

CHAPTER 16

LOWER EXTREMITY

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The plastic and reconstructive surgeon is often called upon to treat many wound problems of the lower extremity. These include leg ulcers of various etiologies, trauma with extensive soft tissue loss or exposed bone, vascular or neural structures, and lymphedema, which is covered in another chapter.

I. CHRONIC WOUNDS

Each wound requires accurate diagnosis. Not all lower extremity wounds will require surgical intervention when appropriate management is pursued. The key to healing is wound hygiene, correction of the underlying problem, treatment of any concurrent infection, optimizing nutrition, and specific surgical intervention when appropriate. The plastic surgeon is an integral member of the treatment team from the onset of the problem. Remember that two different predisposing conditions may occur in the same patient. If so, the treatment must address both conditions.

- A. Venous stasis ulcer
 1. Etiology - venous hypertension related to venous valvular incompetence
 2. Appearance
 - a. Usually found over medial malleolus
 - b. Increased edema
 - c. Increased hemosiderin deposition (dark discoloration)
 3. Treatment
 - a. Most heal if venous hypertension controlled
 - b. Decrease edema with constant bedrest and foot elevation
 - c. "Unna boots" may heal ulcers in patients who are noncompliant with bedrest or must continue to work.
 - d. Surgical treatment requires excision of entire area of ulcer, scar tissue, and surrounding area of increased pigmentation (hemosiderin deposition).
 - e. Pressure gradient stocking and a commitment to avoiding standing for long periods of time are necessary for long term success
- B. Ischemic ulcer
 1. Etiology - proximal arterial occlusion
 2. Appearance
 - a. Usually more distal on the foot than venous stasis ulcers
 - b. Most often on lateral aspects of great and fifth toes, and dorsum of foot
 - c. No edema
 - d. No change in surrounding pigmentation
 - e. Painful
 3. Diagnosis

- a. Doppler ankle/brachial indices 0.1-0.3 indicates advanced atherosclerotic disease
 - 4. Treatment
 - a. Most require revascularization based upon angiographic findings
 - b. Usually a skin graft will close the wound; flap closure may be required if critical structures or bone are exposed. A more proximal amputation may be required if revascularization is not possible
- C. Diabetic ulcer
 - 1. Etiology - decreased sensation (neurotrophic) or occasionally decreased blood flow
 - 2. Appearance
 - a. Usually on plantar surface of foot over metatarsal heads or heel
 - b. Edema ±
 - c. No change in surrounding pigmentation
 - 3. Treatment
 - a. Debride necrotic tissue and use topical and systemic antibiotics to control the infection
 - b. Be conservative in care; early amputation is detrimental since patients often have limb-threatening infections in the other leg within a few years
 - c. After control of bacterial contamination, small ulcers may be excised and closed primarily; larger ulcers may require flap coverage
 - d. Treatment should also include resection of underlying bony prominence
 - e. Postoperative diabetic foot care at home is paramount to proper management. Patient education in caring for and examining their feet is extremely important
- D. Pyoderma Gangrenosum
 - 1. Very difficult to treat
 - 2. May include anti-inflammatory drugs or immunosuppressives, as well as local wound care agents
 - 3. Success in treatment has been reported with hyperbaric oxygen in conjunction with local wound care
 - 4. Surgical treatment if often contraindicated as excision causes perpetuation of wounds

II. ACUTE TRAUMA

Lower extremity trauma is frequently very complex, and often requires a team approach involving the orthopedic, vascular and plastic surgeons. Limb salvage with bipedal ambulation, normal weight bearing, and sensation is the goal of all surgical intervention.

