Foot wounds are a common and serious problem in persons with diabetes. More than half of diabetic foot wounds ultimately become infected, and one in five of these infections leads to lower-extremity amputation. After minor injury and subsequent infection, the blood supply demand is increased beyond the circulatory capacity, and ischemic ulceration and risk of amputation ensue. Most diabetic foot infections require some surgical intervention, if only a bedside debridement or incision and drainage. For deep-tissue infections, it is crucial to involve a clinician with surgical training to determine whether the patient needs an operative procedure. In most cases, it is better to perform needed surgical debridement quickly rather than to delay it to provide prolonged antibiotic therapy. As described by Armstrong and Lipsky, foot complications are common among diabetic patients. Once infected, potentially disastrous progression may occur at the deeper levels of the tissue. If not treated promptly, these complications may lead to amputation. If there is any possibility of retained purulence (ie, an abscess, especially under pressure), compartment syndrome, or advancing infection despite appropriate antimicrobial therapy, surgical exploration should be considered. Possible surgical interventions include incision and drainage, wound debridement, bone resection, tissue revascularization, and amputation.

When dealing with gangrene in the ischemic limb, timing between debridement and revascularization is critical; also, if initially faced with wet gangrene, the wound should be debrided immediately, and the leg should be revascularized as soon as possible. When dealing with an ischemic limb, it is imperative to seek vascular consultation as soon as possible and to correct any vascular obstruction to resume better tissue perfusion, which will help save the limb. On the other hand, in patients who are not candidates for revascularization or when a competent vascular surgeon is not available (in some areas of the world), it is suggested to proceed with surgical management and to debride the necrotic tissues to allow for drainage of infection and a better chance of saving a limb, which has a minimal chance with classic management.

These facts encourage us to interfere surgically for urgent control of infection and for debridement of necrotic tissue, regardless of the delayed presentation, with the aim of removing and draining infected...
necrotic tissues, with subsequent reduction of tissue tension, and improving the environment for better wound healing. We provide examples of patients with diabetes who present infected and gangrenous limbs and show that removal of all nonviable tissue as an emergency measure allows almost immediate improvement in the circulation and oxygenation of the surrounding tissue. This allows for more soft tissue to be preserved and a much better outcome and survival for the limb. The following are examples of patients seen by Dr. Ali. The current thought in the Middle East, and in most of the world, is that most severe diabetic foot complications eventually lead to amputation. Therefore, all work aimed at salvaging the at-risk limb is in vain. It is time for a change in the thought pattern of patients, their families, and treating physicians from this pessimistic look at diabetic foot injury to a more realistic approach that dictates that diabetic limbs are salvageable in a high percentage of patients. Once it is known that limbs can be saved and that amputation is not always the end stage, we would expect an increase in the compliance and cooperation of patients, their families, and foot surgeons.

Case 1

An 80-year-old man with type 2 diabetes was admitted to the Al-Yousif Hospital, Al-Khobar, Saudi Arabia, with anorexia and insomnia from severe pain in the foot. Examination revealed systemic inflammatory signs (fever, leukocytosis, anemia, an elevated creatinine level, and hypoalbuminemia) in addition to gangrene in the distal half of the toes.

Our approach is to address the infection first by debriding all of the nonviable tissue and allowing free drainage of the wound discharge. Infection causes a cascade of events, such as an edematous, indurated foot, which increases the compartmental pressure in the foot and compromises vascular profusion to the surrounding tissue. Once the fluid is allowed to drain from the wound, the tissues become revascularized with improved oxygenation. Once this is done, the quality of the tissue is noted to improve within 24 to 48 hours. On arrival at the hospital, we see gangrenous toes with soft-tissue infection (Fig. 1). The proximal tissue is dusky and appears ischemic, with impending gangrene (Fig. 2).

After aggressive debridement of all nonviable tissue, the tissue regains its viability, which indicates improved blood flow after the removal of infected, gangrenous tissue (Fig. 3). In Figure 4, the tissue has regained its normal appearance, and healing of the wounds has occurred with minimal tissue loss.

Case 2

A 52-year-old woman with type 2 diabetes mellitus presented with infective gangrene of the toes, which was left without any surgical management (waiting for demarcation line and autoseparation). Again, necrotic, gangrenous tissue from neglected infection is present (Fig. 5). The common method is to leave the gangrenous tissue for autoseparation or autoamputation. However, the infection and edema cause hypoxia, which leads to perpetuation of gangrene.

Again, aggressive debridement of nonviable tissue allows for drainage of the edema and for better oxygenation to the tissue (Fig. 6). There is marked improvement in tissue quality once the necrotic tissue is removed, with subsequent drainage of the underlying entrapped fluid under pressure, which plays an im-
important role in impeding the local circulation. With serial debridements to remove all nonviable tissue, good viable tissue is seen in its place (Fig. 7). Within 2 months, almost complete healing is seen, with minimal tissue loss.

**Case 3**

A 74-year-old type 2 diabetic patient had a gangrenous wound and systemic signs of infection (Figs. 8 and 9). The first step should be aggressive debridement of all necrotic and nonviable tissue. Intravenous antibiotic therapy, rigid control of diabetes, correction of anemia, and improvement of nutritional status are started concomitantly with surgical management. Several days after debridement, the viability of the

**Figure 3.** Debridement and removal of necrotic and hemorrhagic tissue.

**Figure 4.** Tissue perfusion is immediate.

**Figure 5.** Hemorrhagic and necrotic tissue impede oxygen perfusion.

**Figure 6.** Removal of hemorrhagic and necrotic tissue allows for oxygenation.

**Figure 7.** New tissue is replaced with minimal tissue loss.
tissue is restored (Fig. 10). The general condition of the patient improved markedly.

Once all nonviable tissue is removed, healthy granulation tissue fills in the defects (Fig. 11). This allows for epithelialization to cover the healthy wound bed or for a split-thickness skin graft to be applied. We see complete healing without loss of the patient's limb despite the severity of the initial infection and gangrene (Fig. 12).

**Conclusions**

A patient with severe infection has a limited time to start treatment to control the infection through aggressive surgical debridement of nonviable tissue and drainage of abscess cavities. The more this treatment is delayed, the more tissue loss is inevitable and the greater the chance of a more proximal amputation, with a risk imposed on the survivability of the patient. This occurs concomitantly with standards of care, eg, rigid control of diabetes and associated medical problems, and to assess the vascularity of the limb, followed by vascular consultation to detect the feasibility of revascularization. In the case of an unfit patient, poor runoff, or unavailability of a vascular surgeon, we should not delay surgical management of the patient. The previous examples demonstrate that immediate treatment of the wound despite the delayed presentation of the patients resulted in limb salvage with much less soft-tissue loss than expected before treatment.
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References