

Antibiotic Loaded Bone Graft as a Definitive Surgical Technique in the Face of Osteomyelitis



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Statement of Purpose

Local infusion of antibiotics is a vast arena in foot and ankle surgery owing to the amount of osteomyelitis foot and ankle surgeons treat each year. Local delivery of antibiotics is ideal for these patients. We report on a technique using antibiotic-loaded cancellous bone graft to fill voids left from prior osteomyelitis in "high-risk" neuropathic patients.

Introduction

Osteomyelitis in the foot and ankle presents numerous treatment challenges. Traditional surgical approaches to osteomyelitis have been resection with antibiotic impregnated cements or polymers with or without oral/ IV antibiotics. The authors of this paper sought to combine autograft and allograft cancellous bone graft with antibiotics for definitive surgical treatment of osteomyelitis.

Local antibiosis with bone graft is an arena not well discussed in the foot and ankle literature. Antibiotic loaded bone grafting was first described for use in avulsive defects in oral and maxillofacial bones as a way to neutralize the oral flora (1). This technique has also been described in great detail for hip replacement revision as well as a salvage option for orthopaedic spinal procedures. Local antibiotic delivery strategies in the foot and ankle are currently dominated by bone substitutes impregnated with antibiotics, which have their own unique set of complications and limitations. For this reason we have sought to find a more definitive approach to bone debridement and limb salvage by eliminating the need for retrieval of a temporary antibiotic-laden bone substitute and developing a one-stage approach to bone void management in the high risk patient.

Case Series

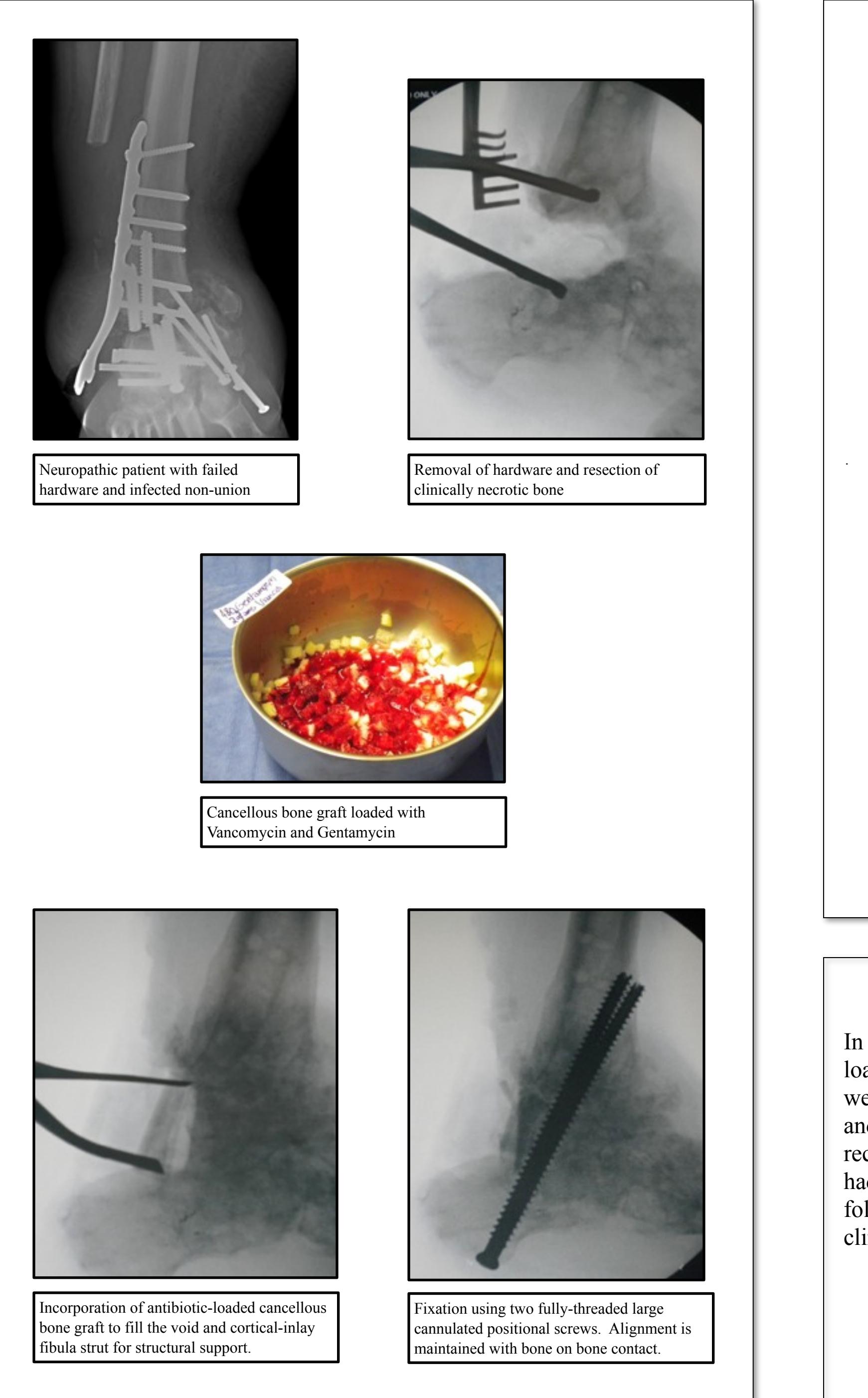
We retrospectively reviewed a total of 6 revision "high-risk" patients with history of nonunions, infection, and charcot neuropathy. 5 of the 6 patients underwent revisional Tibiotalocalcaneal arthrodesis and one underwent subtalar joint nonunion repair. All patients had a combination of Vancomycin, Gentamycin, and/or Tobramycin incorporated with the cancellous bone graft. We should also note that all patients received a 6-week course of IV antibiotics postoperatively. Patients were then followed on a weekly basis postoperatively for the first 30 days then monthly thereafter. All patients had serial radiographs as well as CT scans to confirm arthrodesis.

