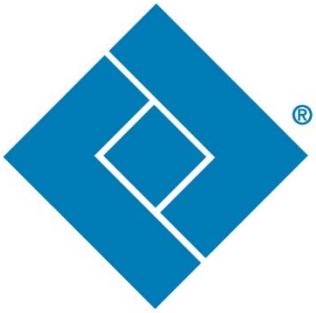
Venous, Arterial, and Neuropathic Lower-Extremity Wounds: Clinical Resource Guide



Wound Ostomy and Continence Nurses Society®

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Contents

Contributors

Originated By:

Wound Committee, WOCN Society

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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

Introduction

This Clinical Resource Guide updates the previous document, *A Quick Reference Guide for Lower-Extremity Wounds: Venous, Arterial, and Neuropathic*, which was developed by the Wound Committee of the Wound, Ostomy and Continence Nurses Society™ (WOCN®, 2013). The guide is a synopsis of content derived from the WOCN Society's Clinical Practice Guideline Series for managing lower-extremity wounds due to venous, arterial, or neuropathic disease.

Refer to the complete version of each Clinical Practice Guideline for more detailed, evidence-based information about the management of wounds in patients with lower-extremity venous, arterial, or neuropathic disease (WOCN, 2011, 2012, 2014): The guidelines are available in print or as an electronic mobile app from the WOCN Society's Bookstore (www.wocn.org/bookstore):

- *Guideline for management of wounds in patients with lower-extremity venous disease* (2011).
- *Guideline for management of wounds in patients with lower-extremity neuropathic disease* (2012).
- *Guideline for management of wounds in patients with lower-extremity arterial disease* (2014).

Purpose

This guide provides an overview of common assessment findings and key characteristics of the three most common types of lower-extremity wounds (i.e., venous, arterial, neuropathic). In addition, it includes a summary of the following information: 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 healthcare providers for additional evaluation and treatment.

Lower-Extremity Venous Disease (LEVD) Wounds (WOCN, 2011)	Lower-Extremity Arterial Disease (LEAD) Wounds (WOCN, 2014)	Lower-Extremity Neuropathic Disease (LEND) Wounds (WOCN, 2012)
Assessment: History/Risk Factors		
• Advanced age. • Obesity. • Pregnancy. • Thrombophilia. • Systemic inflammation. • Anticardiolipin antibody. • Venous thromboembolism (VTE); phlebitis. • Varicose veins. • Pulmonary embolus. • Sedentary lifestyle or occupation; reduced mobility. • Simultaneous insufficiency of two out of three venous systems. • Trauma; surgeries; leg fractures. • Impaired calf muscle pump. • Restricted range of motion of the ankle. • Family history of venous disease. • Injection drug user. • Previous wound.	• Advanced age. • Smoking/tobacco use. • Diabetes. • Hyperlipidemia. • Hypertension. • Elevated homocysteine. • Chronic renal insufficiency. • Family history of cardiovascular disease. • Ethnicity. • Persistent *Chlamydia pneumoniae* infection. • Periodontal disease.	• Advanced age; heredity. • Alcoholism. • Diabetes longer than 10 years; poor diabetes control; impaired glucose tolerance. • Hansen's disease (leprosy); Charcot-Marie-Tooth disease. • Smoking/tobacco use. • Human immunodeficiency virus/acquired immunodeficiency syndrome and related drug therapies. • Hypertension. • Obesity. • Raynaud's disease; scleroderma. • Hyperthyroidism; hypothyroidism. • Chronic obstructive pulmonary disease. • Spinal cord injury; neuromuscular diseases. • Abdominal, pelvic, and orthopedic procedures. • Paraneoplastic disorders. • Acromegaly/height. • Exposure to heavy metals (e.g., lead, mercury, arsenic). • Malabsorption syndrome due to bariatric surgery; celiac disease; vitamin deficiency (B_{12}, folate, niacin, thiamine); pernicious anemia. • Loss of protective sensation; rigid foot deformities; gait abnormalities; history of previous ulcer/amputation.
Assessment: Comorbid Conditions		
• Congestive heart failure. • Lymphedema. • Orthopedic procedures. • Rheumatoid arthritis.	• Cardiovascular disease; cerebrovascular disease; vascular procedures or surgeries. • Sickle cell anemia. • Obesity; metabolic syndrome. • Arthritis. • Spinal cord injury. • Migraine. • Atrial fibrillation. • Human immunodeficiency virus (HIV). • Low testosterone.	• Lower-extremity arterial disease. • Kidney disease.

