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## Efficacy external fixator in the management of infected nonunion fractures

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### Abstract

Management of infected nonunion of fractures is a difficult task for orthopedic surgeons in a manner to create bony stability, in recovery of soft tissue and fracture union. Several surgical treatment modalities have been available like bone grafting, antibiotic treatment, ilizarov methods and free soft tissue transfer. This study was conducted to assess the role of monolateral external fixators in infected nonunion of fractures. A total 40 infected nonunion cases were recruited based on AO classification. Patients with wounds of minimum 3 months were considered as non- draining cases. Blood investigations, microbiological investigation and radiological investigation were done. Special attention was focused on limb length measurements, range of motion of the joints, neuromuscular status and distal vascularity. The final surgical outcome was assessed as per ASAMI'S criteria with grade system. Among the cases, 65% nonunion fractures were observed in femur, 22.5% in tibia and 12.5% in humerus. Superficial pin tract infections was noticed in 48% cases and are responded to oral antibiotics. The final surgical outcome indicates that 90% cases had grade-I & II (excellent and good) recovery from infected nonunion fractures in bony and functional recovery. The monolateral external fixation system is effective and convenient method for the treatment of infected nonunion of long bones and is most reliable to rectify the limb length discrepancies.

**Keywords:** Monolateral external fixators, infected nonunion, bony fractures

### Introduction

Infected non-unions is a major challenge for orthopedic surgeons in past few decades. It is defined as non-fusion of fracture for minimum six months period with persistent infection at the fracture site [1]. Infected non-union of fractures is not only a functional disability but also has severe impact on socio economic status [2].

Factors responsible for infected nonunion are necrosis of fracture ends at nonunion sites due to thrombosis of vascular channels of bones, microbial growth which are resistant to antibiotics, loss of soft tissue, multiple surgeries with muscular fibrosis, limb length inequalities, chronic discharging sinus suggestive of pus collection and joint stiffness [3,4].

Infected nonunion of lower limb bones (femur and tibia) are common in surgical practice. Several surgical treatment modalities have been available like bone grafting, antibiotic treatment, ilizarov methods and free soft tissue transfer [5, 8] Every method has limitations like defects in size, prolonged surgical duration and donor site morbidity in bone grafting, tissue transfer is suitable for soft tissue loss and in treatment of large bone, antibiotic treatment may reduce the infection but need bone grafting backup to reduce nonunion [9]. With the above limitations, the present study was aimed to assess the efficacy of role of external fixators in infected nonunion of bones.

### Materials and methods

The present prospective study was conducted in Department of orthopedic surgery, Konaseema institute of medical sciences and research foundation, Amalapuram during April 2016 to September 2017. A total 40 infected nonunion cases were recruited based on AO classification.

Patients with wounds of minimum 3 months were considered as non- draining cases. Among total cases 26 cases had infected nonunion of femur, 9 patients had infected nonunion of tibia

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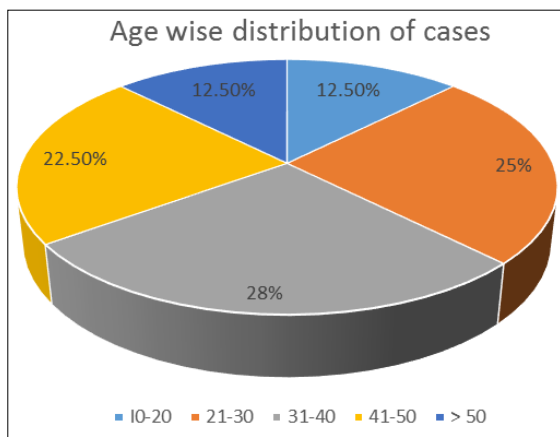
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and 5 cases had infected nonunion of humerus. All the cases were subjected to detailed physical and clinical examination. Blood investigations, microbiological investigation and radiological investigation were done. Special attention was focused on limb length measurements, range of motion of the joints, neuromuscular status and distal vascularity.

In post-operative management, the limb was kept elevated to reduce post-operative oedema. Drain was removed after 48 hrs. Initial 2 weeks parenteral antibiotics were administered and later 2 weeks oral antibiotics were continued to reduce the infection. Physiotherapy and no weight bearing up to 4 weeks later on advised partial weight bearing. Radiological follow up was done every week for the status of distraction. The final surgical outcome was assessed as per ASAMI'S criteria. Based on that, Grade I (Complete union of fracture without infection, shortening and deformity), Grade II (Union with shortening and deformity), Grade III (Union with deformity) and Grade IV (Nonunion of fractures).

