.e., wound fails to heal despite proper care; prolonged slough/necrosis; persistent signs of local infection or inflammation; wound not responding to topical or systemic antimicrobial therapy). Initiate treatment with a combination of aggressive surgical or conservative sharp debridement of biofilms and topical antibiofilm treatments that have been shown in laboratory or clinical studies to be effective at killing biofilm bacteria. ● Treat fungal infection with oral terbinafine; educate patients to wash their feet and toes daily with soap; wash well between each toe four to five times; dry the feet and toes completely.
Adjunctive Therapy		
● Consider medications to promote VLU healing: pentoxifylline, sulodexide, or doxycycline. ● Electrical therapy. ● Negative pressure wound therapy. ● Ultrasound (i.e., high-frequency ultrasound; noncontact low-frequency ultrasound). ● Consider invasive and noninvasive surgical procedures to improve VLU healing and reduce VLU recurrence (i.e., surgery; subendoscopic perforator surgery; skin grafts; biological dressings; human skin equivalents; hair follicle grafts; thermal or nonthermal ablation of varicose veins).	● Use medications to control hypertension, hyperlipidemia, homocysteine levels, and diabetes. ● Arterial flow augmentation (i.e., intermittent pneumatic compression). ● Electrotherapy. ● Low-frequency ultrasound. ● Hyperbaric oxygen therapy. ● Spinal cord stimulation, lumbar sympathectomy, or peridural anesthesia for intractable pain in patients not suitable for surgery. (Continued) ● Bone-marrow-derived, mononuclear cell therapy for pain relief/limb salvage in patients not suitable for surgery. ● Immune modulation therapy for patients with claudication or CLI.	● Hyperbaric oxygen therapy. ● Skin and tissue substitutes/replacements. ● Negative pressure wound therapy. ● Platelet-derived growth factor. ● Electrical stimulation. ● Surgical debridement. ● Surgical implantation of antibiotics (e.g., vancomycin; gentamycin) for osteomyelitis. ● Pain management: o Consider use of acetyl-L-carnitine as a supplement to help alleviate neuropathic pain. (Continued) o For initial treatment of neuropathic pain, use medications such as the antidepressant duloxetine, anticonvulsants (i.e., pregabalin, gabapentin), or topical anesthetics (e.g., lidocaine creams, patches). o *Note:* The U.S. Food and Drug Administration warns that serious breathing difficulties may occur

		when using gabapentin or pregabalin with other medicines that depress the central nervous system (such as opioids) in patients who have underlying respiratory problems, and/or in the elderly. o For acute severe pain, consider short-term treatment with a combination of oral nortriptyline–morphine. o Avoid opioids for chronic pain. o Consider spinal cord stimulation for chronic neuropathic pain.
Indications for Referral to Other Health-Care Providers for Additional Evaluation and Treatment		
● Dermatology referral for unresponsive eczema/ dermatitis after 1–2 weeks of treatment with a topical steroid. ● Vascular/surgical referral for: o Infection/Cellulitis. o Nonhealing wound after 4 weeks of appropriate therapy. o VTE, DVT. o Variceal bleeding. o Intractable pain. o Atypical appearance or location of wound.	● Vascular/surgical referral for: o Infected, ischemic wounds: Clinical signs of infection/cellulitis. o Suspected osteomyelitis (e.g., probe to the bone). o Atypical appearance or location of wound. o Intractable pain. o Wounds and/or edema in mixed venous/arterial disease that fail to respond to compression therapy or worsen. o Absence of both dorsalis pedis and posterior tibial pulses. o ABI < 0.90 plus one or more of the following: Wound fails to improve with 2–4 weeks of appropriate therapy; severe ischemic pain; and/or intermittent claudication. o ABI < 0.50. o ABI > 1.30 or noncompressible arteries. ● Urgent vascular/surgical referral for symptoms of acute limb ischemia; CLI (ABI < 0.40; ankle pressure < 50 mmHg; TP < 30 mmHg; TcPO2 < 30 mmHg); and/or gangrene.	● Refer patients with LOPS who use tobacco to foot care specialists, and for education and counselling for tobacco cessation. ● Refer patients with gait abnormalities to a qualified pedorthic professional for shoe or device customization. ● Vascular/surgical referral for: o Severe infection/cellulitis; suspected osteomyelitis. o Moderate infection complicated by extensive gangrene, necrotizing infection, signs suggesting deep (below the fascia) abscess or compartment syndrome, or severe lower limb ischemia. o Persistent biofilm. o Atypical appearance or location of wound. o Nonhealing wound despite proper treatment. o Symptoms/new onset of Charcot fracture. o Charcot deformities that have failed other treatment. o ABI > 1.30 or noncompressible arteries. ● Consider revascularization (angioplasty or bypass): oPatients with LEAD and a DFU that is not healing within 4–6 weeks of optimal care. oConsider an urgent revascularization for a patient with a TP < 30 mmHg, ankle pressure < 50 mmHg, ABI < 0.50, or TcPO2 < 25 mmHg. (Continued) ● Urgent vascular/surgical referral for symptoms of

		acute limb ischemia, CLI, and/or gangrene. ● Consider use of skin grafts for superficial wounds or flaps for full-thickness wounds on weight-bearing surfaces with exposed tendon, bone, vessels, or joints, ● Consider hospitalization for patients with DM and a severe DFI, and for those with a moderate DFI plus other complex or significant morbidities. ● Refer patients with intractable and/or severe pain for an evaluation by pain specialists and/or a surgical consult to determine if they would benefit from medications, spinal cord stimulation, or nerve decompression surgery. ● Refer patients with anxiety, depression, or mental/psychological issues to appropriate health-care providers.

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