DOI: 10.14260/jemds/2015/229

ORIGINAL ARTICLE

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

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HOW TO CITE THIS ARTICLE:
Soumyajit Mondal, Rajiv Roy, Tapas Kumar Ghosh, Rajeeb Banik, Gautam Bhattacharya. "The Study of Outcome of Chronic Pyogenic Long Bone Osteomyelitis Treated by Antibiotic Impregnated Bone Cement Beads and Nails". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 10, February 02; Page: 1622-1627, DOI: 10.14260/jemds/2015/229

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 osteomylitis 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 osteomyelitis[2] 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.

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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[3], maintaining lethal concentration locally[4] without associated hazard of systemic toxicity[5] and also obliterate the dead space.

MATERIAL AND METHODS: Thirty patients suffering from diaphyseal and metaphyseal osteo-myelitis 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[6] 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.[7]

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 Antibiotic	Antibiotic given	Treatment response
1	14	F	Haematogenous	Discharging sinus	Left femur	Metaphysis	S.aureus	Vancomycin	Vancomycin	Cured
2	10	F	Haematogenous	Discharging sinus	Left femur	Metaphysis	S.aureus	Vancomycin	Vancomycin	Cured
3	11	F	Haematogenous	Discharging sinus	Right tibia	Metaphysis	S.aureus	Vancomycin	Vancomycin	Cured
4	19	F	Post-operative	Discharging sinus	Left femur	Diaphysis	S.aureus	Cefuroxime	Cefuroxime	Cured
5	36	M	Post-operative	Discharging sinus	Left ulna	Diaphysis	No-growth	Nil	Vancomycin	Cured
6	42	F	Post-operative	Quisent sinus	Right humerus	Diaphysis	S.aureus	Vancomycin	Vancomycin	Cured
7	14	M	Haematogenous	Discharging sinus	Left tibia	Metaphysis	Steptococcus	Cefuroxime	Cefuroxime	Cured

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8	35	M	Post-operative	Discharging sinus, Ulcer	Left tibia	Diaphysis	Steptococcus	Cefuroxime	Cefuroxime	Cured
9	7	F	Haematogenous	Discharging sinus	Left tibia	Metaphysis	S.aureus	Vancomycin	Vancomycin	Cured
10	50	M	Post-operative	Discharging sinus	Right femur	Diaphysis	S.aureus	Cefuroxime	Cefuroxime	Cured
11	38	M	Post-traumatic	Quisent sinus	Right humerus	Diaphysis	No-growth	Nil	Vancomycin	Cured
12	18	M	Post-traumatic	Discharging sinus	Right tibia	Metaphysis	S.aureus	Cefuroxime	Cefuroxime	Cured
13	14	M	Post-traumatic	Discharging sinus	Right femur	Metaphysis	S.aureus	Cefuroxime	Cefuroxime	Cured
14	18	M	Post-traumatic	Discharging sinus	Right femur	Metaphysis	S.aureus	Cefuroxime	Cefuroxime	Failure
15	15	F	Haematogenous	Quisent sinus	Right humerus	Metaphysis	S.aureus	Vancomycin	Vancomycin	Cured
16	6	F	Haematogenous	Discharging sinus	Right tibia	Metaphysis	S.aureus	Vancomycin	Vancomycin	Cured
17	40	F	Post-operative	Discharging sinus	Left femur	Metaphysis	S.aureus	Cefuroxime	Cefuroxime	Cured
18	7	M	Haematogenous	Quisent sinus	Right radius	Diaphysis	S.aureus	Vancomycin	Vancomycin	Cured
19	53	M	Post-traumatic	Discharging sinus	Right ulna	Diaphysis	No-growth	Nil	Cefuroxime	Cured
20	56	M	Post-operative	Discharging sinus	Right radius	Diaphysis	Steptococcus	Vancomycin	Vancomycin	Cured
21	14	M	Haematogenous	Quisent sinus	Right tibia	Diaphysis	S.aureus	Cefuroxime	Cefuroxime	Cured
22	22	M	Post-operative	Discharging sinus	Left femur	Diaphysis	No-growth	Nil	Vancomycin	Cured
23	22	M	Post-operative	Discharging sinus	Left femur	Metaphysis	E.coli	Meropenam	Meropenam	Cured
24	32	M	Post-traumatic	Discharging sinus	Right tibia	Diaphysis	No-growth	Nil	Cefuroxime	Cured
25	24	M	Post-traumatic	Discharging sinus	Right tibia	Metaphysis	S.aureus& Streptococcus	Vancomycin	Vancomycin	Failure
26	34	M	Post-operative	Discharging sinus	Left tibia	Metaphysis	S.aureus	Cefuroxime	Cefuroxime	Cured
27	48	M	Post-operative	Discharging sinus	Right femur	Metaphysis	No-growth	Nil	Vancomycin	Cured
28	18	M	Post-traumatic	Discharging sinus	Right humerus	Diaphysis	S.aureus	Vancomycin	Vancomycin	Cured
29	17	F	Haematogenous	Quisent sinus	Left ulna	Diaphysis	S.aureus	Cefuroxime	Cefuroxime	Cured
30	9	F	Haematogenous	Discharging sinus	Left humerus	Metaphysis	S.aureus	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.[8]

