ORIGINAL RESEARCH PAPER VOLUME-6 | ISSUE-8 | AUGUST - 2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ANTIBIOTIC IMPREGNATED BONE CEMENT COATED INTRAMEDULLARY NAIL AS A TREATMENT OF CHRONIC OSTEOMYELITIS AND INFECTIVE NONUNION OF LONG BONES.

Orthopaedics

Dr. Abhijeet Shroff Associate Professor, Department of Orthopaedics, Dr. D.Y. Patil Medical College And Hospital, Sant Tukaram Nagar, Pimpri, Pune 411018.

Dr. Tushar Krishna Pisal Lecturer, Department of Orthopaedics, Dr. D.Y. Patil Medical College And Hospital, Sant Tukaram Nagar, Pimpri, Pune 411018. - Corresponding Author

Dr. Sumeet Kumar Junior Resident III, Department of Orthopaedics, Dr. D.Y. Patil Medical College And Hospital, Sant Tukaram Nagar, Pimpri, Pune 411018.

Dr. Jay Janakbhai Patel Senior Resident, Department of Orthopaedics, Dr. D.Y. Patil Medical College And Hospital, Sant Tukaram Nagar, Pimpri, Pune 411018.

Dr. (Col.) S. K. Biswas Proff. Emeritus, Department of Orthopaedics, Dr. D.Y. Patil Medical College And Hospital, Sant Tukaram Nagar, Pimpri, Pune 411018.

Dr. Vikas Singh Rawat Junior Resident II, Department of Orthopaedics, Dr. D.Y. Patil Medical College And Hospital, Sant Tukaram Nagar, Pimpri, Pune 411018.

ABSTRACT

Introduction- With increase in dynamic mechanism of life there is increase in primary fixation (internal/ external) of such fractures. Ultimately there is an increasing number of post operated osteomyelits. There are various modalities available to surgeon for treatment of chronic Osteomyelitis and infected non- union of long bones. We have used of Antibiotic impregnated, bone cement coated intra- medullary nail in this study. Materials and Methods- Fifty patients with chronic osteomyelitis and infective nonunion of long bone were included in the study. Thorough debridement and Intramedullary device with coating of antibiotic impregnated bone cement was put in the patient until infection was controlled. Result- Mean time to infection resolution was 6.5 weeks. Average hospital stay was 2.3 weeks after primary procedure. Patients were discharged on oral antibiotics and followed up in OPD till 2-3 weeks after discharge stopped. We found excellent result in 38 cases, good results in 6 cases, unsatisfactory result in 3 cases. 3 patients didn't come for follow-up.

KEYWORDS:

Introduction:

- With increase in dynamic mechanism of life like vehicular accidents and adventurous sports activities, the incidence of diaphyseal fractures has increased alarmingly. There is increase in primary fixation (internal/ external) of such fractures. Ultimately there is an increasing number of post operated osteomyelits. Besides, presence of osteomyelitis pose the problem of healing leading to infective nonunion.[1-4] Infected non-union of long bones is a chronic and debilitating disorder that still poses a very complex problem to the surgeon today in terms of cost- and time-effective treatment.[5]

- Problems with longstanding infections are Multiple surgeries with its attended complications, development of joint stiffness and deformities, multi- drug resistant strains of organisms, multiple sinus tracts, extensive scarring and poor skin condition, bone necrosis & bone loss leading to large gap non- union, psychologically and economically weak patient and family and long term inability to carry out daily activities and absence from work.[5]

- There are various modalities available to surgeon for treatment of chronic Osteomyelitis and infected non- union of long bones. Usually the treatment involves multiple staged surgeries.[6-11]
- We have used of Antibiotic impregnated, bone cement coated intra- medullary nail in this study for the control of infection in chronic osteomyelitis and infected non- union.[12-15]

- **How to diagnose:**

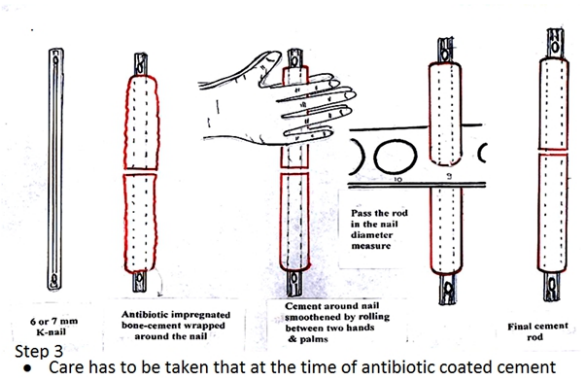
- **Clinical:** Discharging sinus, non- healing ulcer, cellulitis, abscesses, tenderness at fracture site and/ or painful abnormal mobility.
- **Laboratory investigations:** Heamogram (increased TLC count), raised ESR, raised CRP, culture sensitivity report
- **Radiological:** X-ray (To see Sequestrum, Fluffy callus, thickening of cortices, loosening of implants/ screws) and USG, CT scan and MRI if necessary.

