THE STUDY OF OUTCOME OF CHRONIC PYOGENIC LONG BONE OSTEOMYELITIS TREATED BY ANTIBIOTIC IMPREGNATED BONE CEMENT BEADS AND NAILS

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ABSTRACT: OBJECTIVE: In developing country the incidence of chronic pyogenic infection of long bone is high among children and adults. This entity is difficult to be managed by conventional systemic antibiotics alone. Many treatment methods for long bone osteomyelitis were attempted but unfortunately the eradication of chronic osteomyelitis remains a problem. Local antibiotic therapy has been introduced by arthroplasty surgeons and subsequently this method has been tried for treating chronic osteomyelitis. Treatment of chronic osteomyelitis using antibiotic-impregnated bone cement beads or nail after thorough debridement has become a good option of treatment. Therefore this prospective study has been designed to evaluate the effect of local antibiotic therapy in the form of bone cement beads or nail for eradication of chronic pyogenic long bone osteomyelitis. METHODS: Thirty patients with chronic osteomyelitis of metaphyseal and diaphyseal area of long bones were studied prospectively about outcome of treatment. The diagnosis of chronic osteomyelitis was made on the basis of clinical and radiological features and confirmed by deep aspiration, staining and culture sensitivity of the aspirate. Patients suffering from fungal or tubercular osteomyelitis were excluded. Also the patients with small bones osteomyelitis or open injury more than Gustilo type 2 were excluded. Antibiotic impregnated polymethylmethacrylate beads or nails were implanted after thorough debridement and wound closed primarily. Two dose of intervenous antibiotic were used, one before and another after operation. Beads or nails were removed at the end of six weeks. Patients were followed up for an average period of two years. RESULT: Out of thirty patients in this study, twenty eight patients were cured completely and two patients had persistent discharge till the last follow up visit. No organism found in six cases. No systemic adverse reactions were seen. CONCLUSION: The present study observes that approximately 93% patients were completely free from recurrence in two year follow-up. However, two patients with metaphyseal osteomyelitis had persistence discharge probably due to inadequate removal of glycocalyx in the metaphyseal region where the bone tissue is spongy in nature. KEYWORDS: Chronic osteomyelitis, pyogenic infection, long bone, thorough debridement, antibiotic impregnated polymethylmethacrylate beads and nails.

INTRODUCTION: Treatment of chronic osteomyelitis is an eternal problem due to cavity and dead bone formation, poor blood supply, ineffective systemic antibiotic therapy with antecedent toxicity and bacterial resistance mostly due to unique biofilm formation.¹ Before 1970s, principle of treatment of chronic osteomyelitis² was not established because of lack of investigation facilities to determine the extent of involvement. Repeated curettage of sinus tract and short term antibiotic therapy was used for flare up. Radical surgery in the form of saucerization invited complication like fracture and nonunion and hence disfavored ultimately.
In 1980s, after the invention of investigation facilities like CT and MRI, osteomyelitis cavity and sequestrum is being delineated easily and surgery toward removal of sequestrum and obliteration of cavities with vascular tissue come to replace previous methods.

In 1990, with the success in management of complication in arthroplasty with antibiotic impregnated bone cement, interest develops in using local antibiotic for the management of chronic osteomyelitis. Various studies since 1970, have shown that heat stable powder antibiotic impregnated in bone cement eluted for prolonged periods, maintaining lethal concentration locally without associated hazard of systemic toxicity and also obliterates the dead space.

MATERIAL AND METHODS: Thirty patients suffering from diaphyseal and metaphyseal osteomyelitis were recruited for this study. These patients were selected from a pool of fifty patients attended the OPD and emergency from 1/7/11 to 30/6/12. A detailed history, physical examination, haematological and radiological investigation were done for all these patients. Subsequently they were posted for deep aspiration for the detection of organism and its sensitivity to antibiotic.

Culture sensitive heat stable powder antibiotic impregnated bone cement beads or nails were placed in the affected site after thorough debridement of all necrotic and infected tissue till the punctate bleeding appears. Several beads of 5-7 mm diameter were prepared and those beads were placed on 18-20 gauge wire to form a chain.

Antibiotic mixed bone cement was placed in a 50 ml syringe and injected into T-95 chest tube of desired length. Before the cement set up enders/rush nail inserted into chest tube. Proximal end of the inserted nail was used as a handle. After cement hardening, the plastic tube was cut and then the nail was ready for insertion.