A. Initial Management

- 1. All patients with lower extremity trauma should be evaluated for associated injuries, and treated according to advanced trauma life support (ATLS) criteria

2. Surgical debridement and irrigation of the wound in the operating room is the proper initial management. Specific management depends upon the level of injury, presence or absence of vascular, nerve, and bony injury
 3. Limb threatening injuries, vascular interruption, or open fracture are best assessed and treated in the OR
 4. Fasciotomy is often required to maintain tissue perfusion in severe high energy or crush injuries when compartment syndrome exists
- B. Fractures of the lower leg are usually classified by the Gustilo system (Table 7-1)
1. Type I and II fractures usually have a good outcome with varied treatment
 2. Gustilo Type III injuries have a worse prognosis and often require plastic surgical intervention

Gustilo Classification of Open Fractures of the Lower Leg	
Type I	Open tibial fracture with a wound less than one centimeter
Type II	Open tibial fracture with a wound greater than one centimeter, without extensive soft tissue damage
Type IIIA	Open tibial fracture with adequate soft-tissue coverage despite extensive laceration or flaps, or high-energy injury accompanied by any size wound
Type IIIB	Open tibial fracture, extensive soft-tissue loss with periosteal stripping and bone exposure
Type IIIC	Open tibial fracture with arterial injury requiring repair

Table 1. Gustilo Classification of Open Fractures of the Lower Leg

III. NON-SURGICAL CARE

- A. Wound vac
1. Applies negative pressure to aid in wound healing
 2. Has decreased the need for flaps in many cases

IV. SURGICAL CARE

- A. Indications for limb salvage versus amputation
1. Assessment tools - none are good enough to use as a guide in management
 2. Consider co-morbidities, concomitant injuries, and whether multi-level injury
 3. Posterior tibial nerve function as the determinate - has been challenged

4. Plastic surgery may still be involved in amputations to preserve length for prosthesis
 - a. Fillet flaps - use tissue from amputated part to close surgical site and preserve limb length
- B. Essentials
 1. Adequate debridement
 2. Timing
 - a. Classic Godina study from 1986 advocated early coverage - within 72 hours
 - b. Has been challenged - especially for more extensive injuries, wound vac has probably helped
 - c. Cover all vital structures (nerves, vessels, tendons, joints, hardware) within 1 week
 3. Zone of injury
 - a. Need to debride all damaged, non-vital tissue
 - b. If performing flap coverage, be aware of potential microscopic vessel injury in surrounding tissue. This zone of injury may affect flap or recipient vessel choice.
- C. Need for graft vs. flap coverage
 1. Dermal substitutes may help convert a wound requiring flap coverage to a skin graft.
- D. Location - Traditional upper, middle, and lower third leg options
 1. Upper third
 - a. Gastrocnemius
 - i. Blood supply - medial and lateral sural vessels
 - ii. May use medial or lateral head, although medial head is more often used due to larger size and more favorable arch of rotation
 - iii. Peroneal nerve at risk for injury with lateral head
 2. Middle third
 - a. Soleus
 - i. Blood supply - popliteal vessels (proximal), posterior tibial vessels (medial belly), and peroneal vessels (lateral belly)
 - ii. Divide distally to rotate into defect
 - iii. May split in half if necessary
 3. Lower third
 - a. Free flap
 - i. Considerations with flap selection - pedicle length, OR positioning (concomitant injuries), durability on heel, bony need, sensation
 - ii. Recipient vessel selection
 - a) Consider preoperative imaging if questionable vascular exam - CTA or angiogram
 - b) Consider end- to-side versus end-to-end anastomosis to preserve flow to distal extremity
 - c) Vein grafts may be needed
 - b. Reverse sural flap
 - i. Blood supply - peroneal vessel perforators
 - ii. Controversy over whether reliable and truly more simple than free flap

- a) If chosen, consider surgical delay to improve the perfusion and delineate viable tissue
 - c. Medial plantar flap
 - i. Blood supply - medial plantar vessels
 - ii. Sensate flap
- E. Free-style perforator flaps
 - 1. Locoregional flaps based off perforators near the defect
 - 2. Not necessarily a simpler option, need to consider zone of injury
- F. Bony gaps - may be filled with grafts, flaps, or distraction techniques depending on length and quality of remaining bone
- G. Postop care
 - 1. Elevate extremity
 - 2. Dangle protocols
 - a. Want to slowly get flap used to being in a dependent position, will swell and get congested at first
 - b. No hard evidence for best timeline

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