Antibiotic Cement-Coated Rods for the Treatment of Infected Intramedullary Nail

Eric So, DPM[1] , Chandana Halaharvi, DPM[1], Rona Law, DPM[1], Lee M. Hlad, DPM [2]
1: Resident, Grant Medical Center, Columbus OH; 2: Fellowship Trained Foot & Ankle Surgeon, Private Practice, Columbus OH

OhioHealth
Grant Medical Center

Introduction & Purpose

Medullary osteomyelitis of the tibia present a complex problem to the treating surgeon. Treatment traditionally is below-knee amputation. More recently, limb salvage attempts and techniques have been described in the literature. There is no established consensus on the ideal method for treating infection of the tibia. Implanting antibiotic-loaded bone cement is a well-established option (1,2), which is effective in the treatment of osteomyelitis and peri-periprosthetic infections. (3,4) This form of treatment allows local delivery of concentrated doses of antibiotics with limited systemic effects. (5,6) Antibiotic polymethylmethacrylate (PMMA) rods beads have widely been used since the 1980s. (5,6) Antibiotic cement-coated rods (ACR) were first used in the 1990s and have shown promising results in the treatment of chronic osteomyelitis and infected nonunions. (5,7) ACRs provide local delivery of antibiotics and simultaneously offer stability. This design may eliminate the need for external fixation, which can result in higher rates of infection, pain, and scarring. (8,9) This is a report of a retrospective study of 4 patients and description of technique. The purpose of this study is to evaluate the results of an antibiotic coated rod for the management of medullary osteomyelitis of the tibia.

Technique

40-gram bag of cement was mixed with 2.4 grams of tobramycin and 2.0 grams of vancomycin and placed into a cement gun. The cement was injected into a 12.5mm inner diameter silicone tube. A 300mm threaded rod is then placed within the tubing. After the cement has cured, the tubing is removed and is retrograded into the tibia. Care is taken to prevent incarceration. Serial debridements were performed until infection was eradicated as indicated by a negative culture (Figure 1-5). Second-stage limb salvage procedure was then able to be performed with tibial reconstruction or arthrodesis.

Methods

A retrospective review of consecutive patients was performed of medullary osteomyelitis of the tibia from 2014-2016. An institutional review board approved the study and informed consent was obtained by all study participants prior to study enrollment. A retrospective chart review of four consecutive patients who failed elective foot and ankle surgery was undertaken (Table 1). Patients underwent radiography of the foot pre- and post-operatively (Figure 6-8). Serial debridements, IV antibiotics, bone cultures, and antibiotic cement-spacer with external fixation were used to assist in the eradication of infection (Table 1).

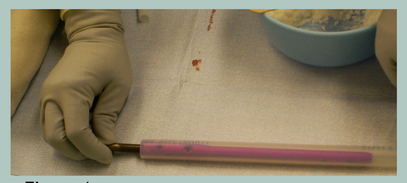

Figure 1.

Figure 2.

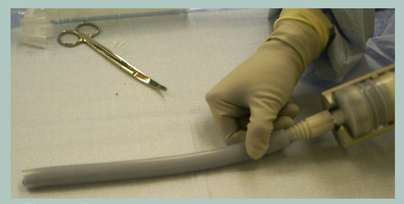

Figure 3.

Figure 4.

Figure 5.

Results

Mean follow-up is 16 months. Average number of operative ACR exchange with debridements was 2.3. The most common pathogen was MSSA in 3/4 patients (75%). Infection was eradicated in all 4 cases with antibiotic coated rod as indicated by negative cultures. Limb salvage rate was 100% (4/4). One patient healed and six months after application of final antibiotic coated rod, the patient re-ulcerated. This patient elected to undergo elective below-knee amputation.

Two out of three (66%) patients healed uneventfully. The lone patient with a post-operative complication had a previous total ankle replacement skin compromise over the anterior ankle. This was successfully treated with local wound care and PO antibiotics. With an average of 14.5 months, all patients are able to ambulate without pain. 3/3 (10patients were fitted for a custom orthotic or brace. A 6-month post-operative CT demonstrated osseous integration of the implant as well as the supplemental bone graft within the implant itself (Figure 6a-d). There have no clinical evidence 0%) of impending skin breakdown, infection, or non-union.