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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.	• Plantar foot surface is the most typical location. • Other common locations include: o Pressure points/sites of painless trauma/repetitive stress, over bony prominences (e.g., heels). o Metatarsal head (e.g., first metatarsal head and inter-phalangeal joint of great toe). o Dorsal and distal aspects of toes, inter-digital areas, inter-phalangeal joints. o Midfoot/fore-foot: Collapse of mid-foot structures with "rocker-bottom foot" suggests Charcot fracture.
Assessment: Wound Characteristics		
• Base: Ruddy red; granulation tissue and/or yellow adherent or loose slough may be present. • Size: Variable; can be large. • Depth: Usually shallow. • Edges: Irregular; undermining or tunneling are uncommon. • Exudate: Moderate to heavy. • 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. • Non-healing; wound often precipitated by minor trauma.	• Base: Pale or pink; necrosis/eschar may be present. • Size: Variable. • Depth: Variable from shallow to exposed bone/tendon. • Edges: Well-defined; smooth; undermining may be present. • Shape: Usually round or oblong. • Exudate: Usually small to moderate; foul odor and purulence indicate infection.
Assessment: Surrounding Skin		
• Edema: Pitting or non-pitting; worsens with prolonged standing or sitting with legs dependent. • Scarring from previous wounds. • Ankle flare; varicose veins. • Hemosiderosis (i.e., brown staining). • Lipodermatosclerosis. • Atrophie blanche. • Maceration; crusting; scaling. • Temperature: Normally warm to touch. • Localized elevation of skin temperature (greater than 4° F) measured at the ankle with a non-contact infrared thermometer is predictive of a wound.	• Pallor on elevation. • Dependent rubor. • Shiny, taut, thin, dry, and fragile. • Hair loss over lower extremity. • Atrophy of skin, subcutaneous tissue, and muscle. • Edema: Atypical of arterial disease; localized edema may indicate infection. • Temperature: Skin feels cool to touch.	• Normal skin color. • 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 deformities. • Erythema and induration may indicate infection/cellulitis. • Edema: Unilateral edema with increased erythema, warmth, and a bounding pulse may indicate Charcot fracture. • Temperature: Skin warm to touch; localized elevation of skin temperature greater than 2° C indicates inflammation. • Diabetic skin markers: Dermopathy, necrobiosis lipoidica, acanthosis nigricans, bullosis diabeticorum.

