ELSEVIER

Operative Techniques in
Orthopaedics

Operative Treatment of Infections in the Foot and Ankle

Patrick S. Buckley, MD,* and Steven M. Raikin, MD*

Treatment of infections of the foot and ankle, similar to other areas of orthopaedics, often require operative treatment to remove infected tissue and bone, and potentiate the effectiveness of antibiotic management. Owing to the presence of patient comorbidities such as diabetes and peripheral vascular disease, a seemingly minor infection can result in major morbidity and even mortality in patients already having infections in the foot and ankle. In this article, we focus on the general principles of irrigation and debridement for treating foot or ankle infections or infections of both, and discuss treatment strategies for septic ankle arthritis and periprosthetic ankle joint infections following total ankle arthroplasty. Additionally, we add tips and techniques based on our experience in treating a variety of situations involving the patient with infected foot and ankle.
Oper Tech Orthop 26:45-52

KEYWORDS Infection, Foot and Ankle, Osteomyelitis, septic arthritis

Introduction

Infection is a serious complication in any area of orthopaedics and it imparts a significant emotional, physiological, and financial burden for patients, surgeons, and health care systems. Presentation of infections of the foot and ankle is similar to that in other areas of the body (rubor, tumor, calor, and dolor), but patient comorbidities such as diabetes and peripheral vascular disease play an important role in their treatment, management, and outcome. Even small, seemingly minor infections can have major consequences in patients with diabetes or peripheral vascular disease that can result in amputation or significant morbidity.

Infections of the foot and ankle are common in both the general population as well as the postsurgical patient. The rate of surgical site infection after elective foot and ankle surgery is higher than that after other elective orthopaedic procedures.[1] This article focuses on the operative treatment of common foot and ankle infections. We focus on general principles of irrigation and debridement (I&D) for treating foot and ankle infections, and evaluate treatment strategies for septic ankle arthritis and periprosthetic ankle joint infections following total ankle arthroplasty (TAA).

*Rothman Institute, Thomas Jefferson University Hospital, Philadelphia, PA.
*Address reprint requests to Steven M. Raikin, MD, Rothman Institute, Thomas Jefferson University Hospital, 925 Chestnut St, Philadelphia, PA 19107. E-mail: Steven.raikin@rothmaninstitute.com

Prevention of Foot and Ankle Infections

Prevention of infections is paramount in the foot and ankle. In the setting of a displaced fracture, prompt reduction, strict elevation, and well-padded immobilization are important to limit soft tissue swelling. Judicious surgical timing that respects the soft tissue envelope would allow for easier wound closure and decrease postoperative infection rates. Patients with diabetes should be advised to regularly check their feet for ulcers and skin breakdown. Judicious patient selection and optimization before operative intervention, such as smoking cessation, close perioperative glucose control in patients with diabetes, cessation of medications that have a negative effect on wound healing, and nutritional optimization and counseling are all important preoperative steps to follow. Many foot and ankle infections can be prevented or their severity lessened with regular thorough clinical evaluations and patient education.

Diagnosis of Foot and Ankle Infections

Evaluation of a patient with a possible foot and ankle infection starts with a similar evaluation to other patients with orthopaedic problems with a suspicion for infection. A thorough

http://dx.doi.org/10.1053/j.oto.2015.12.003
1048-6666//

history and physical examination are undertaken. The patient should be questioned for comorbidities that affect the treatment of foot and ankle infections, such as diabetes, peripheral vascular disease, smoking, concomitant sites of infection, inflammatory arthritis, prior surgery in the region, or if they are taking medications that increase the risk of infection such as anticoagulation or immune-modulating medications.

The patient should be evaluated for systemic signs of infection including fever, tachycardia, and hypotension. Next, the local area of concern is examined for signs and symptoms of infection, such as erythema, purulence, skin breakdown, or wound drainage. Important physical examination findings signifying other underlying pathology include the presence of venous stasis, weak or absent pulses, loss of hair over the dorsum of the foot or anterior tibia, soft tissue swelling, open wounds or ulcers, or decreased sensation suggesting neuroarthropathic Charcot involvement. Additionally, overall foot and ankle alignment should be assessed to exclude causes of asymmetric contact pressures due to deformity such as a tight gastroc-achilles complex that can predispose to ulceration and infections. Acute Charcot Eichenholt type 1 changes may mimic infection in the foot presenting with acute-onset redness, warmth, and swelling of the foot in a patient with neuropathic pain. A clinical test performed by elevating the limb for 5-10 minutes should be performed in these patients. If the erythema and swelling resolves with elevation, this is usually consistent with a neuroarthropathic process rather than infection.

