

Using Antibiotic loaded bone cement (ALBC) as the novel method to treatment of chronic osteomyelitis

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Abstract: Bone and joint infection is the main complication of bone fracture as a result of pyogenic bacteria. The long-term clinical course, extended period of silence, cases of recurrence and abundant discharge are the overriding side effects of bone infection that can be considered a challenge to treat the patients. Given the associated problems of bone infection, the aim of current study is to elucidate the efficiency of Antibiotic loaded bone cement (ALBC) as the novel method to treatment of chronic osteomyelitis. This study looks at the treatment of chronic osteomyelitis through cement containing antibiotic approach. Five patients with chronic osteomyelitis as a consequence of surgical operation of bone fracture were evaluated for efficiency of ALBC method (Gentamicin and Vancomycin have been used as antibiotics in our homemade bone cement). The study was performed in Imam Khomeini hospital of Falavarjan in Isfahan between February 2009 to January 2014. The patient information was obtained from the hospital data bank to monitor treatment and recovery. The ALBC application in temporary manner leads to magnificent results about treatment of chronic osteomyelitis and septic arthritis. However, extensive and complete debridement of necrosis and infectious area with application of proper fixation and bone graft should be considered with the ALBC. Our results have shown that antibiotic loaded cement leads to reduction of pyrogenic discharge as the main clinical complication of chronic osteomyelitis in all patients also; the application of extensive debridement and antibiotic drugs is declined. It should be noted that the patient satisfaction was increased by this approach. Finally, the cement-containing antibiotic can be suitable approach to reduce bone infection.

Keywords: Cement-containing Antibiotic, Chronic Osteomyelitis, Bone Fracture.

INTRODUCTION

The immune response of bone tissue is not strong as other tissues because the blood supply of bone is not effective and functional. Given the weak immune response of bone tissue, it can provide a unique environment to pyogenic bacteria [1-3]. Chronic osteomyelitis is the main complication that can affect the treatment process of bone fracture especially in complicated cases. The signs and symptoms of chronic osteomyelitis can be the draining pus through a sinus on the bones involved, pain and other symptoms of inflammation at the site of the lesion and mild fever. The long-term of clinical course, long periods of silence and relapses are frequent outcomes also serious complications such as deformities, neurological defects and limited mobility can be found in some patients [4]. The critical points in the treatment of chronic osteomyelitis are adequate antibiotic doses, integrity of the host immune system, sufficient surgical debridement, replacement and correction of the fixation method due to the lack of consolidation of applied approach and long-term hospitalization [5]. Antibiotic loaded bone cement (ALBC) is the novel method, which can sustain high concentrations of the drug locally, especially to areas that are inaccessible by systemic antibiotics also, in which the vasculature is not

completely developed (e.g. bone tissue). This technique leads to the high concentrations of drug to the bacteria that are resistant to drug concentrations attained through systemic antibiotics also the low serum antibiotic concentrations is the other significant result of ALBC approach that can reduce the toxicity of systemic administration [6,7]. The aim of current study is to evaluate the efficiency of ALBC method on five patients that are suffered from post-operative infection in attention to the few associated studies in our province between February 2009 to January 2014. To construct ALBC for all treatments, two grams vancomycin was added to one package of gentamycin cement.

CASE PRESENTATION

Case 1

54-year-old patient with a hip fracture, segmental fracture of the femur's body (shaft), proximal tibia fracture and dislocation of the ankle was referred to the surgical department of Imam Khomeini hospital of Falavarjan (Fig 1). After the initial examinations and complementary diagnosis, the patients was underwent the fixation of femoral neck and shaft with Reconstruction Nail, proximal tibia by percutaneous screw fixation and ankles with open reduction and plating. Despite of extensive antibiotic therapy, drainage

and debridement (two times) during 6 months following the surgery, the post-operative bone infection was diagnosed on the site of surgery at left hip that involved infected nonunion of hip fracture leading to gradual collapse and dislocation of femoral head. In order to treat the infection, ALBC approach has been used

concomitantly with removal of the device and necrotic area of femoral head for three months.

The infection has been cured after 3 months, at this stage of treatment; the patient was able to walk with a cane.