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Assessment: Nails		
N/A	• Dystrophic.	• Dystrophic; hypertrophy. • Onychomycosis; paronychia.
Assessment: Complications		
• Venous dermatitis (e.g., erythema, itching, vesicles, weeping, scaling, crusting, afebrile). • Infection/Cellulitis (e.g., pain, erythema, swelling, induration, bulla, fever, leukocytosis). • Variceal bleeding. • Tinea pedis. • Venous thromboembolism.	• Infection/Cellulitis (e.g., pain, edema, periwound fluctuance; or only a faint halo of erythema around the wound). • Osteomyelitis (e.g., probe to bone). • Gangrene (wet or dry).	• Infection/Cellulitis. • Arterial ischemia. • Osteomyelitis. • Charcot fracture (e.g., swelling, pain, erythema, localized temperature elevation of 3–7° C compared to an unaffected area). • Gangrene.
Assessment Perfusion/Sensation of the Lower Extremity: Pain		
• Leg pain may be variable (e.g., severe, throbbing). • Pain may be accompanied by complaints of leg heaviness. • Leg pain worsens with dependency. • Elevation relieves pain.	• Intermittent claudication is a classical sign and indicates 50% of the vessel is occluded (i.e., cramping, aching, fatigue, weakness, and/or pain in the calf, thigh, or buttock that occurs after walking/exercise and typically is relieved with 10 minutes rest). • Resting, positional, or nocturnal pain may be present; resting pain indicates 90% of the vessel is occluded. • Elevation exacerbates pain. • Dependency relieves pain. • Neuropathy and paresthesia may occur 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; and warrants an immediate referral to a vascular surgeon. • Critical limb ischemia (CLI): Chronic rest pain; rest pain of the forefoot/toes. Ischemic non-healing wounds or gangrene are limb threatening with a high mortality rate and warrant referral to a vascular surgeon.	• Pain may be superficial, deep, aching, stabbing, dull, sharp, burning, or cool. • Decreased or altered sensitivity to touch occurs. • Altered sensation not described as pain (e.g., numbness, warmth, prickling, tingling, shooting, pins and needles; "stocking-glove pattern") may be present. • Pain may be worse at night. • Allodynia (i.e., intolerance to normally painless stimuli such as bed sheets touching feet/legs) may occur.

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Assessment Perfusion/Sensation of the Lower Extremity: Peripheral Pulses		
• Pulses are present and palpable.	• Pulses are absent or diminished (i.e., dorsalis pedis, posterior tibial). • Femoral or popliteal bruits may be heard.	• Pulses are present and palpable. • If co-existing LEAD is present: Pulses are absent or diminished (i.e., dorsalis pedis, posterior tibial); and femoral or popliteal bruits may be heard.
Assessment Perfusion/Sensation of the Lower Extremity: Common Non-Invasive Vascular Tests		
• Capillary refill: Normal (less than 3 seconds). • Venous refill time: Shortened (less than 20 seconds). • Ankle brachial index (ABI): Within normal limits (1.0–1.3). • Duplex scanning with ultrasound: Most reliable non-invasive test to diagnose anatomical and hemodynamic abnormalities and detect venous reflux.	• Capillary refill: Abnormal (more than 3 seconds). • Venous refill time: Prolonged (greater than 20 seconds). • Ankle brachial index (ABI): o Non-compressible arteries: Unable to obliterate the pulse signal at cuff pressure greater than 250 mmHg. o Elevated: Greater than 1.30. o Normal: Equal to/or greater than 1.00 o LEAD: Equal to/or less than 0.90. o Borderline: Equal to/or less than 0.60–0.80. o Severe ischemia: Equal to/or less than 0.50. o Critical ischemia: Equal to/or less than 0.40. • Transcutaneous oxygen (TcPO2): Less than 40 mmHg is hypoxic; less than 30 mmHg is CLI. • Toe brachial index (TBI): Less than 0.64 indicates LEAD. • Toe pressure (TP): Less than 30 mmHg (less than 50 mmHg if diabetes present) indicates CLI.	• Capillary and venous refill times: Normal. • ABI: LEAD, which often co-exists with neuropathic disease and diabetes should be ruled out. • The ABI can be elevated greater than 1.30 or arteries can be non-compressible (i.e., unable to obliterate the pulse signal at cuff pressure greater than 250 mmHg), which indicates calcified ankle arteries. In such cases, a TP or TBI is indicated. o TBI: Less than 0.64 indicates LEAD. o TP: Less than 50 mmHg (if diabetes is present) indicates CLI and failure to heal. • TcPO2: Less than 40 mmHg is hypoxic; less than 30 mmHg is CLI.
Assessment Perfusion/Sensation of the Lower Extremity: Screen for Loss of Protective Sensation		
• Assess for peripheral, sensory neuropathy using a 5.07/10 g Semmes-Weinstein monofilament.	• Assess light pressure sensation using a 5.07/ 10 g Semmes-Weinstein monofilament. • Assess vibratory sensation using a 128 Hz tuning fork. • Check deep tendon reflexes at the ankle and knee with a reflex hammer. • Inability to feel the monofilament, diminished vibratory perception, and diminished reflexes indicate a loss of protective sensation and an increased risk of wounds.	• Assess light pressure sensation using a 5.07/10 g Semmes-Weinstein monofilament. • Assess vibratory sensation using a 128 Hz tuning fork. • Check deep tendon reflexes at the ankle and knee with a reflex hammer. • Inability to feel the monofilament, diminished vibratory perception, and diminished reflexes indicate a loss of protective sensation and an increased risk of wounds.

