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Comparative study of compound both bone leg fractures managed with versatile antibiotic intramedullary inter locking nailing with external fixator

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ABSTRACT

Background: Background Compound fractures of the tibia are more likely to result in non-union and the development of infection because of inadequate blood supply and the absence of soft tissues in the antero-medial side of the tibia. Whether to undertake a primary fixation or a staged fixation is still a difficult decision to make in situations like these. Hence, we performed this study to compare the clinical, functional and radiological outcome of compound both bone leg fractures managed with Versatile Antibiotic Intramedullary Interlocking Nailing system and external fixator.
Methods: This is a Prospective comparative study performed on all patients admitted with compound fractures (Grade 1,2,3A,3B) of both bone leg fractures in the Department of Orthopaedics at a tertiary care center. Thorough wound debridement was done layer by layer after adequate extension of the wound. Fracture ends were debrided, thorough wound wash given with Reamer Irrigation Aspiration system (RIA).
Results: In our study, there is a significant association between the time delay of surgery and post operative infection (p value 0.008). In our study, average time from admission to surgery was 20.9 hours in group A vs group B (21.81 hours).
Conclusions: The final outcome in our study mainly depended on wound debridement and thorough pulsatile lavage and early intervention (VAIL Nailing), earlier the surgery better the outcome.

Keywords: Non-union, Malunion, Osteomyelitis, Tibial shaft fracture

INTRODUCTION

Over the past few years, there has been an increase in the number of compound fractures that have occurred as a result of the spike in the number of motor vehicle accidents as well as other high velocity injuries.[1] Compound fractures of the tibia are more likely to result in non-union and the development of infection because of inadequate blood supply and the absence of soft tissues in the antero-medial side of the tibia. Whether to undertake a primary fixation or a staged fixation is still a difficult decision to make in situations like these.[2] When it comes to compound fractures, external fixators are only used for the management of soft tissue.[3] They require a secondary final procedure for bone union and carry a high risk of infection. There are a number of practical challenges associated with the use of an external fixator. These challenges include the use of complex surgical techniques, poor patient compliance, the inability to weight bear with heavy fixators, and the prolonged use of intravenous antibiotics, which have considerable adverse effects due to their systemic toxicity.[4-8] In order to address all of these challenges, we developed a revolutionary method that would prevent infection, provide antibiotics, and

definitively fixate the patient in a single step process using antibiotics.MHence we performed this study to compare the clinical, functional and radiological outcome of compound both bone leg fractures managed with versatile antibiotic intramedullary interlocking nailing system and external fixator.

METHODS

Study place

This is a Prospective comparative study performed on all patients admitted with compound fractures (Grade 1,2,3A,3B) of both bone leg fractures in the Department of Orthopaedics at a The Oxford Medical College, hospital and research center, Bangalore. Ethical committee clearance was sought.

Sample size calculation

[Z2p (1 − p)]/ C2, Z value for 1% level of significance [Z]=1.96, Z value for 80% power [Z]=0.84. Pooled Standard deviation σ =18. Effect size (d)=7.2. Minimum sample size required in each group considering 10% non-response sample size is 12 in each group. Total sample size=24.

Those patients presenting with Pathological fractures, previous trauma or deformity, polytrauma, haemodynamic instability or segmental trauma of the tibia/fibula were excluded from this study. After resuscitation, patient were subjected to blood investigation. Antero- posterior (AP) and lateral X-rays including knee and ankle were taken for the involved limb.[13] Thorough wound debridement was done layer by layer after adequate extension of the wound. Fracture ends were debrided, thorough wound wash given with Reamer Irrigation Aspiration system (RIA). After ensuring thorough debridement, fracture was stabilized with Primary Versatile Antibiotic interlocking Nailing System. All Grade II wounds were closed primarily after adequate wound debridement. All Grade III wounds were closed primarily or split skin grafting/Flap cover based on the nature and extent of wound.

Surgical method for antibiotic intramedullary nailing

Patient was placed in Supine Position, after spinal anaesthesia. In case the relaxation was inadequate, general anaesthesia was administered. The approach used in all cases was an anterior patellar tendon splitting approach.

Definitive surgical fixation includes steps: Preparation of Intramedullary Canal, Preparation of antibiotic bone cement, Preparation of VAIL Nail. Radiographs of the concerned limb were obtained immediately after surgery, at six-week intervals until the leg was joined, and three months after the operation. The radiographs were taken with a standard anteroposterior and lateral perspective. On the following day after surgery, the patient began performing activities to strengthen their quadriceps and active range of motion exercises for the knee and ankle joints. Following the radiographic examination, which revealed evidence of union in the form of bridging callus, weight bearing was initiated. If there were no evidence of callus formation in the interlocking nailing group by the end of the third month, then dynamization was performed and the patient was encouraged to bear partial weight. After six weeks, the patient was contacted for radiological follow-up.

Statistical analysis

SPSS v22 utilized for the analysis.

RESULTS

Majority of population are between the age group of 20 to 60 years, with the mean age of the study population being 28.91+/-16.21 years.

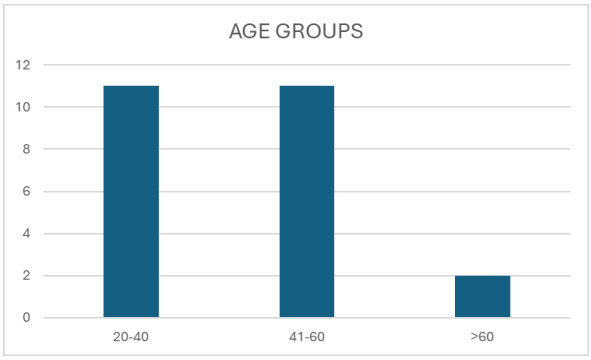

Figure 1: Age distribution.

