

# Comparative Antibiotic Outcomes for Diabetic Foot Wounds

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## Statement of Purpose

We performed a retrospective analysis to determine healing and treatment outcomes in surgical versus conservative management of osteomyelitis in diabetic foot wounds in hopes of better understanding patient prognosis for the treatment of future patients

## Level of Study

Level IV Retrospective Study

## Introduction

Diabetic patients are at increased risk for wound development and associated infection. Overall, roughly 20% of patients with a diabetic foot infection have underlying osteomyelitis. A large proponent for infectious resolution is the treatment with antibiotics versus surgical intervention. To date, there has not been much literature published for antibiotic duration or resolution of infection rates. Infection or colonization can be suspected in wounds which have stalled and have not healed after 4 weeks of treatment. Treatment guidelines from the Center of Infectious Disease do not exist currently for osteomyelitis with a diabetic foot wound. Co-morbidities such as Diabetes Mellitus, Hypertension, and Peripheral Arterial Disease can complicate treatment course and the efficacy of antibiotics.

Current treatment protocols for osteomyelitis are hospital and physician dependent. Options include surgical eradication of infection versus conservative approach with local wound care and IV antibiotics. The type of antibiotic and course are currently not standardized. In most cases, surgical excision is performed with a 1-2 week course of PO antibiotics provided. If conservative measures are taken, IV antibiotics are pursued, but the course duration varies from 4 to 8 weeks based on hospital providers. Antibiotics are often chosen for specificity with varying reports on success. Many factors come into play for antibiotic efficacy including bioavailability and bone penetration rates.

## Methods

We retrospectively analyzed thirty-seven patients with no co-morbidity restrictions who had confirmed acute osteomyelitis via clinical findings, imaging, and bone biopsy results. Patients were screened based on clinical signs of infection via erythema, edema, wounds which probed to bone, and purulent drainage. Lab values and advanced imaging used to confirm infection were WBC, Sedimentation Rate, C-Reactive Protein, radiographs, and MRI. Bone biopsy was used to confirm osteomyelitis in all cases. Failure was qualified as patients who had recurrence of clinic symptoms, advanced imaging, or need for proximal amputation. Success was qualified as the opposite with no recurrence of symptoms. Twenty-two patients underwent proximal amputation to eradicate infection and received a course of 2 weeks of PO antibiotics at discharge. Antibiotics provided included Clindamycin, Doxycycline, and Augmentin. Fifteen patients underwent an extended 6 week course of IV antibiotics based on sensitivities including Ceftaroline, Merrem, and Ancef without amputation.

## Results

From the operative group, sixteen patients achieved healing of the amputation site with no recurrence of wound, infection, or osteomyelitis over a 12 month period. Four patients demonstrated delayed healing and/or relapse of infection. Two patients demonstrated non-healing with need for a proximal amputation. In patients receiving IV antibiotics, seven patients completed their course with no relapse of infection over a year. Five patients did not complete their course of IV antibiotics prior to a relapse of infection with need for proximal amputation. Three patients completed a 6 week duration of antibiotics and required proximal amputation. For the surgical versus conservative treatment, healing rates were 72.7% versus 46.7%. Time to healing for both groups were 5.4 weeks and 7.8 weeks respectively. Out of the surgical debridement with PO antibiotics, 4 of the 6 failure patients were on oral Augmentin at discharge. Only 1 patient on Doxycycline and Clindamycin had relapse of infection. There was no correlation between the IV antibiotic choice and failure.

## Discussion

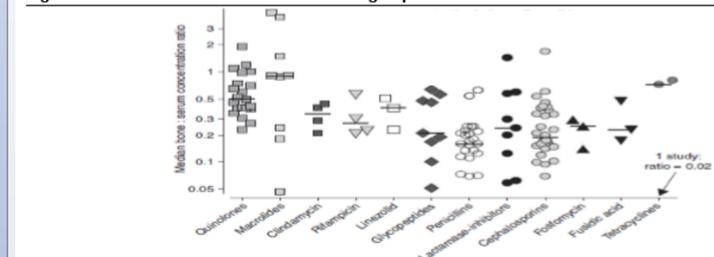
Antibiotic management for diabetic patients in the setting of osteomyelitis has largely been physician dependent with little guideline or established precedent. Staphylococcus infections include over 50% of infections with approximately 25% being attributed to Streptococcus, Proteus, Pseudomonas, and Enterobacter. Diagnosis of osteomyelitis is not the most dependable as recent studies have shown the concordance between bone pathology and microbiology to identify osteomyelitis is 41.4%. In spite of this, analysis for treatment remains vital for patient outcomes.

PO antibiotic bioavailability and bone penetration varies based on antibiotics. Keflex, Augmentin, Clindamycin and Doxycycline have unique bone penetration rates studied at 18%, 1-14%, 55-65%, and 76-86% respectively. Doxycycline is also advantageous for its bioavailability of 90%.

Gentry, et al, documented increased failure rates, approximately 43%, in patients with conservative measures without receiving debridement. Classic standards have led treatments to be pursued for PO and IV antibiotics for a period of at least 6 weeks as bone revascularization usually occurs between 3 to 4 weeks. PO antibiotic success rates are contingent on bioavailability and bone penetration; however, vascular compromise can lead to compromise of this success. A prior study from Lipsky has documented 24 patients receiving antibiotic treatment, and 22 patients receiving surgery with rates of healing at 75.0 vs. 86.3%, respectively and time to healing at 7 vs. 6 weeks, respectively. Spellberg, et al, also reviewed PO versus IV antibiotics with similar outcomes in cure, but those receiving surgical debridement had improved outcomes.

## Discussion (Continued)

Figure 1. Human bone:serum ratios for various groups of antibacterials.<sup>20</sup>



As mentioned, For the surgical versus conservative treatment, healing rates were 72.7% versus 46.7%. Time to healing for both groups were 5.4 weeks and 7.8 weeks respectively. Patients with vascular disease, who smoke, or who received Augmentin as a PO antibiotic only had a higher risk for delayed healing, re-infection, and proximal procedure. Patients receiving Doxycycline at discharge did extremely well with resolution with no recurrence. Doxycycline may provide an interesting analysis moving forward to study its efficacy for an extended course for conservative care.

Study limitations included the small patient sample size. Also, the exclusion of certain antibiotics may have led to a change in outcomes despite the aim of focusing on culture sensitivity data. Lastly, the use to qualifying what a cure versus relapse counts as is a subjective preference and may lead to bias.

## References

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