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Improving The Treatment Of The Consequences Of Burns Of Large Joints Of The Foot In Children With Surgical Wool

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Annotation: Foot infections are common in the diabetic patient. Early recognition, proper assessment, and prompt intervention are vital. A combination of surgery and antibiotics is mandatory in virtually all foot infections. The aim of surgery is 2-fold: first, to control the infection, and second, to attempt to salvage the leg. The eventual goal is always to preserve a functional limb. Foot deformities resulting from surgery may cause reulceration and a high morbidity. The surgical treatment of the infection largely consists of draining of pus and removal of all necrotic and infected tissue. Frequently, revascularization of the foot is needed to save the limb; thus, there must be a close cooperation with the vascular surgical service. The surgeon must have a thorough knowledge of foot anatomy and must be familiar with the defects in wound healing that are caused by diabetes. The outcome of surgery mainly depends on the skill, care, and experience of the surgeon. The best results are achieved within a multidisciplinary setting.

Key words: food , infection, diabetic patient, surgical treatment.

Most deep infections are preceded by tissue breakdown, with local penetration of bacterial pathogens to the deeper tissues. In many cases, the extent of the infection is underestimated; in 10%–15% of mild infections and in ~50% of serious infections, an underlying contiguous osteitis can be demonstrated [1]. Familiarity with the several causative factors that lead to foot complications in diabetic patients and early recognition of the infection are crucial in ensuring proper treatment. A combination of surgical and antibiotic treatment is mandatory in virtually all deep foot infections. Surgical therapy has several aims. The main goal is to control the deep infection, with the hope of salvaging the limb. This is accomplished by drainage of any pus, removal of all necrotic or infected tissues, and creating a healthy wound bed. It is also important to keep in mind the functional results after surgery. Residual foot deformities may lead to abnormal pressure points and, thus, reulceration. The surgeon must also consider the vascular status of the limb and the anatomic level at which a wound would be likely to heal. Furthermore, the surgeon must ensure that there is sufficient viable soft tissue to cover any deficits left by resections or amputations. Foot infections can be classified in several ways: by the depth of the infection and its severity, by the anatomic site affected, by the tissues involved, and by the causative factors, including any arterial insufficiency. To ensure an optimal outcome, the surgeon must also possess an understanding of the microbiology and pathophysiological behavior of infection, wound management principles, and foot biomechanics. The surgeon’s training

may be in orthopedic, vascular, or general surgery or, in some countries, podiatric surgery. What is important is the surgeon's knowledge, experience, and interest in the problem.

Infection is diagnosed on primarily clinical rather than microbiological, laboratory, or radiological grounds. Although infection in diabetic patients may have a subclinical course, with absent or minimal signs and symptoms, it may sometimes progress rapidly in days or hours. This can lead to underestimation of the presence or severity of the infection [2, 3]. We consider infection to be present when the wound has purulent secretions or at least 2 of the following: redness, pain, tenderness, induration, warmth, lymphangitis, foul smell, or gas formation [4]. Pain on the plantar aspect of a foot that had previously been insensitive because of neuropathy may indicate a deep foot infection [5]. This can be further delineated by imaging tests such as MRI or by a simple needle aspiration at the bedside. Infections in diabetic patients may cause recalcitrant hyperglycemia and malaise, but systemic inflammatory manifestations, such as fever and leukocytosis, may not be present. Patients with a serious infection, however, may have an elevated erythrocyte-sedimentation rate or C-reactive protein level [6]. Bone involvement is a concern with deep infections. In the presence of an ulcer, one study suggested a high specificity and positive predictive value for osteitis when bone can be felt with a sterile metal probe [7]. Clinical, radiological, and/or scintigraphic signs compatible with osteitis may lead to suspicion of the diagnosis, but MRI is the imaging procedure of choice for distinguishing osteomyelitis from other conditions, including neuroarthropathy [8]. A recent study showed that on MRI of the infected diabetic foot, the nonenhanced areas represent necrotic tissue. Lack of enhancement in these areas can mask the presence of abscesses and osteomyelitis. Sometimes, histological examination or bacteriologic culture is required to prove the presence of osteomyelitis [3, 7–9]; these procedures should be considered when either the diagnosis or the likely causative pathogens are in doubt.