Sutures were removed after two weeks and antibiotic mixed bone cement beads or nails were removed after six weeks. Two doses of prophylactic intravenous antibiotic were used; one before, and another after the operation. All patients were followed up for a period of two years. The pictures of preoperative clinical condition of the wound, preoperative X-ray of the diseased bone, immediate postoperative X-ray, follow up X-ray and clinical condition at recovery of one patient are given in figures 1a to 1e.

RESULTS:

| Sl. No | Age (Yrs) | Sex | Aetiology      | Clinical features | Bone involve | Site involve | Organism | C/S Antibiotics given | Antibiotic given | Treatment response |
|--------|-----------|-----|----------------|------------------|-------------|-------------|----------|----------------------|-----------------|-------------------|
| 1      | 14        | F   | Haematogenous  | Discharging sinus| Left femur  | Metaphysis  | S.aureus | Vancomycin Vancomycin | Vancomycin       | Cured             |
| 2      | 10        | F   | Haematogenous  | Discharging sinus| Left femur  | Metaphysis  | S.aureus | Vancomycin Vancomycin | Vancomycin       | Cured             |
| 3      | 11        | F   | Haematogenous  | Discharging sinus| Right tibia | Metaphysis  | S.aureus | Vancomycin Vancomycin | Vancomycin       | Cured             |
| 4      | 19        | F   | Post-operative | Discharging sinus| Left femur  | Diaphysis   | S.aureus | Cefuroxime Cefuroxime | Cefuroxime       | Cured             |
| 5      | 36        | M   | Post-operative | Discharging sinus| Left ulna   | Diaphysis   | No-growth| Nil                  | Vancomycin       | Cured             |
| 6      | 42        | F   | Post-operative | Quiescent sinus  | Right humerus| Diaphysis   | S.aureus | Vancomycin Vancomycin | Vancomycin       | Cured             |
| 7      | 14        | M   | Haematogenous  | Discharging sinus| Left tibia  | Metaphysis  | Steptococcus | Cefuroxime Cefuroxime | Cefuroxime       | Cured             |
### DISCUSSION:

Treatment of chronic osteomyelitis remains a problem in orthopaedics owing to the unique microarchitecture of bone tissue, precarious blood supply compared to soft tissue and consequently less delivery of antibiotics to the affected site. Moreover, the use of systemic antibiotics for prolonged period leads to systemic toxicity.\(^9\)

Saucerization as a mode of treatment for chronic osteomyelitis was plagued by complications like fracture and non-union.\(^9\) Some micro-organisms form biofilm, which is a highly structured community\(^10\) of bacterial cell that adhere\(^11\) to biomaterial, foreign body or host tissue. Biofilm is
actually made of glycocalyx\textsuperscript{12} and acts as a multicellular organism. It invites several other organisms which remained dormant at the site of infection and now multiply in that favourable environment. On the other hand, antibiotics administered via systemic route reach to infected site in a sublethal dose as biofilm prevent penetration of antibiotics.

Therefore it is now understood that the best way to treat chronic osteomyelitis is to prevent the development of chronic osteomyelitis. Dedicated management of open injury to prevent infection, strict aseptic and antisepsic technique, improvement in operating room environment and implant design is a few of these developments.

With the success in controlling infection with antibiotic mixed bone cement in arthroplasty,\textsuperscript{13} ideas developed regarding the use of local antibiotic therapy in chronic osteomyelitis.\textsuperscript{14} Local antibiotic therapy maintains lethal concentration locally against bacteria without escaping to systemic flow.

The elution properties of various bone cement, their heat stability, pharmacodynamic and pharmacokinetic, local tissue toxicity and systemic adverse reaction due to local use were thoroughly studied in last few decades.

In the present study, out of thirty patients involving diaphyseal and metaphyseal osteomyelitis, twenty eight patients were completely free from recurrence in two year follow-up. Two patients had persistence discharge. These two patients had metaphyseal osteomyelitis following open injury.

The result of the current observation is encouraging in most of the cases particularly in diaphyseal region where medullary glycocalyx was removed easily. However, the authors faced difficulties in removing glycocalyx adequately in the metaphyseal region where the bone tissue is spongy in nature.

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**Figures 1a to 1e:** Pictures showing the discharging sinus (1a), pre-operative X-ray (1b), Post-operative X-ray at 2 weeks (1c), at 18 weeks (1d) and healing at 6 months (1e) of left tibia of one girl aged 7 years.
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Fig. 1e: Follow up at 6 months: Complete cure after treatment

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