Fig 1: Fracture of femoral neck and shaft and dislocation of ankle and talus

Case 2

The second case was a 26-year-old man who suffered from closed tibia fracture. The open surgery and associated-plate fixation have been done as the first treatment but three months after the first surgery, the patient underwent plating+BC surgery due to plate breaking and device failure. The both surgeries were ineffective therefore after 2.5 years, extensive debridement of necrotic area (once) in both sides of fracture, removing debris of remaining screws in the bone and ALBC approach have been used for the patient. ALBC spacer has been removed after three months; the treatment has been completed with Elizarov fixation, and Cortico cancellous bone graft. Finally, union achieved after three months.

Case 3

The third patient, a 17-year-old man with proximal tibia fracture for which open reduction and fixation with LCDCP was done (Fig 2). During surgery, popliteal artery and nerve were cut that leads to infection of nonunion proximal tibia. Therefore, surgeon removes plates and screws and fixed it again by lateral to medial directed screws, but discharge continued. Conformational sequelae such as equinus, leg muscle atrophy and infected nonunion was established. Finally, bone particles, necrotic and infected areas were removed (once) and ALBC was used through surgery. The ALBC was removed after two months and the fracture area has fixed by Cortico cancellous bone graft and external fixator. The union was completed after four months and signs and symptoms of infection improved completely. 6 months later equinus was treated by percutaneous ATL.



Fig 2: Closed tibia fracture and associated-plate fixation

Case 4

Another patient, a 27-year-old men who was suffered from fracture of femoral neck and shaft, open ankle, talus fracture dislocation and 6 months infection that undergone twice debridement (Fig 1). Treatment by plating and orif of talus and pilon fix lead to ankle and Sub talar infection, for which I & D (Irrigation and Debridement) and ALBC spacer was applied and 2 weeks later cement removed and ankle and Sub talar fusion was done by screw and TBW. Complete recovery was achieved after 4 months and bones fused together entirely.

Case 5

The final case was a 24-year-old man who was referred to the hospital after two weeks with open fracture of humerus, hand crashes and infected discharge. The routine I & D were done for arm and hand injuries also twice debridement was applied before ALBC approach. ALBC was applied on humerus infected fracture plus external fixator application. Dorsal hand tendon loss was repaired by intervening grafts that harvested from EDL tendons of foot and inguinal flap. After two weeks, external fixator was removed, applied cement was removed and plating plus cortico cancellous bone graft done. Fracture union of humerus was completed in 3 months without any infection at all

DISCUSSION

Chronic osteomyelitis as a malignant tumor can spread to healthy tissues in uncontrolled fashion so, management of the infection development should be considered as the main task to halt the chronic osteomyelitis establishment. ALBC is an effective therapeutic modality to treat chronic bone and joint infection in traumatic bone fracture. Our results have shown the ALBC method has significant effect for five chronic osteomyelitis and join infections when it has been used concomitantly with extensive debridement of necrotic area, suitable fixation of fracture and bone graft application. The chronic osteomyelitis of tibia, femur and humerus that has been treated with ALBC method in this study were complicated cases which the open surgery and long-term systemic antibiotic therapy could not cure them. It should be noted that our study has some limitations such as low number of patients and lack of the control group. Our results suggest that the application of ALBC as one of the first application can be considered in complicated cases to reduce the time of hospitality, treatment cost and unwanted outcomes of surgery.

The choice of antibiotic and the effective release and diffusion of the antibiotic in the surrounding tissues are some of the conflicting options of the use of antibiotic cement [8]. The gentamicin and vancomycin have been used as antibiotics in our homemade bone cement. Our results have shown this combination has suitable results in all cases and can be considered as

best choice when antibiograms are not available. Although the ALBC method has interesting effect on chronic osteomyelitis, it cannot be considered as a fully solution. The other application such as extensive debridement and suitable fixation must be done to fix the fracture and help the ALBC to control the infection, in other means the ALBC cannot treat chronic osteomyelitis alone.

CONCLUSION

Temporary application of ALBC method accompanied by LBO and appropriate fracture fixation can lead to favorite results in chronic osteomyelitis and joint infections in treatment patients.

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