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Prophylactic Antibiotic-Coated Plating for articular compound fractures of long bones

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Abstract

Infection after fracture fixation (IAFF) is a dreaded complication, leading to non-union, loss of function, and even amputation. The purpose of our study was to evaluate the outcomes of cases treated with second stage antibiotic cement coated plating. A retrospective analysis of the patients (6 in number) of 3 of the authors of this paper was made using prior documents and xrays. Only one patient required a return to the OR , as the infection did not subside and union could not be achieved without further intervention. This patient was a habitual smoker. The use of this technique in a prophylactic setting for patients at high risk of infection and risk of poor outcomes may prove to be of enormous clinical significance.

Keywords : Bone infection, Antibiotic impregnated bone cement coated plate, open fractures, external fixation, internal fixation

Introduction

A 15-year review of data reports the incidence of open fractures to be 30.7 per 100,000 persons per year.[1] Most long bone open fractures require surgical stabilization. These cases have a very high rate of infectious complications. Infection after fracture fixation (IAFF) is a dreaded complication, leading to non-union, loss of function, and even amputation. These injuries have high levels of morbidity & mortality and result in a heavy

economic burden [2,3]. Again the results of treatment of these complications is between 70% and 90%[4]. Infection rates are 30% in many studies on open fracture fixation[5]

Perioperative antibiotic prophylaxis is a routine procedure in orthopedic surgery for reducing the risk of implant related infection. This gave rise to the understanding that a local delivery system for antibiotics impregnated on a cement coated implant may improve the prophylaxis. Presently the standard of care is a first stage external fixation and a second stage definitive internal fixation. Unfortunately, even this has a higher than acceptable rate of infection. What may complicate matters is that intra-articular fractures have a much worse prognosis than extra-articular ones. The purpose of our study was to evaluate the outcomes of cases treated with second stage antibiotic cement coated plating.

Material and Methods

A retrospective analysis of the patients of 3 of the authors of this paper was made using prior documents and x rays. Patients older than 18 years of age and having undergone antibiotic impregnated bone cement coated plating for a long bone fracture between January 1st 2016 and December 31st 2020 were included in this study. Patients who had less than one year of follow up or inadequate documentation of radiographic union or nonunion, incomplete documentation regarding the antibiotics used to mix with bone cement or inadequate follow up, were excluded from our study. Patient details including demographics, fracture/injury type and pattern, preoperative, intraoperative, and postoperative variables, xarys and other imaging and data were collected from the previous prescriptions and records. To start with all the fractures were open injuries and had been treated with initial external fixators. All patients were brought to the operating room and prepped and draped in standard fashion. The external fixators had been previously removed 2 days back and the extremity placed in a splint. Prior approaches were used if possible, and standard approaches utilized where necessary. Following soft tissue dissection, the fracture site was exposed. Culture swabs and tissue cultures had been sent in all the cases. The site of injury had been thoroughly debrided and irrigated to ensure a clean contamination free environment. The fracture was then reduced and temporarily stabilized with k wires of appropriate size.

The antibiotic impregnated cement plate was then constructed. One unit of bone cement was mixed with two grams of vancomycin powder and 80 mgs of gentamicin. Once the cement mixture had reached the working it was applied in a thin layer over the surface of the choseorthopedic implant (anatomical locking plate). Locking towers made of silicon were used to cover screw holes whenever available. This was done to prevent cement from blocking the screw heads from appropriately contacting the plate. The plate was then positioned and used for final fixation. The final fixation was then confirmed on carm. The wound was then irrigated and closed in layers.

Results

A total of eleven patients were identified out of whom six were included in the study as per our criteria. Two of these patients had proximal tibia fractures, two of them had distal femur fracture while the rest two had olecranon fractures. All the patients had compound injuries and had been treated by thorough initial debridement, 1st stage external fixation and finally by open reduction and internal fixation with antibiotic impregnated bone cement coated plating. The operating surgeons had considered the history and mechanism of injury to be high risk scenarios for infections. All the patients were male and the mechanism of trauma was high velocity injury. The basic demographic and surgical data are provided in the

table below. Four of the patients were smokers, while culture was found positive in 3 of the cases prior to the antibiotic cement coated plating. Only one person had postoperative infection for which the patient had to go back to the OR for implant removal and further treatment.

Table 1: Demographic and surgical data

Sn.	Age	Gender	Smoking	Bone involved	Initial Culture	Union	Infection	Return to OR
1	45	M	Y	Ulna Olecranon	Y	Y	N	N
2	36	M	Y	Proximal tibia	N	Y	N	N
3	27	M	Y	Una Olecranon	Y	N	Y	Y
4	40	M	N	Distal femur	N	Y	N	N
5	51	M	N	Proximal tibia	Y	Y	N	N
6	44	M	Y	Distal femur	N	Y	N	N

Discussion

Open fractures present significant challenges to the treating team with a higher rate of complications than closed fractures. Anderson et al had reported 50.7% of their open fracture patients had a positive wound culture upon initial evaluation. Our values were similar at 50% [6]. Average rates of orthopaedic implant infections are > than 5% after fracture fixation. This is worse in the subgroups with open fractures and subcutaneously placed bones [7,8]. Bone cement has already been recognised as a delivery vehicle for antibiotics in case of infection [9,10]. Traditionally this delivery method has been used for local antibiotic delivery with cement beads and intramedullary nails. The initial results with these studies were quite encouraging [9]. Concerns with antibiotic impregnated cement techniques have ranged from antibiotic resistance to slow elution [11]. But these concerns have been trivialized by most other authors [12]. Some authors have already presented good results with antibiotic cement coated plates [13, 14]. But none of these studies solely presented intra-articular fractures. Myers DM et al who presented their findings with a mixed group of articular and extra articular fractures had union in 5 of the 6 cases. Our study had a similar outcome with 5 of the 6 cases going into union. In the last case, the patient with an olecranon fracture had to undergo further treatment with implant removal debridement, stabilization with external fixation, antibiotic cement bead placement and postoperative systemic antibiotic administration.

Prior studies have already established that open fractures carry a much higher rate of infection and that these conditions further predispose the patient to increased rates of systemic antibiotic use, reoperation and amputation [15, 16].

Conclusion

Antibiotic impregnated bone cement plating is an effective technique that may prove useful in preventing infection requiring further fixation. The use of this technique in a prophylactic setting for patients at high risk of infection and risk of poor outcomes may prove to be of enormous clinical significance. What is needed in the future are studies with larger populations so that the

beneficial effects of this technique can be supported with more robust evidence.

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