The foot and ankle is unique in its anatomical location in that some areas, such as the distal fibula or plantar foot, have relatively little soft tissue coverage. Its location in the lower extremity make it particularly susceptible to swelling because of gravity, as well as the downstream effects of systemic disorders such as diabetes and peripheral vascular disease. Infections can primarily involve the soft tissues, bone, or joints, or can seed from distant sites hematogenously. Infections in the foot and ankle are most commonly caused by bacteria, but can also be caused by mycobacteria, fungi, or viruses.

Laboratory tests such as a complete blood count with differential, erythrocyte sedimentation rate, C-reactive protein, and blood cultures should be ordered to further work-up the presence of infection. Although these levels are elevated in infection, these markers may also be elevated in noninfectious conditions such as acute Charcot or inflammatory arthritic flare-ups. Other less common laboratory tests for lyme, mycobacterial, or fungal infections can be ordered when a clinical suspicion is present. Superficial wound area culture is of little benefit because of the high local contamination rates and may lead to misleading results. Blood cultures may be useful if systemic involvement is suspected.

Standing weight-bearing radiographs should be taken to examine the underlying bone for signs of infection (eg, destructive bony changes suggesting osteomyelitis), to evaluate for free air in the soft tissue, and to examine the hardware for signs of loosening. Additional studies, such as magnetic resonance imaging, allow for soft tissue evaluation, including the presence of abscesses, and for bony evaluation of osteomyelitis. However, the presence of prior surgical implants significantly affects the accuracy of these studies. It is important to remember that false positives exist for each diagnostic avenue, particularly in patients with Charcot arthropathy. A 3-phase bone scan has little value in diagnosing foot and ankle infections because of the very-high false-positive rates secondary to prior surgery, arthritis, or fractures, which may present similarly to infections. In these situations, a tagged white blood cell scan has high specificity in diagnosing suspected bone infection.

As a general rule, antibiotics should not be started unless deep cultures have been obtained and the infection has been confirmed. Most "slow to heal" incisions around the foot and ankle are not infected, and nonjudicious use of antibiotics may mask a deeper developing infection or result in wound colonization with an antibiotic-resistant organism that makes subsequent infections more difficult to manage.

Principles of General I&D of the Foot and Ankle

If a deep infection is diagnosed in the foot and ankle region, surgical debridement is usually required to remove infected tissue and bone, to improve the effectiveness of antibiotic management. The principles of I&D surgery are identical to other areas of orthopaedics, and include abscess drainage, extensive debridement of infected tissue including bone and soft tissue, hardware removal when possible, and copious irrigation of the area. The infection may involve the deep and dead spaces of the foot, and the surgeon needs to ensure that these areas are debrided and drained to ensure infection eradication. If the infection has been controlled, a vacuum-assisted closure system can be used to facilitate wound healing. If there is concern about persistent infection requiring additional subsequent debridement, a polymethymethacrylate (PMMA) antibiotic-impregnated spacer or other antimicrobials can be used to fill the space. This allows for slow release of high concentrations of antibiotic within the local tissue, without a large systemic effect. Ideally, the PMMA spacer should have a high surface area, and PMMA beads threaded over a non-absorbable suture are commonly used. The spacer is then removed once the infection has been eradicated, or after 6 weeks when the concentration of antibiotics in the PMMA becomes negligible. Wounds should never be sutured closed in the presence of infection, but should be left open to drain, unless a PMMA antibiotic pouch is being created.

Treatment of the Septic Ankle Joint

Primary septic ankle arthritis is rare, but has the potential for devastating outcomes for the patient. Bacteria can seed an ankle joint from a hematogenous source, direct inoculation, or extension from a contiguous source of infection.[2] Prompt identification and treatment is paramount to prevent long-term sequelae of septic ankle arthritis. Both local and systemic effects can be present with an overall mortality rate estimated as high