



ORTHOPAEDICS

THE ROLE OF ANTIBIOTIC-IMPREGNATED CEMENT NAIL IN INFECTED NON-UNION OF TIBIA: A PROSPECTIVE STUDY

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ABSTRACT Infected non-union of long bones present a complex problem to the treating surgeon. The treatment of non-union traditionally followed a two-staged procedure. More recently, single-stage procedures such as debridement and application of Ilizarov fixator or use of antibiotic cement impregnated intramedullary nails (ACIINs) have been described in the literature. This is a report of a prospective study of 20 nonunion cases of tibia treated with antibiotic-impregnated intramedullary nail (ACIIN).

Aims and objectives: To evaluate the results of antibiotic cement impregnated nailing in the management of infected nonunion of tibia.

Materials and methods: This prospective study was done on 20 cases of infected nonunion of the tibia in Government Medical College, Kurnool during the period 2017-2019. Functional results were evaluated with regards to control of infection, bony union and complications.

Results: Infection was eradicated in 18 cases with ACIIN and the fractures united. One case lost to follow up. In one case, though the infection was controlled, they required subsequent procedures to achieve bony union.

Conclusion: Antibiotic cement impregnated nailing is a simple, economical and very effective procedure than the traditional methods in management of infected non-unions of long bones.

KEYWORDS :

INTRODUCTION

Infected non-union of long bones is a chronic and debilitating disorder that still poses a very complex problem to the surgeons today in terms of cost and time-effective treatment. Traditionally, treatment of non-union follows a two-stage procedure. The first stage comprises of debridement with or without antibiotic cement bead insertion and systemic antibiotics to convert an infected non-union to an aseptic non-union. The second stage is performed to achieve stability by either external or internal fixation and bone grafting. The presence of poorly vascularised tissues, adherence of bacteria to bone structures and implants and slow bacterial replication rate contribute to infection. Single-staged procedures such as debridement and the use of antibiotic cement impregnated intramedullary nails (ACIIN) have been described in the literature. ACIIN can provide stability, across the fracture site and antibiotic cement allows a high local concentration of antibiotics and low systemic side effects. Gentamicin has been the most widely used agent followed by Vancomycin. 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.

AIMS AND OBJECTIVES

The aim of the present study is to evaluate the results of antibiotic cement impregnated nailing in the management of infected nonunion of tibia.

MATERIALS AND METHODS

This prospective study was done on 20 cases of infected non-unions of tibia at Government Medical College, Kurnool during the period of 2017-2019.

1. Inclusion criteria

- a) Cases of infected nonunion of the tibia.
- b) Bone gap of <2cm

2. Exclusion criteria

- a) Patients less than 15 years,
- b) Allergy to vancomycin or gentamycin,

Procedure:

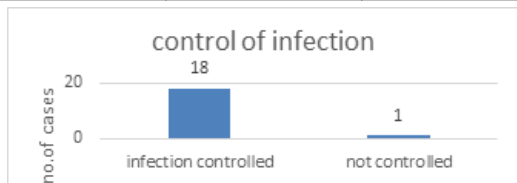
Patients underwent a pre-operative evaluation including the following parameters: complete blood count, ESR, C Reactive Protein, culture and sensitivity. Standard radiographs of the part in two views were also obtained. The surgical technique involves a series of steps, each of which

