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A Quick Reference Guide for Lower-Extremity Wounds: Venous, Arterial, and Neuropathic

WOCN® Society's Wound Committee

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Purpose:

This quick reference guide provides a brief overview of key characteristics and common assessment findings, measures to improve venous return, tissue perfusion and prevent trauma; and key strategies for topical/adjunctive therapy for the three most common types of lower-extremity wounds (i.e., venous, arterial and neuropathic). Please refer to the Wound, Ostomy and Continence Nurses Society™ (WOCN®) Clinical Practice Guideline Series for more detailed, evidence-based information about management of wounds in patients with lower-extremity venous, arterial and neuropathic disease (Wound, Ostomy and Continence Nurses Society [WOCN], 2008, 2011, 2012). The guidelines are available from the WOCN Society's Bookstore (www.wocn.org/bookstore).

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Lower-Extremity Venous Disease (LEVD) Wounds (WOCN, 2011)	Lower-Extremity Arterial Disease (LEAD Wounds (WOCN, 2008)	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. • Diabetes. • Hyperlipidemia. • Hypertension. • Hyperhomocysteinemia. • Chronic renal insufficiency. • Family history of cardiovascular disease. • Ethnicity.	• Advanced age. • Alcoholism. • Chemotherapy. • Diabetes/impaired glucose tolerance. • Hansen's disease (leprosy). • Heredity. • Smoking. • HIV/AIDS 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. • Charcot-Marie-Tooth disease. • 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.
Assessment: Comorbid Conditions		
• Congestive heart failure. • Lymphedema. • Orthopedic procedures	• Cardiovascular disease. • Vascular procedures or surgeries. • Sickle cell anemia. • Obesity.	• Lower-extremity arterial disease. • Kidney disease.