**Results**

This study included a total 40 patients of nonunion of bones with wounds of minimum 3 months. Among 40 cases 32 are male and 8 are females. Majority of the cases were in between age group 31-40 years (28%) followed by 21-30 years (25%) (Figure 1).



**Fig 1:** Age wise distribution of cases.

**Table 1:** Distribution of nonunion in various bones in our study.

Bone wise Distribution of nonunion	No. of cases	
	Number	Percentage
Femur	26	65%
Tibia	9	22.5%
Humerus	5	12.5%

**Table 2:** Draining and non-draining nonunion distribution of bones.

Bone	Draining nonunion (n=27)		Non draining nonunion (n=13)	
	Number	Percentage	Number	Percentage
Femur	18	66.6%	8	61.5%
Tibia	6	22.2%	3	23.07%
Humerus	3	11.1%	2	15.3%
Total	27		13	

**Table 3:** History of past treatment received by the patients.

Infected nonunion	Total	Native treatment	POP	External fixation	Plating	Nailing
Femur	26	8	3	6	4	5
Tibia	9	2	1	2	-	4
Humerus	5	1	1	-	3	-

Among the cases, 56% cases developed infected nonunion following open fractures and 46% patients developed infected nonunion following previous implant surgeries of closed fractures. Among total cases, 48% cases had pin tract infection and after surgical procedure in 5 cases split skin graft cover was given for wound dehiscence. The average time for union of fractured bone was 21 weeks. Among the total cases, superficial pin tract infections was noticed in 48% cases and are responded to oral antibiotics. Edema was observed and was reduced after fixator removal in few cases. Extended oedema cases were advised to wear elastocrepe bandage.

**Table 4:** Final surgical outcome for the treatment of infected nonunion of bony fractures.

	Bony outcome		Functional outcome	
	Number	Percentage	Number	Percentage
Grade I	16	40%	11	27.5%
Grade II	18	45%	25	62.5%
Grade III	4	10%	2	5%
Grade IV	2	5%	2	5%

**Discussion**

The management of infected nonunion of fracture has become a major clinical challenge for orthopedic surgeons. This study was aimed to assess the efficacy of role of external fixators in infected nonunion of bones. The present study included a total 40 patients of infected nonunion of bones with wounds of minimum 3 months. Among 40 cases, 32 (76%) were male and 8 (24%) were females. Majority of the cases were in between age group 31-40 years (28%) followed by 21-30 years (25%) (Figure 1).

In order to bone wise distribution of nonunion among the total cases showed, 65% nonunion fractures were observed in femur, 22.5% in tibia and 12.5% in humerus (Table 2). Infected nonunion of humerus are often observed and management is challenge for clinicians. In this study 5 (12.5%) cases had infected nonunion and were treated with external fixators. There was evidence of good bony union in an average of 21.2 weeks. The results of present study is compatible with the study by Gualdrini *et al.*, where the average union time was 5.5 months and in study by Biasibetti. *A et al.*, the union time was 4 months [10, 11].

In the present study, among the total cases, superficial pin tract infections was noticed in 48% cases and are responded to oral antibiotics. This results were comparable with the study conducted by Gopal S *et al.*, where the reported pin tract infection was in ten out of 19 cases (53%). Study by J.R Coll., reported pin tract infection was 30%. Hence the rate of pin tract infection remained moderate in our study. Edema was observed and was reduced after fixator removal in few cases. Extended oedema cases were advised to wear elastocrepe bandage [12].

In this study the mean limb discrepancy was 1.98cms. A study by Eduardo el al., found mean limb length discrepancy was 2.03 cm [13]. The Monolateral external fixator is a telescopic device that can be locked for rigid fixation or unlocked to permit load sharing. Light weight, patient friendly, day-to-day activities can be done easily, Since the pins are unilateral it is much more comfortable for the patients, hence joint mobilization can be done with ease. Being rigid, early weight bearing can be allowed with the device. The Bone healing index (BHI) in our study was 45.9 days/cm, which is high when compared with that reported by Spanish study of 261 lengthening had a lowest BHI of 28 days/cm, Noonan *et*

al reported BHI of 49 days/cm. In this study, the final surgical outcome indicates that 90% cases had grade-I & II (excellent and good) recovery from infected nonunion fractures in bony and functional recovery.

### Conclusion

An infected nonunion shows a series of complications, each of which needs to be tackled separately. The final outcome concluding that, in 90% cases recovery from infected nonunion of fractures was excellent and good. Indian version of the monolateral external fixation system is effective and convenient method for the treatment of infected nonunion of long bones and is most reliable to rectify the limb length discrepancies.

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