Technique

Whenever possible, autogenous bone is used for grafting. In revision TTC fusion cases the distal fibula is harvested for graft. Another acceptable choice would be allograft as well.

Inevitably, when bridging large bone voids left from resection of necrotic, infected bone, the case has necessitated larger quantities of bone graft. In these instances we routinely use allogenic cancellous bone chips.

The first step to this technique is separating the cancellous from the cortical bone. If a fibular strut inlay graft is needed, this is measured and press fit into the site. All other autogenous corticocancellous graft is milled using a bone mill. After the patients blood is taken from his/her arm by anesthesia and mixed with our bone creating a slurry. At this time, choice of antibiotic based on culture results is added to the slurry.



Results

In total, 6 patients (3 male and 3 female) received antibiotic loaded bone graft. Vancomycin, Tobramycin, or Gentamicin were used our antibiotics of choice, depending on the pathogen and sensitivity. Average follow-up was 6-8 months. No recurrence of deep-seeded infections were noted. All patients had minor wound complications postoperatively. At their last follow-up all 4 patients had CT proven osseous union with no clinical signs of infection.

Discussion

The use of antibiotic impregnated bone graft has been detailed in many reports throughout the orthopaedic hip and spine literature. However, in the lower leg and foot there is a paucity of literature discussing this treatment option for osteomyelitis. Winkler et al. reported on a case series of one-stage infected THR revisions using allograft impregnated with either Vancomycin or Vancomycin and Tobramycin depending on the pathogen. Out of 37 hips, 3 recurrent infections developed with a follow up time of 4.4 years (2). McKee et al. compared antibiotic impregnated bioabsorbable bone substitute and antibiotic impregnated PMMA. They found that both treatments eradicated infection in 86% of patients. Therefore, the use of antibiotic impregnated bone substitute could reduce the number of subsequent surgical procedures (3). Antibiotic impregnated bone graft has also been used for prophylaxis against infection in spinal fusion surgery (4). Borkhuu et al. found a reduction in postoperative infection from 15% to 4% when utilizing Gentamycin loaded allograft bone, while Mathejessin et al. found no difference in bone remodeling with the addition of ceftazolin (5).

In some centers with high volumes of total joint surgery this product is stocked. Storage of these products has also been a concern in the past. Mathijssen et al. found that storage of antibiotics in frozen form or pill at temperatures up to 37 deg C for 12 months did not effect their activity however storage of antibiotics in liquid form above 20 deg C did effect efficacy (6).

The technique of local antibiotic delivery can decrease the number of surgeries necessary when dealing with osteomyelitis and revision surgery. In our particular population of patients, we feel this is the most important benefit of antibiotic bone graft. We feel the properties of cancellous bone graft laden with antibiotics provides high levels of local antibiotics while also introducing osteogenic properties to aid in bony fusion.

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