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Measures to Improve Venous Return	**Measures to Improve Tissue Perfusion**	
• Use compression therapy: 30–42 mmHg compression at the ankle, if ABI is equal to/or greater than 0.80: o Multi-layer compression systems are more effective than single layer systems. o Consider intermittent pneumatic compression for patients who are immobile or need higher levels of compression than can be provided by wraps or stockings. • Elevate legs above heart level: 30 minutes, 4 times per day. • Consider medications (e.g., pentoxifylline) to improve blood flow. • Increase exercise: Walking, calf muscle exercise, toe lifts, ankle flexion exercises. • Avoid constricting garments, crossing legs, prolonged standing, and high heeled shoes. • Stop smoking/tobacco use. • Manage weight; healthy nutrition. • Surgically obliterate damaged veins: Subfascial endoscopic perforator surgery (SEPS).	• Revascularize if possible. • Change lifestyle: Stop smoking/tobacco use; avoid secondhand smoke, restrictive garments, and cold temperatures. • Maintain proper hydration/nutrition. • Maintain legs in a neutral or dependent position. • Increase physical activity: Walking; supervised exercise 30–45 minutes, 3 times per week. • Use medications to control hypertension, hyperlipidemia, homocysteine levels, and diabetes; antiplatelets to improve blood cell movement through narrowed vessels. • Control or reduce weight if obese.	• Revascularize if ischemic. • Stop smoking/tobacco use. • Maintain tight glucose/glycemic control; control hypertension. • Engage in exercise that is adapted to prevent injury. • Consider medications, as indicated.
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 less than 0.80 and equal to/or greater than 0.50. o Do not apply compression if ABI is less than 0.50.	• Use proper footwear; wear socks/stockings with shoes; obtain professional nail/callus care. • Use pressure redistribution/offloading products/devices for heels, toes, and bony prominences, especially if bedbound or chairbound. • 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). • Self-inspect the lower extremities daily; promptly report injuries to the healthcare provider. • Use reduced compression for mixed venous/arterial disease if the ABI is less than 0.80. • Do not apply compression if ABI is less than 0.50, ankle pressure is less than 70 mmHg, or TP is less than 50 mmHg.	• Reduce shear stress and offload the at-risk neuropathic foot, and/or wounds (e.g., bedrest, total contact casts, walking splints, orthopedic shoes); use assistive devices for support, balance, and additional offloading. • Use proper footwear; obtain routine professional nail/callus care. • Use pressure redistribution/offloading products/devices for heels, toes, and bony prominences, especially if in bed or chairbound. • 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; wear socks/stockings with shoes). • Self-inspect the lower extremities on a daily basis.