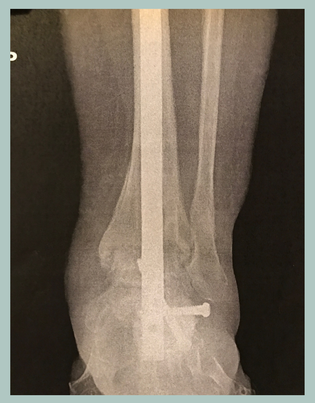

Figure 6a.

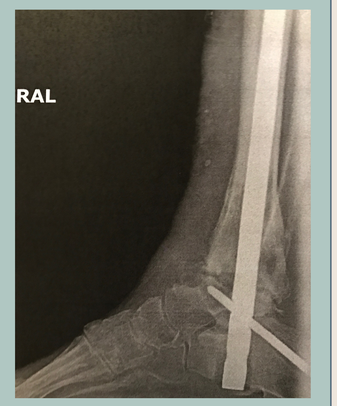

Figure 6b.

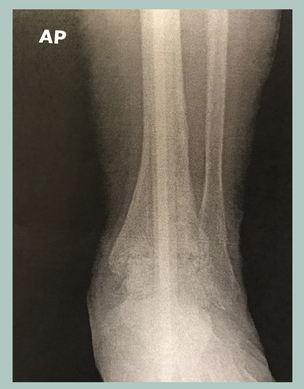

Figure 7a.

Figure 7b.

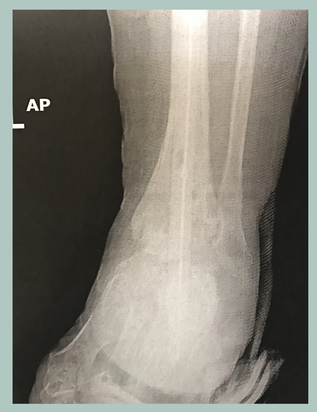

Figure 8a.

Figure 8b.

Table 1.

Patient	1	2	3	4
Demographics				
Age	52	52	70	40
Gender	Female	Male	Female	Male
Surgical Management				
# of previous surgeries	7	8	7	5
# of debridements	6	5	4	3
BKA (y or n)	N	Y (9th sx)	N	N
Wound Cultures (y or n)	Y	Y	Y	Y
Bacteria cultured	PMM, MRSA	MRSA	C. Clostridiiforme	Staph Epi., MSSA
Cement Rod Characteristics				
ABX included (y or n)	Y	Y	Y	Y
# of applications	4	2	1	2
Orthobiologics included (y or n)	N	N	N	N
Length of recovery (months)	7	21	4	12
Complications				
None	N	N	N	N
Infection	Y	Y	N	Y
revision	Y	Y	Y	Y
non-union	Y	N	N	Y
Wound complications	N	Y	Y	N
DVT	N	N	N	N
Other	N	N	N	N

Discussion

Medullary osteomyelitis of the tibia presents a complex problem to the treating surgeon. Treatment traditionally is below-knee amputation. More recently, limb salvage attempts and techniques have been described in the literature. There is no established consensus on the ideal method for treating infection of the tibia. Implanting antibiotic-loaded bone cement is a well-established option (1,2), which is an effective treatment for osteomyelitis and peri-periprosthetic infections. (3,4) This form of treatment allows local delivery of concentrated doses of antibiotics with limited systemic effects. (5,6)

This series demonstrates successful treatment of medullary osteomyelitis of the tibia using an ACR to provide serial debridements and local delivery of antibiotics. This method effectively provides antibiotic delivery as well as the stability needed for healing. Given the complexity of the problem posed by these patients, we consider this rate to be acceptable. We describe a technique that is novel in its application. The advantage of ACR for medullary osteomyelitis is the ability to stage serial debridements prior to definitive reconstruction. Antibiotic coated rod is a simple and effective adjunct to deliver local antibiotics to the medullary bone of the tibia.

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