Materials and Methods

- Patients included were the cases of chronic diaphyseal osteomyelitis of long bones. Recurred after conventional treatment. Cases of infected non- union (with osteomyelitis). Patients who were excluded in the study were those with immunodeficiency, severe uncontrolled diabetes. Tuberculous, osteomyelitis and patients previously operated by same treatment.
- Fifty patients with chronic osteomyelitis and infective nonunion of long bone were included in the study. All patients except 3 had discharging sinus, in which 27 patients had positive culture report with staphylococcus aureus and 2 patients had pseudomonas aeruginosa. Rest all patients had no growth.
- All patients were started pre-operative I.V antibiotics according to culture report and those who had no growth were started on empirical cephalosporin 3rd generation. Firstly, thorough debridement (intramedullary/extramedullary) and Intramedullary device (v-nail/k-nail/flexible nail/k-wire) with coating of heat stable antibiotic (vancomycin/ gentamycin/ cefuroxime) impregnated bone cement was put in the patient until infection was controlled (approx 6-8 weeks).[12-16]
- Sensitive I.V antibiotics were given postoperatively for 15 days followed by oral antibiotics. Infection was monitored clinically and by repeated CRP. Once infection was controlled, implant was removed and assessed for union. In non-united fracture, fixation was done in same sittting either by intramedullary nail or external fixator or ilizarov's ring fixator with or without bone grafting and followed up for union and recurrence of infection for next 6-8 weeks. In chronic osteomyelitis patients, only implant was removed. Clinical outcomes were assessed as Excellent, good and unsatisfactory.

Step 1
- Debridement
- Reaming
- Sample collected to be sent for microbiology.

Step 2 : Making the antibiotic nail
-20 grams of bone cement to be mixed with 2 grams of vancomycin/ gentamycin and has to be coated over the intramedullary nail.
-The surface has to be even all over the rod.



Step 3

- Care has to be taken that at the time of antibiotic coated cement preparation blood should not be mixed with it, so new pair of gloves has to be taken at time of cement preparation.
- Pass the coated rod through sizer.

Step 4: Nail insertion

Result:

Excellent	No Tenderness and Local rise of temperature Healed Discharging Sinus Decreased TLC and Normal CRP Absent Radiological Signs of Infection
Good	Mild Tenderness still present Some discharge is still coming which can be managed by IV antibiotics Decreased TLC and Normal CRP Sclerosis of bone is still present
Unsatisfactory	Severe Tenderness and Local rise of temperature Presence of discharging sinus Raised TLC and CRP Radiological signs of infection are still present Failure of Implant

- Mean time to infection resolution was 6.5 weeks. Average hospital stay was 2.3 weeks after primary procedure. Patients were discharged on oral antibiotics and followed up in OPD till 2-3 weeks after discharge stopped. We found excellent result in 38 cases, good results in 6 cases, unsatisfactory result in 3 cases. 3 patients didn't come for follow-up.

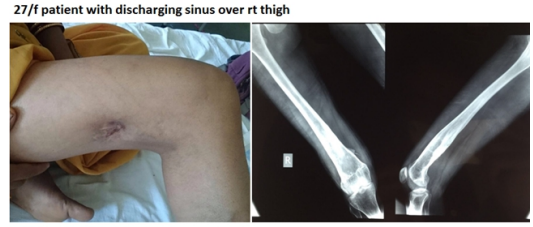
Discharging Sinus	Number
Present	47
Not Present	3
Total	50

Organisms/ Antibiotic	Organism In Culture Report	Antibiotic Given
Staphylococcus Aureus	27	According to culture report
Pseudomonas Aerugenosa	2	According to culture report
No Growth	21	Third generation cephalosporin
Total	50	

Results	Number
Excellent	38
Good	6
Unsatisfactory	3
Patient who did not come for follow up	3
Total	50

Case 1

27/f patient with discharging sinus over rt thigh



Debridement and Antibiotic cement coated Nailing was done Implant Removal after 3 Months

Case 2

32year/M Came with complaint of pain and swelling over right thigh since one month, opco rt femur fracture one year back