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Topical Therapy: Goals		
• Reduce and control edema. • Attain/maintain intact skin; protect the periwound skin from drainage; absorb/manage exudate. • Prevent trauma/injury. • Prevent, promptly identify, and manage complications (e.g., infection/cellulitis; dermatitis/eczema). • Promote wound healing; maintain moist wound surface. • Reduce pain.	• Prevent trauma/injury. • Prevent, promptly identify, and manage complications (e.g., infection/cellulitis). • Promote wound healing. • Minimize pain. • Preserve limb.	• Prevent trauma/injury. • Prevent, promptly identify, and manage complications (e.g., infection/cellulitis or osteomyelitis). • Promote wound healing. • Keep the periwound dry while maintaining a moist wound bed. • Minimize pain. • Preserve limb.
Topical Therapy: Considerations/Options		
• Use absorptive dressings to control exudate. • Treat infection: Use culture-guided antibiotic/antimicrobial therapy. o Consider topical antimicrobial/antibiotics for superficial infection. o Deep tissue infection/cellulitis warrants systemic treatment. • Remove devitalized tissue. • Avoid known skin irritants and allergens, tapes, and adhesives in patients with venous dermatitis/eczema. • Use emollients such as petrolatum to manage dry, scaly skin. • Consider use of barrier products to protect the periwound skin from excessive drainage and maceration. • Identify and treat dermatitis/eczema (e.g., topical steroids 1–2 weeks). • Consider topical analgesics for painful wound care/debridement.	• Avoid occlusive dressings: Use dressings that permit easy, frequent visualization of the wound. • Aggressively treat infection. • Dry, non-infected 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. 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: o Consider a closely monitored trial of autolytic or enzymatic debridement. • Open/draining wounds with exposed bones or tendons: o Consider a carefully monitored trial of moist, non-occlusive, absorbent, dressings. • Open/draining, non-necrotic wounds: o Consider moist wound healing with non-occlusive, absorbent dressings.	• Use dressings that maintain a moist surface, absorb exudate, and allow easy visualization. • Use occlusive dressings cautiously. • Aggressively treat infection/cellulitis, including fungal infection. • Do not rely on topical antimicrobials alone to treat cellulitis, but they could be used in conjunction with systemic antimicrobials; use of antimicrobials should be culture-guided. • Debride focal callus to reduce pressure. • Debride avascular/necrotic tissue in non-ischemic wounds.

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Adjunctive Therapy		
• Skin substitutes. • Electrical stimulation. • Ultrasound.	• Hyperbaric oxygen therapy. • Arterial flow augmentation (i.e., intermittent pneumatic compression). • Electrotherapy. • Low frequency ultrasound. • Spinal cord stimulation.	• Hyperbaric oxygen therapy. • Skin substitutes. • Topical negative pressure. • Growth factor therapy. • Surgery to correct structural deformities. • Surgical debridement/implantation of antibiotic beads, spacers, or gels. • Pain management specialists.
Indications for Referral to Other Healthcare Providers for Additional Evaluation and Treatment		
• Dermatology referral for unresponsive dermatitis/eczema after 2 weeks of appropriate therapy. • Vascular/surgical referral for: o Infection/Cellulitis. o Non-healing wound after 4 weeks of appropriate therapy. o Venous thromboembolism. o Variceal bleeding. o Intractable pain. o Atypical appearance or location of wound.	• Vascular/surgical referral: o Infected, ischemic wounds: Clinical signs of infection/cellulitis or suspected osteomyelitis. 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 less than 0.90 plus one or more of the following: Wound fails to improve with 2 to 4 weeks of appropriate therapy, severe ischemic pain, and/or intermittent claudication. o ABI less than 0.50. o ABI greater than 1.30 or non-compressible arteries. • Urgent vascular/surgical referral for symptoms of acute limb ischemia; CLI (ABI less than 0.40; ankle pressure less than 50 mmHg; TP less than 30 mmHg/or less than 50 mmHg if diabetes present; TcPO2 less than 30 mmHg); and/or gangrene.	• Refer patients who smoke/use tobacco and have a loss of protective sensation to foot care specialists and for tobacco cessation education/counselling. • Refer patients with gait abnormalities to a qualified pedorthic professional for shoe or device customization. • Vascular/surgical referral: o Infection/Cellulitis or suspected osteomyelitis (i.e., probe to the bone). o Atypical appearance or location of wound. o Symptoms/new onset of Charcot fracture. o Musculoskeletal/structural foot deformities. o ABI less than 0.90 and no response to 2 to 4 weeks of conservative wound care. o ABI less than 0.50. o ABI greater than 1.30 or non-compressible arteries. • Urgent vascular/surgical referral for symptoms of acute limb ischemia, CLI, and/or gangrene.

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