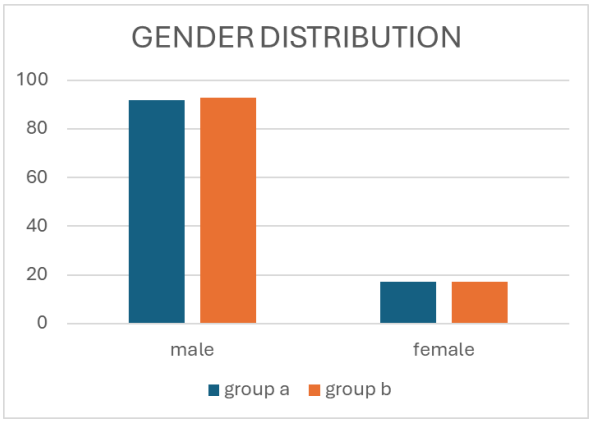

Figure 2: Gender distribution in the groups.

In the study, 91.7% of the study population was male in group A, and 92.88% were males in group be, there was no difference statistically. Majority of the fractures were in mid and distal third of the tibia and fibula, seen in 91.7% of the study population. When we compared the age, gender and site of fractures between the two groups, we found no statistically significant difference. Majority were Gustilo Anderson grade 2 fractures and were operated within 24 hours of the injury. Only in 1.25% in VAIL

group and 1.67% in external fixator. Majority has a RUST score of 10 i.e. 45.8% followed by 33.33% had a score of 12 in VIAL (group A), and the score was 10 in 41.67%, score 12 in 37.5%. the difference between the two groups was not significant.

Table 1: Site of fracture.

Site of fracture	Group A	Group B
Proximal	6	5
Middle	9	8
Distal	9	12
Total	24	24

In our study, there is a significant association between the time delay of surgery and post operative infection with p value 0.008 in both groups. However, there was no difference between the two groups. (p value 0.082). It is a well-known fact that lesser the time taken from injury to surgery, the better is the infection control rate. In our study, average time from admission to surgery was 20.9 hours in group A vs group B (21.81 hours)

Table 2: Time to surgery and its correlation with post-operative infection.

Time delay in surgery (hours)	Post op infection			P value
	0	**1**	**2**	
12	7	0	0	0.008
16	1	1	0	
24	9	0	1	
36	2	1	1	
48	0	0	1	
Total	19	2	3	24

DISCUSSION

When an extra articular distal tibial fracture is brought to an orthopedician, it frequently presents a problem to the surgeon.[8] This is because the status of the soft tissue and the degree of comminution itself complicate the plan of care. The objective of surgical therapy is to achieve anatomical alignment of the joint surface while simultaneously providing sufficient stability to permit early motion.[9] To achieve this goal, it is recommended that approaches be utilised that minimise the devascularisation of osseous and soft tissues.[10,11] This is done with the expectation of reducing the difficulties that are brought about by the treatment. The fact that males participated in our study in greater numbers than females in the Indian setting is likely attributable to the fact that males engage in more activities that take place outside and perform more labour than girls do. The findings were comparable to those previously published by Kumar et al, Ram et al, Li et al and Vallier et al, among others.[12-14] These investigations likewise demonstrated that road traffic accidents are the most common cause of injury. An investigation into the use of the VAIL for the treatment of infected non-union long bones was carried out by Shyam et al, which was very similar to our own work. In situations of infected non-union with bone defect less than 6 centimetres, they came to the conclusion that VAILs should be utilised for the purpose of infection control and bone union.[11] They argued that other options should be utilised in situations where the flaws were greater than six centimetres. Additionally, Bhatia et al investigated the effect that antibiotic cement-coated nailing plays in the treatment of infected non-union of the tibia at the same time.[12] It took an average of 32 weeks for patients with bone abnormalities of less than 2 cm to achieve bony union, with sixty percent of patients achieving this goal. Bone grafting and exchange nailing were two of the operations that were necessary for the remaining patients who had bone deficiencies that were greater than 2 cm. The researchers noticed a variety of problems, including difficulty in nail removal, broken nails, twisted nails, and recurrences of infection. Using Ilizarov, Maini et al were able to successfully establish bone union in patients with bone abnormalities ranging from 4 cm to 15 cm.[13] Antibiotic-coated intramedullary interlocking nail (ACIIN) was able to achieve an infection control rate of eighty percent.

In addition, Thonse et al were successful in controlling infections in 84% of the cases.[6] According to the findings of a number of studies, external fixators are linked to a number of problems, including a high rate of pin infections, pin loosening, poor compliance on the part of patients, joint stiffness, and muscle contractures.[22,23] Because VAIL Nailing is a definitive technique that only requires one step, the risk of several surgeries is eliminated, and the need for systemic antibiotics for an extended period of time can be reduced. According to Wahlig et al, the primary benefit of local antibiotic therapy is the ability to achieve a high local antibiotic concentration, which is something that could not be done safely with systemic antibiotics.[14] When compared to other procedures, such as secondary nailing followed by external fixation and antibiotic coated (external coating only) nail, our research found that the time of bone union was much shorter, and overall complications were significantly lower. This was the case when compared to other procedures.

CONCLUSION

Our study, patient who underwent surgery within 24 hours of admission had good functional outcome, wound healing and good bony union with both fixation methods. The final outcome in our study mainly depended on wound debridement and thorough pulsatile lavage and early intervention (VAIL Nailing), earlier the surgery better the outcome.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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