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Assessment: Wound Location		
The most typical location is superior to the medial malleolus in the gaiter/sock area (Carmel, 2012), but wounds can be anywhere on the lower leg including back of the leg/posterior calf.	Areas exposed to pressure, repetitive trauma, or rubbing of footwear are the most common locations: • Lateral malleolus. • Mid-tibial area (shin). • Phalangeal heads, toe tips or web spaces.	• Plantar foot surface is the most typical location. • Other common locations include: o Altered pressure points/sites of painless trauma/repetitive stress, over bony prominences. o Metatarsal head (e.g., first metatarsal head and inter-phalangeal joint of great toe is common). o Dorsal and distal aspects of toes, inter-digital areas, inter-phalangeal joints. o Heels.
Assessment: Wound		
• Base: Ruddy red; granulation tissue present; yellow adherent or loose slough may be present. • Size: Variable; can be large. • Depth: Usually shallow. • Margins: 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. • Margins: Edges rolled, smooth, undermined; punched-out appearance. • Exudate: Minimal. • Infection: Frequent (signs may be subtle). • Pain: Common. • Non-healing; often precipitated by minor trauma.	• Base: Pale, pink; necrosis/eschar may be present. • Size: Variable. • Depth: Variable from shallow to exposed bone/tendon. • Margins: 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. • Temperature: Normally warm to touch. • Localized elevation of skin temperature at the ankle (spike over 4° F) is predictive of a wound.	• Pallor on elevation. • Dependent rubor. • Purpura. • Shiny, taut, thin, dry. • Hair loss over lower extremity. • Atrophy of skin, subcutaneous tissue and muscle. • Edema: Atypical of arterial disease. • Temperature: Skin feels cold to touch.	• Normal skin color. • Anhidrosis, xerosis, fissures; or maceration. • Callus formation over bony prominences (might cover a wound), and periwound. • Musculo-skeletal/foot deformities. • Edema: Localized area with erythema may indicate high pressure/inflammation. • Temperature: Skin warm to touch; localized elevation of skin temperature greater than 2° C indicates increased pressure, inflammation, or Charcot fracture. • Tinea pedis. • 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 faint halo of erythema around 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). • Gangrene.
Assessment Perfusion/Sensation of the Lower Extremity: Pain		
• Leg pain may be variable: Dull aching, itchy, sore, tender; severe sharp or throbbing. • The pain may be accompanied by complaints of heaviness. • The leg pain worsens with dependency. • Elevation relieves pain.	• Intermittent claudication (i.e., cramping, aching, fatigue, weakness or pain in the calf, thigh or buttock, which occurs after exercise; and is only relieved by 10 minutes rest) is a classical sign. • Resting, positional, or nocturnal pain may be present. • Elevation exacerbates pain. • Dependency relieves pain. • Paresthesia may occur. • 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.	• Decreased or altered sensitivity to touch occurs. • Pain may be superficial, deep, aching, stabbing, dull, sharp, burning, or cool. • 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: Peripheral Pulses		
• Pulses are present and palpable.	• Pulses are absent or diminished (i.e., pedal, posterior tibial). • Femoral or popliteal bruits may be heard.	• Pulses are absent or diminished (i.e., pedal, posterior tibial). • Femoral or popliteal bruits may be heard.
Assessment Perfusion/Sensation: 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).	• Capillary refill: Abnormal (more than 3 seconds). • Venous refill time: Prolonged (greater than 20 seconds). • Ankle brachial index (ABI): o LEAD: Equal to/or less than 0.9. o Borderline: Equal to/or less than 0.6–0.8. o Severe ischemia: Equal to/or less than 0.5. o Critical ischemia: Equal to/or less than 0.4. • Transcutaneous oxygen (TcP02): Less than 40 mmHg is hypoxic. • Toe brachial index (TBI): Less than 0.64 indicates LEAD. • Toe systolic pressure (TP): Less than 30 mmHg (less than 50 mmHg if diabetes) indicates critical limb ischemia (CLI).	• Capillary/venous refill: Normal. • ABI: LEAD often co-exists with neuropathic disease and should be ruled out. • The ABI can be elevated greater than 1.3(indicative of calcified ankle arteries), and in such case, a toe pressure/TBI is indicated. o TBI: Less than 0.64 indicates LEAD. o TP: Less than 30 mmHg (less than 50 mmHg if diabetes) indicates CLI. • Transcutaneous oxygen (TcP02): Less than 40 mmHg is hypoxic.
Assessment Perfusion/Sensation: Screen for Loss of Protective Sensation		
• Assess for peripheral, sensory neuropathy using a 10-g Semmes-Weinstein monofilament.	• Assess light pressure sensation using a 10-g Semmes-Weinstein monofilament. • Assess vibratory sensation using a 128 Hz tuning fork. • Check deep tendon reflexes at the ankle/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 10-g Semmes-Weinstein monofilament. • Assess vibratory sensation using a 128 Hz tuning fork. • Check deep tendon reflexes at the ankle/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**	
Provided vascular studies have ruled out LEAD: • Use compression therapy: 30–42 mmHg compression at the ankle, if ABI greater than 0.8: o Multi-layer compression systems are more effective than single layer systems. o Intermittent pneumatic compression may be considered for patients who are immobile or need higher levels of compression than can be provided by wraps or stockings. • Elevate legs above the level of the heart for 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. • Control weight (Carmel, 2012). • Surgically obliterate damaged veins: subfascial endoscopic perforator surgery (SEPS).	• Revascularize if possible. • Change lifestyle: Stop smoking; avoid caffeine, 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, and diabetes; antiplatelets to improve blood cell movement through narrowed vessels.	• Revascularize if ischemic. • Stop smoking. • Maintain tight glucose/glycemic control; control hypertension. • Engage in exercise that is adapted to prevent injury. • Consider medications, as indicated.
Measures to Prevent Trauma		
• Use reduced compression (23–30 mmHg) if ABI is less than 0.8. • Do not apply compression if ABI is less than 0.5, and refer for vascular testing/surgical evaluation.	• Use proper foot wear. • Use pressure redistribution for heels, toes, and bony prominences, especially if in bed. • Obtain professional nail/callus care. • Avoid chemical, thermal, 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.	• Reduce shear stress and offload wounds (e.g., bedrest, contact casting, walking splints, orthopedic shoes). • Use proper footwear. • Use assistive devices for support, balance and additional offloading. • Use pressure redistribution for heels, toes, and bony prominences, especially if in bed. • Obtain routine professional nail/callus care. • Avoid chemical, thermal, 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		
• Control edema. • Absorb exudate. • Prevent trauma/injury. • Identify/treat infection. • Promote wound healing/maintain moist wound surface. • Protect periwound skin. • Minimize pain.	• Prevent trauma/injury. • Identify/treat infection. • Promote wound healing. • Minimize pain. • Preserve limb.	• Prevent trauma/injury. • Identify/treat infection. • Promote wound healing. • 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 in patients with venous dermatitis/eczema. • Use emollients such as petrolatum to manage dry, scaly skin. • Identify and treat dermatitis/eczema (e.g., topical steroids 1–2 weeks); refer to a dermatologist if unresponsive (Carmel, 2012). • 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: o Keep dry, no debridement. o Assess perfusion status. • Infected, necrotic wounds: o Refer for revascularization/surgical removal of necrotic tissue and antibiotic therapy. o Do not rely on topical antibiotics to treat infected, ischemic wounds. o Institute culture-guided systemic antibiotics promptly for patients with critical limb ischemia 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, 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 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 consultation, as needed.

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