Saucerization as a mode of treatment for chronic osteomyelitis was plagued by complications like fracture and non-union.[9] Some micro-organism 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[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 antiseptic 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,[13] ideas developed regarding the use of local antibiotic therapy in chronic osteomyelitis.[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 osteomylitis 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.

ACKNOWLEDGEMENT: The authors wish to thank Dr. M. C. Mandal, Associate Professor in Anaesthesiology, N.B.M.C. for his contribution in editing the first draft before submission.

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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.

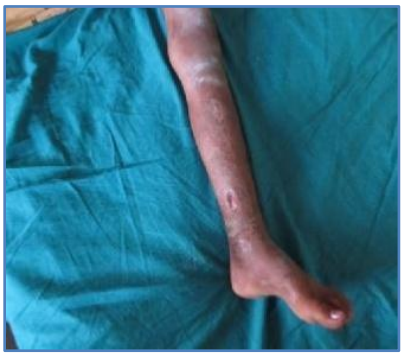

Fig. 1a: Discharging sinus from left tibia

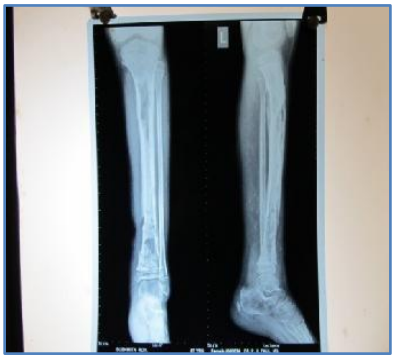

Fig. 1b: Pre-operative X-ray

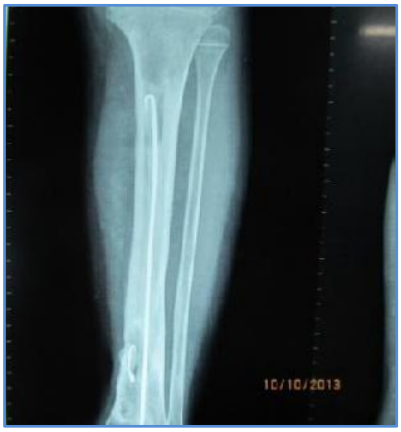

Fig. 1c: Post-operative X-ray at 2 weeks

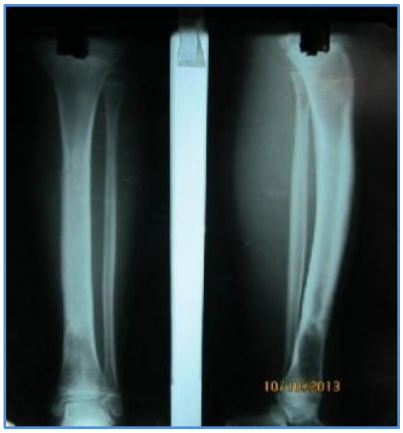

Fig. 1d: Post-operative X-ray at 18 week

DOI: 10.14260/jemds/2015/229

Fig. 1e: Follow up at 6 months: Complete cure after treatment

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Date of Submission: 28/11/2014.
Date of Peer Review: 29/11/2014.
Date of Acceptance: 22/01/2015.
Date of Publishing: 30/01/2015.