Wound infections can be classified as mild, moderate, or severe. From a surgeon's perspective, it is perhaps more relevant to distinguish the infections that are not limb threatening from those that are limb threatening. Foot infection predisposes diabetic patients to amputation [10], and early, aggressive surgical intervention may reduce the need for above-the-ankle amputations [11–13]. Therefore, early recognition and treatment of infection is crucial for the survival of the limb. In infections that are not immediately limb threatening, the patient manifests no signs of systemic toxicity. In general, if cellulitis is present, it does not extend for 12 cm around an ulcer. There should be no signs of deep abscesses (e.g., plantar pain at palpation), osteomyelitis, or gangrene. Ulcers that are not infected should be debrided to estimate their depth, their extent, and any potential penetration into bone or joints and along tendon sheaths. Evidence of extensive cellulitis, deep abscesses, osteomyelitis, or necrotic tissue, especially in the presence of limb ischemia, suggests a limb-threatening infection. When wound infection is present, several additional investigations should be considered. Appropriate samples of the wounds must be obtained for culture. Plain radiographs should be obtained, not only to evaluate potential bone involvement but also to search for foreign bodies and soft-tissue gas. Radiography may also reveal bony variants, such as accessory ossicles, foot deformities, fractures and bone deformities, prior surgical procedures and resections, and neuroarthropathic changes. MRI is also useful to delineate the extent of the infection and the presence of deep nonenhancing areas, such as necrosis and abscesses [8]. Local treatment of an infected foot is not likely to succeed when wound hypoxia, debris or necrotic tissue, nutritional deficiencies, or metabolic disorders coexist. These factors must be promptly identified and corrected. After local control of an infection in an ischemic foot, revascularization might be needed to save the limb. Results with low infragenual and pedal bypasses are good, with 36-month rates of limb salvage and vascular patency of up to 98% and 92%, respectively [14, 15]. Proper debridement and drainage of the

infection requires a sound knowledge of foot anatomy. The usual routes of progression of the infection along anatomic pathways must be understood. Specialized anatomy makes the foot architecture well adapted to its function. In the sole of the foot, the plantar aponeurosis is the most superficial fascia. Its central portion is the thickest and is attached to the medial tubercule of the calcaneous. The fascia then spreads fanlike distally (figure 1). The plantar fascia forms the inferior boundary of the 3 plantar fascial compartments. The medial compartment is roofed by the inferior surface of the first metatarsal bone. The lateral boundary is formed by an intermuscular septum, which runs longitudinally from the calcaneous to the medial side of the first metatarsal head. This medial compartment contains all of the intrinsic foot muscles of the first toe. The central compartment is bounded by the intermuscular septum on the medial side and a second lateral intermuscular septum, which runs from the calcaneous to the fifth metatarsal head. The roof is formed by the tarsometatarsal structures. This compartment contains all intrinsic foot muscles of the second, third, and fourth toes. The lateral compartment, bounded by the 5th metatarsal bone and the lateral intermuscular septum, contains all intrinsic foot muscles of the 5th toe. A 4th compartment, called the interosseus, is bounded by the interosseous fascia of the metatarsals and contains the interosseus muscles (figure 2). These compartments play an important role in determining the spread of infection and the development of deep ischemia. After an infected wound has been assessed, rest is needed to control the inflammatory reaction. Sharp debridement is essential as part of the therapy for an infected ulcer, as noted in several national guidelines and textbooks [2, 10, 18–20]. There are, however, only a few studies to support the use of debridement [21]. In a study of 118 patients, frequent debridement of noninfected ulcers resulted in faster wound healing [22]. Other reports described wound debridement as a vital adjunct for the healing of diabetic foot ulcers [23, 24]. Indirect evidence in favor of debridement can be found in other studies showing that late foot complications, such as major amputations, can be reduced by an aggressive surgical approach to every infection [11, 25]. The purpose of sharp (surgical) debridement is 3-fold: drainage of necrotic tissue and pus, stimulation of healing of a (usually chronic) wound, and assessment of the extent of the infection. Moreover, debridement enables deep specimens to be obtained for culture. A wound with skin undermining creates a reservoir for bacterial proliferation. Therefore, the overlying tissue must be removed, even though this creates a larger wound [22]. Debridement of devitalized tissue is an essential step in preparation of the wound bed [26]. Only after removal of the slough and necrotic tissue can the real depth and destructions of the infection be determined.

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