Antibiotic cement impregnated nailing in the management of infected non-union of femur and tibia

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INTRODUCTION

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. Traditionally, treatment of non-union follows 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 18 non-union cases (femur or tibia) treated with ACIIN.

AIMS AND OBJECTIVES

To evaluate the results of antibiotic cement impregnated nailing in the management of infected non-union of femur and tibia.

MATERIALS AND METHODS

This prospective study was done on 18 cases of infected non-union of femur and tibia at Government Medical College, Thrissur during the period 2010-2011. Functional results were evaluated with regards to control of infection, bony union, deformity, limb length discrepancy and complications (intra and post-operative).

RESULTS

Infection was eradicated in 10 cases with ACIIN and the fractures united. In eight case, though the infection was controlled with ACIIN, 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: Infected non-union, long bones, antibiotic cement impregnated nail
**Materials and Methods**

This prospective study was done on 18 cases of infected non-unions of femur and tibia at Government Medical College, Thrissur during the period 2010-2011. Inclusion criteria included cases of infected non-union of femur and tibia. Exclusion criteria included patients less than 15 years, allergy to vancomycin or gentamycin, bone defects more than 4 cm. Functional results were evaluated with regards to control of infection, bony union, deformity, limb length discrepancy and complications (intra and post-operative).

**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.

**Surgical steps**

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 and copious lavage. 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 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. The nail is prepared on a separate sterile table. Nail length is measured with a guide wire per-operatively. Nail diameter is determined by the per-operative reaming diameter. Kuntscher nail or Ender nail of 6 mm or 7 mm diameter is chosen and 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 2 gm. Vancomycin, following which the polymer was added. When the cement reaches doughy consistency, a Kuntscher nail or Ender 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 rerolled before the cement sets. The diameter is re checked. Bone cement is allowed to set for 15 minutes before insertion to allow the monomer to evaporate and to prevent cement nail de-bonding.
Bone loss of up to 4 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 tibia and retrogradely in femur.

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 till the range of movement was satisfactory.

**RESULTS**

Of the 18 infected nonunion cases, 11 cases were initially open fractures and 7 were closed fractures. Infection was controlled in all cases. Eight cases required additional procedures to achieve bony union. Majority of the cases progressed to bony union without any additional procedures.

**DISCUSSION**

Osteomyelitis is commonly polymicrobial in 70% of patients. The most common infecting organism in the literature and in our study was Staphylococcus aureus. Gentamycin and Vancomycin are common choices for local delivery of antibiotics because of their broad spectrum of activity, heat stability and low allergenicity. Clinical and experimental studies show them to have good elution properties from bone cement and have no deleterious effects on bone healing.

Infection was controlled in 17 out of 18 cases in our study. Exchange nailing was done for only 3 cases to achieve bony union. Paley et al have shown that control of infection was about 85% and bony union achieved in about 80% cases by Ilizarov methodology in infected non-union of long bones.

The time for bony union was an average of 18 weeks for tibia and 25 weeks for femur.

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.

Advantages of antibiotic cement impregnated nailing:
1. High local concentration of antibiotic : 200 times greater than systemic drug administration.
2. Systemic toxicity of antibiotics is not observed.
3. Antibiotics level above the minimal inhibitory concentration of sensitive organisms.
4. Versatility of modifying antibiotic as per the culture report.
5. Post-operative morbidity is less due to early rehabilitation. Patient compliance is good.
6. Long stay in hospital is avoided. Hence the chances for hospital acquired infections is low.
7. Control of infection and stability in achieved by a single stage procedure.
8. It is cost effective.
10. Planning for soft tissue plastic procedures is easier.
11. Wider surface area of elution allows for high antibiotic concentration along entire length of the bone treated.
12. Antibiotic concentration at source of infection is not dependent on the pharmacokinetics of the antibiotic.
13. There is a high local concentration of antibiotic even in the presence of extensive scarring and compromised vascularity.
14. Patients with elevated renal parameters can be treated with effective concentration of antibiotic without side effects.
15. Overall patient compliance in our study was good and acceptance was better when compared with compliance to external fixators in literature.

**CONCLUSION**

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


