Diabetic Foot Ulcers: Conservative Management as Limb Salvage

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ABSTRACT

The diabetic foot ulcer remains a difficult clinical infection, often resulting in disability and amputation. Standard management consists of thorough removal of all infected tissues in conjunction with antimicrobial therapy.

This may have an untoward effect on foot mechanics and may increase risk of future ulcer events. In order to evaluate the efficacy of a more conservative approach, we retrospectively assessed the outcome of patients managed by an interdisciplinary team of comprehensive inpatient and outpatient care.

Over a two-year period, 50 patients were identified by a discharge database, of these, 30 had outpatient follow-up records for more than 12 months. The treatment regimen consisted of conservative debridement or surgery, two to five weeks of empiric intravenous antibiotics, and biomechanical offloading of pressure impediments to wound healing.

Initial procedures were debridement (35 patients), excision of necrotic bone (5 patients), toe or ray amputation (8 patients), and major amputation (2 patients).

At twelve-month follow up, twenty patients failed treatment, with nine patients having persistent ulcers, and two patients requiring amputation. Three patients had ulcer recurrence and 15 patients had new ulcer episodes in the followup observation period. The remaining 30 patients healed.

In conclusion, an approach to the diabetic foot ulcer that is based on conservative surgical intervention, long-term empiric antibiotics, and interdisciplinary wound care and offloading may be a safe and effective alternative to amputation in selected patients.

INTRODUCTION

Foot ulcers in patients with diabetes constitute a growing and costly public health concern. Diabetes is increasing in prevalence, especially in developed nations.

In the United States, the prevalence is estimated to be 7.3 percent of adults [1]. Foot ulcers in these individuals rise at an incidence of 2.5 percent each year and, unfortunately, may initiate a pathway to amputation and limb loss [2].

One adverse consequence of foot ulceration is infection, which becomes limb threatening particularly when there is bone involvement. Repetitive pressures on an ulcer often are rapidly converted to tissue-disruptive inflammation close to an underlying bony prominence; the consequence is that approximately 15 percent of foot ulcers are complicated by osteomyelitis [3]. The customary management of diabetic foot ulcer with osteomyelitis is thorough surgical removal of all infected bone and often involves resection of relatively noninfected adjacent soft tissue and bone. Along with concurrent use of appropriate antimicrobials, this aggressive approach may lead to successful eradication of the infection; however, it may also result in the untoward outcome of altered biomechanics, foot instability, and increased residual plantar pressures, placing the patient at greater risk of future ulcerations. Indeed, one of the risk factors for amputation is prior amputation [4].

In the past decade, there has been a growing clinical interest in an approach to diabetic foot ulcers with or without osteomyelitis with more foot sparing and less aggressive surgical ablation, favoring instead more reliance on conservative surgery and long-term antimicrobials. Beside reducing the number of major amputations as firstline treatment, the advantage to such an approach would be in the maintenance of some biomechanical stability to allow easier accommodation of the foot and prevention of new ulcer events.

PATIENTS AND METHODS

Both inpatient and outpatient records were analyzed for the evaluation and management of the diabetic foot ulcers. The diagnosis of osteomyelitis was made on clinical grounds, defined by grossly infected or exposed bone; an ulcer that probed to bone [5] or a diagnostic radiograph, or similar nuclear imaging scan.

All Patients were Evaluated Surgically:

The type and extent of the initial surgical procedure was determined according to clinical judgment of the treatment team, often with a conservative treatment philosophy of wound debridement with minimal bone resection whenever indecated. Patients were all treated with intravenous antibiotics, which were initiated empirically based on expected microbial flora and changed if the patient did not respond clinically or if the bone culture grew clearly resistant pathogens.

After discharge from the hospital, the patients were managed by one or more members of an interdisciplinary foot clinic, endocrinology, vascular surgery, physical therapy, pedorthic, and infectious diseases. As a general treatment protocol, patients received outpatient care with frequent wound inspection and debridement, home antibiotic treatments and home dressing, and appropriate offloading of the foot to protect the involved area from recurrent injury.

Diabetic foot ulcers with osteomyelitis was considered to have clinical cure when there was complete ulcer healing. Treatment failure was defined as persistence of the ulcer at 12 months or further surgical resection of bone after the initial hospitalization. Patients who had healed were evaluated monthly for recurrent ulcer at the same location or new ulcer episode at a different site on either feet. Clinical data collected included location of the infection, type of initial surgical procedure, ultimate surgical procedure, antibiotic type and duration of treatment, time to ulcer healing, and clinical outcomes after 12 months follow up.

RESULTS

A total of 50 discharged patients were identified as having diabetes and chronic foot ulcers with or without osteomyelitis and, in addition, had posthospitalization outpatient follow up for at least 12 months. There were 10 women and 40 men, with a mean age of 50 years.