Implant removal and antibiotic coated nailing was done

Implant removal was done after 8 weeks

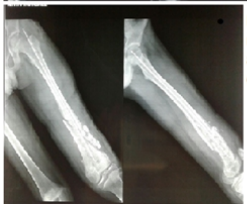
Case 3

15/m pt with pain and swelling over lt thigh

CT scan s/o periosteal reaction in distal meta-diaphyseal region of femur which s/o chronic osteomyelitis

Initially treated with antibiotic cemented beads and pin

After 1 month, patient came with an pathological fracture of femur shaft with discharging sinus



- Finally, we did implant removal, debridement and antibiotic cement coated nail with beads

Discussion:

- § Appropriate treatment of Osteomyelitis involves adequate anti-microbial therapy following operative debridement of all necrotic bone & soft tissues. Dead space management, soft tissue coverage and stabilization are essential for resolution of infection, to re vascularize non-union site and to provide good environment for fracture operative intervention. [5,6,17-19]
- § A variety of staged procedures have been described for the management of infected non-union. Intramedullary devices have been used in both primary stage of infection control[12–15] and in secondary stage of bone healing[20] with good results. Bone defect following debridement increases the complexity of the management.[21]
- § Use of antibiotic-impregnated cement was first noted by Buchholz and Engelbrecht. [22, 23] A high local concentration of antibiotics and low systemic side effects were the major advantage. [24, 25]Gentamicin has been the most widely used agent followed by vancomycin. [23-26] Use of two antibiotics, namely gentamicin and vancomycin, with bone cement widens the spectrum of activity and also enhances the elution properties of the two antibiotics. [26, 27] Klemm was the first to use antibiotic cement beads in cases of osteomyelitis. [28] Cement beads fill the dead space and also allow a high concentration of local antibiotics. The effectiveness of the antibiotic-impregnated cement beads in the control of bone infection is well established.
- § Antibiotic impregnated rods have advantage over antibiotic beads as beads do not offer any mechanical support and are difficult to remove. Ilizarov's ring fixator is a very lengthy procedure as compared to antibiotic impregnated rods. Also pin tract infections and longer duration of application of ring fixator add to the disadvantage. [29]
- § The study by Thonse and Conway has studied cases of infected non-union with bone defects in 20 patients. They were able to achieve primary union by primary use of antibiotic coated intramedullary nailing in only two cases with bone defect, with the remaining cases requiring secondary procedure. They reported infection control in 95% of their cases. [15] In our study also majority of patients required secondary procedure for fixation.
- § In the study done by Ashok k Shyam et. al, antibiotic coated impregnated intramedullary nail was a good procedure to achieve early primary infection control in cases of infected non-union with bone defect <4 cm. Antibiotic coated impregnated intramedullary nail is useful for infection control in cases with bone defects from 4 to 6 cm; however, it takes a significantly longer time when compared with patients with lesser bone defect. It should not be used in cases with bone defects >6 cm, where it fails to achieve an adequate stability and infection control, and for these cases procedures like Ilizarov fixator with bone transport or lengthening with acute docking should be used.[30]
- § A close interaction between various specialists is required to improve the management of this disease. It is Simple & inexpensive alternative. Local delivery of antibiotic at concentration exceeding the MIC (200 times higher) with low systemic toxicity.

Conclusion:

With proper selection of case and with correct surgical technique the antibiotic loaded cement nail proves to be an effective modality of treatment in cases of chronic osteomyelitis and infected non-unions of long bones.

References:

1. Goebel M, Gerdesmeyer L, Mueckley T, Schmitt-Sody M, Diehl P, Stienstra J, et al. Retrograde intramedullary nailing in tibiotalocalcaneal arthrodesis: a short-term, prospective study. J Foot Ankle Surg. 2006;45:98–106.
2. Miehlke W, Gschwend N, Rippstein P, Simmen BR. Compression arthrodesis of the rheumatoid ankle and hind foot. Clin Orthop Relat Res. 1997;340:75–86.
3. Mueller EJ, Wick M, Muhr G. Chirurgische Therapie bei Inkongruenzen und Arthrosen am oberen Sprunggelenk. Orthopäde. 1999;28:529–37.
4. Stephenson KA, Kile TA, Graves SC. Estimating the insertion site during retrograde intramedullary tibiotalocalcaneal arthrodesis. Foot Ankle Int. 1996;17:781–2.
5. Toh CL, Jupiter JB. The infected nonunion of the tibia. Clin Orthop Relat Res. 1995;315:176–91.
6. Court-Brown CM. Fractures of the tibia and fibula. In: Bucholz RW, Heckman JD, Court-Brown CM, editors. Rockwood and Green's fractures in adults. 6th ed. Lippincott Williams and Wilkins; 2006. pp. 2080–146.
7. Patzakis MJ, Zalavras CG. Chronic posttraumatic osteomyelitis and infected nonunion of the tibia: Current management concepts. J Am Acad Orthop Surg. 2005;13:417–27.
8. Beals RK, Bryant RE. The treatment of chronic open osteomyelitis of the tibia in adults. Clin Orthop Relat Res. 2005;433:212–7.
9. Ueng SW, Chuang DC, Cheng SL, Shih CH. Management of large infected tibial defects with radical debridement and staged double-rib composite free transfer. J Trauma. 1996;40:345–9.
10. Chen CE, Ko JY, Wang JW, Wang CJ. Infection after intramedullary nailing of the femur. J Trauma. 2002;55:338–44.
11. Wu CC, Shih CH. Distal tibial nonunion treated by intramedullary reaming with external immobilization. J Orthop Trauma. 1996;10:45–9.
12. Paley D, Herzenberg JE. Intramedullary infections treated with antibiotic cement rods: Preliminary results in nine cases. J Orthop Trauma. 2002;16:723–9.
13. Qiang Z, Jun PZ, Jie XJ, Hang L, Bing LJ, Cai LF. Use of antibiotic cement rod to treat intramedullary infection after nailing: Preliminary study in 19 patients. Arch Orthop Trauma Surg. 2007;127:945–51.
14. Madanagopal SG, Seligson D, Roberts CS. The antibiotic cement nail for infection after tibial nailing. Orthopedics. 2004;27:709–12.
15. Thonse R, Conway J. Antibiotic cement-coated interlocking nail for the treatment of infected nonunions and segmental bone defects. J Orthop Trauma. 2007;21:258–68.
16. Cierny G. Classification and treatment of adult osteomyelitis. In: Evarts CM, editor. Surgery of the Musculoskeletal System. Vol. 5. New York: Churchill Livingstone; 1990. p. 4363.
17. Jain AK, Sinha S. Infected nonunion of the long bones. Clin Orthop Relat Res. 2005;431:57–65.
18. Motsitsi NS. Management of infected nonunion of long bones: The last decade (1996-2006) Injury. 2008;39:155–60.
19. Struijs PA, Poolman RW, Bhandari M. Infected nonunion of the long bones. J Orthop Trauma. 2007;21:507–11.
20. Shahcheraghi GH, Bayatpoor A. Infected tibial nonunion. Can J Surg. 1994;37:209–13.
21. Eshima I, Feibel RJ, Louie KW, Lowenberg DW. Combined muscle flap and Ilizarov reconstruction for bone and soft tissue defects. Clin Orthop Relat Res. 1996;332:37–51.
22. Wininger DA, Fass RJ. Antibiotic-impregnated cement and beads for orthopedic infections. Antimicrob Agents Chemother. 1996;40:2675–9.
23. Buchholz HW, Elson RA, Heinert K. Antibiotic-loaded acrylic cement: Current concepts. Clin Orthop Relat Res. 1984;190:96–108.
24. Zalavras CG, Patzakis MJ, Holtom P. Local antibiotic therapy in the treatment of open fractures and osteomyelitis. Clin Orthop Relat Res. 2004;427:86–93.
25. Springer BD, Lee GC, Osmon D, Haidukewych GJ, Hanssen AD, Jacofsky DJ. Systemic safety of high-dose antibiotic-loaded cement spacers after resection of an infected total knee arthroplasty. Clin Orthop Relat Res. 2004;427:47–51.
26. Koo KH, Yang JW, Cho SH, Song HR, Park HB, Ha YC, et al. Impregnation of vancomycin, gentamicin, and cefotaxime in a cement spacer for two-stage cementless reconstruction in infected total hip arthroplasty. J Arthroplasty. 2001;16:882–92.
27. Gallo J, Kolár M, Florschütz AV, Novotný R, Pantůcek R, Kesselová M. In vitrotesting of gentamicin-vancomycin loaded bone cement to prevent prosthetic joint infection. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2005;149:153–8.
28. Klemm KW. Antibiotic bead chains. Clin Orthop Relat Res. 1993;295:63–76.
29. Patzakis MJ, Wilkins J, Wiss DA. Infection following intramedullary nailing of long bones: diagnosis and management. Clin Orthop Relat Res. 1986;212:182–91.
30. Ashok K Shyam, Parag K Sancheti, Salim K Patel, Steve Rocha, Chetan Pradhan, and Atul Patil, Use of antibiotic cement-impregnated intramedullary nail in treatment of infected non-union of long bones. Indian J Orthop. 2009 Oct-Dec; 43(4): 396–402. doi: 10.4103/0019-5413.55468