is critical for successful results. The first step involves thorough debridement of the infected bone and soft tissues. All the nonviable and infected tissues, including the skin, soft tissue and bone are excised until bleeding viable tissue is present at the resection margins. Specimens of the bone, soft tissues and any purulent material were sent for culture and sensitivity. Preparation of the intramedullary canal is an important step. Adequate reaming is done to accommodate a larger diameter nail which ensures more stability. Thorough saline lavage of the medullary canal and the wound is done. The surgical team then change their gowns and gloves. The limb is prepared again and re-draped before antibiotic cement impregnated nail is prepared. The third step is the preparation of antibiotic cement impregnated nail under sterile conditions in the operating room. Nail length is measured with a guide wire pre-operatively. Nail diameter is determined by the per-operative reaming diameter. Interlocking nail is coated with bone cement up to 1 mm less than the diameter of the last reamer used. Standard viscosity gentamycin bone cement was used. 40 gm cement was thoroughly mixed with 2gm Vancomycin, following which the polymethylmethacrylate was added. When the cement reaches doughy consistency, interlocking nail is coated with bone cement using an endotracheal or chest tube to make the diameter uniform. Nail is inspected for spotty coverage and smoothened. The diameter is checked with Kuntscher diameter measuring gauge, excess cement is shaved off and the nail rolled before the cement sets. The diameter is rechecked. Bone cement is allowed to set for 15 minutes before insertion. Bone loss of up to 2 cm due to primary bone defect following fracture, sequestrectomy or freshening of bone ends were docked primarily. Bone ends aligned and nail is placed antegradely in the tibia. Nail-cement debonding during insertion is avoided by allowing adequate time for cement to set and bond with nail. Wound is inspected at intervals of 48-72 hour. A repeat debridement was done whenever required. The systemic antibiotics are given based on culture and sensitivity results. Further treatment was with oral antibiotics for 6 weeks depending on individual patient characteristic and the organism involved. A complete blood count (CBC), Erythrocyte Sedimentation Rate (ESR) and C-reactive protein (CRP) levels were performed at regular biweekly intervals to record rising or falling trends. Clinical and radiological features were used to assess the progress of bony union at 4 weeks interval till union was sound. As soon as the wound healed, a patellar tendon-bearing cast was applied in case of tibia and gradual full weight-bearing was permitted. The cast was changed every 6 weeks and continued till union was confirmed with clinico-radiological assessment. Active physiotherapy for regaining ankle and knee mobility were instituted until the range of movement was satisfactory.

RESULTS

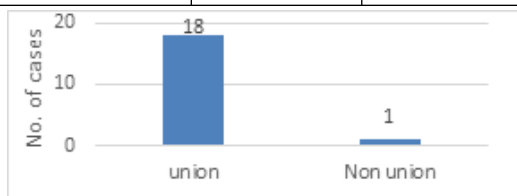
1.CONTROLOF INFECTION

No. of Cases	Infection Controlled	percentage
19	18	94



2.BONY UNION

No. of Cases	Union	Percentage
19	18	94



3.RATE OF UNION

Bone treated	Minimum duration	Maximum duration	Mean
Tibia	20 weeks	32 weeks	26 weeks

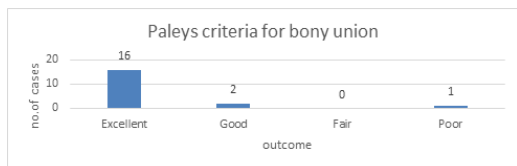
FOLLOW UPPERIOD:

Maximum	13 months
Minimum	4 months
Average	8 months

PALEY'S BONY CRITERIA:

Bony Criteria	Union	Infection	Deformity	Limb length discrepancy
Excellent	✓	Nil	<7o	<2.5 cm
Good	✓	With any two criteria		
Fair	✓	With any one criteria		
Poor	Non Union	With or without the above criteria		

According to these criteria, there were 16 excellent results, 2 good results, 0 fair and 1 poor result respectively.



DISCUSSION:

Osteomyelitis is commonly polymicrobial in 70 % of patients. The most common infecting organism in the literature and in our study was Staphylococcus aureus^{1,2}. Gentamycin and Vancomycin are common choices for local delivery of antibiotics because of their broad spectrum of activity, heat stability and low allergenicity^{3,4}. Clinical and experimental studies show them to have good elution properties from bone cement and have no deleterious effects on bone healing⁴. Infection was controlled in 18 out of 19 cases in our study and union in 18 cases. Exchange nailing was done for only 1 case to achieve bony union. **Paley et al**⁵ have shown that control of infection was about 85% and bony union achieved in about 80% of cases by Ilizarov method in infected nonunion of long bones. **Zhang Qiang et al**⁶ have shown bony union in only 11(58%) out of 19 cases, and infection controlled in 18 cases. **Thonse et al**⁷ have shown bony union in 17(85%) out of 20 cases, and infection controlled in 19 (95%) cases. Rate of bony union average of 26 weeks for tibia and is comparable with results shown by **Han SK et al**⁸ of 26.4 weeks for tibia and Use of external fixators is associated with poor compliance and pin site complications. They are difficult to apply and maintain in obese patients. Such patients benefit from the antibiotic cement impregnated nailing.

CONCLUSION:

1. Antibiotic cement impregnated nailing provides effective infection control and good stability to promote union and has good patient compliance.

2. It is a simple economical and effective single-stage procedure for infected nonunion of tibia.
3. The method utilises existing easily available instrumentation and materials to manage a complex problem in a highly cost-effective way.

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