Location of ulcerations were toe in 20 patients, metatarsal in 15 patients, midfoot in 2 patients, heel in 10 patients, and ankle in 3 patients.

Only two patients were surgically treated with a major amputation. Five patients had wound debridement with excision of the involved bone, while eight patients had an amputation of a toe or ray. The majority of the patients (35) underwent simple surgical debridement of soft tissue and/or bone.



Case (I)



Case (II)







Case (III)

DISCUSSION

The management of chronic foot ulceration with osteomyelitis in the patient with diabetes has been increasingly modified to a more conservative foot-sparing approach [6,7].

Traditionally, it has been felt that cure was only possible with thorough resection of all involved soft tissues and bone along with antimicrobial therapy. With the advent of newer broad-spectrum antibiotics and better understanding of the basics of diabetic foot wound care, clinicians around the world have been attempting a treatment based on local care and potent antibiotic regimens to allow conservation of soft tissue and bony architecture and better long-term outcomes [6,7,8].

Bamberger et al., in 1987 reported success in eradicating osteomyelitis in 27 out of 51 patients (53%), with failures being those with swelling, necrosis, or gangrene [6]. The use of intravenous antibiotics against isolated pathogens for at least four weeks improved the likelihood of cure. Subsequently, Peterson et al. [7] showed that oral antibiotic therapy in chronic osteomyelitis may be useful, successfully treating 19 out of 29 patients (66%) with oral ciprofloxacin.

Since then, other retrospective studies primarily from Europe have demonstrated reasonable efficacy to a conservative approach. Eneroth, et al., demonstrated healing deep foot infections, including osteomyelitis, without amputation in 39 percent of their large series of 223 patients. The authors emphasize aggressive initial soft tissue surgical debridement [8]. Conservative therapy by another multidisciplinary diabetic foot clinic and longterm oral antibiotics resulted in resolution of bone infection in 17 out of 21 patients with chronic foot ulcers without bone resection [9]. In another larger retrospective study, Pittet et al. [10] reported successful conservative treatment of diabetic foot ulcers with osteomyelitis. In this series, 35 out of 50 (70%) patients were cured of osteomyelitis with long-term antibiotics without any significant surgical intervention. The analysis was made, however, after the exclusion of 14 patients who initially underwent amputation. The studies do suggest, however, that cure of chronic foot ulcers with osteomyelitis without significant bone resection is possible with long-term antibiotics.

A more defined analysis on the value of surgical intervention was a retrospective study by Ha Van et al., which showed that patients who had a conservative surgical procedure faired better than those who were managed only medically with antibiotics [11]. Similarly, Tan and colleagues showed the value of early surgical intervention in a retrospective post-hoc analysis of pooled data from several clinical trials for antibiotic therapy of osteomyelitis. It was found that those that had prompt surgical intervention had significantly less amputations than those treated by medical therapy alone [12]. Thus, there is some validation to the clinical approach to chronic ulcers with osteomyelitis in the diabetic foot that advocates long-term systemic antibiotics in concert with early conservative surgical intervention.

Our findings support this conservative management, especially as an initial intervention. Only two of our series of fifty patients required major amputation on their first admission. Patients collectively fared well with either soft tissues and bone debridement, or partial amputation. The outcomes were comparable in all subgroups, but the size of the subgroups was not large enough for analysis to detect significant differences. Furthermore, the choice of the initial procedure was by the treating practitioners' clinical judgment, interjecting selection bias into the analysis. We can only conclude that achievement of nearly 80percent cure overall makes several treatment options viable. This contrasts with a prevailing surgical view that chronic foot ulcers with osteomyelitis should be treated with surgical resection [13].

Historically, these infections are often polymicrobial with gram-positive (most commonly staphylococcal), gram-negative, and anaerobic species represented [14], so the clinician has to avoids the pitfall of too narrow an antibiotic spectrum when antibiotics are targeted against a single isolate, rather than the polymicrobial flora that is historically known to be present in such complicated ulcers [15].

The high rates of healing of chronic foot ulcers with osteomyelitis could also reflect the impact of having a comprehensive center providing interdisciplinary care, which has been held up as a model for management of complex diabetic foot disorders [16]. The high rate of new ulcerations, in face of a low rate of persistent or recurrent ulcers, probably reflects the morbidity of the patient population rather than the quality of care.

In conclusion, our series supports an approach to diabetic foot ulcers that is based on early conservative surgery under cover of empiric antibiotic therapy. When this is complimented by good foot ulcer care and suitable offloading, satisfactory healing rates may be achieved. Although early surgical intervention seems beneficial, the extent of the necessary debridement and/or bone excision is not yet clear. A conservative, foot-sparing approach, however, appears safe in selected patients and may be an alternative to early amputation, especially as an initial intervention. A well-defined prospective study with intent-to-treat analysis is needed to guide clinicians with more certainty.

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