

Functional Outcome of Open Diaphyseal Tibial Fracture Treated By A.O Fixation VS N.A Fixation

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ABSTRACT

Objective: To evaluate the comparative results of open diaphyseal tibial fractures treated with A.O fixation and N.A fixation.

Study Design: Comparative and experimental study

Place and Duration of Study: This study was carried out at Orthopedic Department of Liaquat University Hospital Hyderabad from February 2011 to January 2013.

Materials and Methods: Total 50 cases were included in this study. All the cases with diabetic mellitus and associated head and abdominal injuries were excluded from the study. All the cases were divided in two groups equally 25 patients in group A, treated by N.A fixator and 25 patients treated with A.O fixator were selected in group B. Initial resuscitation, splintage and primary care for the wound was provided in the emergency department, any bone fragments that were protruding out were covered with sterile dressing. After counseling the patient and attendants regarding the condition of injury, its importance & possible complications, also explained about the method of treatment selected (Group A or Group B) then the patients were taken to the operating room.

Results: The mean age $\pm$ SD in group A (NAEF, n = 25) was 35.4 ± 9.22 years and 32.10 ± 9.69 years in groups B (AOEF, n = 25), Out of total cases, male were in majority. Majority of patients were found RTA in both groups. In the group A (NAEF), pin tract infection 5(20.0%) cases, pin site osteolysis 5(20.0%), pin loosening 5(20.0%) , pin site inflammation were in 3(12.0%) cases, which were cured by curettage of the outer cortex and oral antibiotics for a short period, 1(4.0%) patient went in infective nonunion and converted into Illizarrov external fixator. Knee stiffness was found in 2(8.0%) and Ankle stiffness was 3(12.0%) cases, in group A (NAEF) and 3(12.0%) in group B. Five (20.0%) patients of group A (NAEF) had mild limitation of ankle motion (mainly dorsiflexion) and 3(12.0%) were with Limited Flexion, patients of group B were without limitation of knee motion with a flexion ranges of 5(20.0%).

Conclusion: AO external fixator is much better than Naseer Awais External Fixator. It is simple and safe to apply, cost effective and successful management of open tibial fractures.

Key Words: Open Diaphyseal Tibial Fracture, A.O fixation vs N.A fixation

INTRODUCTION

The tibia is one of the longest bones of skeleton, located in the lower extremities; and affected in about 40% of all long bone fractures, Approximately 25% of all tibial fractures are open fractures.^{3, 4} This is due to its subcutaneous location.⁵ Open tibial fractures usually result from high-energy trauma.⁶ The aim for the treatment of open tibial fractures are prevention of infection, early coverage of soft-tissue defects, achievement of bony union and functional rehabilitation with limb salvage. Early soft-tissue coverage is associated with a decrease in infection rate.⁷

A widely used method of treatment for unstable tibial shaft fractures is unilateral external fixation. External fixation is indicated in all open fractures, where the soft tissues are compromised and it's necessary to stabilize the fracture as soon as possible.⁸ It is presently the best method to stabilize an open fracture, because it allows for easy access to the soft tissues and mobility of the nearby joints.¹¹ In AO classification for soft tissue

injuries to skin, muscle, tendon and neurovascular structures.¹² The AO external fixator is very popular in treating type 111A & B open tibial fractures in our set up because of it is easily available ,cost effective, light weight, simple to apply, least cumbersome, giving minimal operative trauma, and good access to the soft tissue and massive contamination. It is particularly useful in type 111A & B open fractures of tibia. Different types of external fixators are used for segmental bone transport to fill bony defects. In our study we use the local version monolateral and monoplaner external (N.A Naseer Awais) fixator which is the modification of A.O, Hoffman fixator and other unilateral fixators used for this purpose, N.A fixator is less cumbersome technically easy to apply and more comfortable for patients. Advantages of the N.A fixator is the cheap locally available and has short leaving curve for trainees in its use , however full weight bearing is Limited with this N.A fixator, this procedure is however the definitive treatment of bone loss, eradication of infection and good quality of new bone

formation along with soft tissue bridging.¹¹ Advantages of the external fixator are avoidance of infection, quick and better rehabilitation and excellent functional outcome. Factors such as the degree of soft tissue damage and velocity of injury are more important than the wound size.¹² Complications of external fixators are, damage to soft tissue structures (nerves & Vessels), over distraction or mal union and pin tract infection.¹³ It is aimed to determine the effectiveness of both methods for treatment of open tibial fracture.

MATERIALS AND METHODS

This comparative and experimental study was carried out at orthopedic department of Liaquat University Hospital Hyderabad with the duration of time February 2011 to January 2013. Total 50 cases were included in this study. All the adult patients with fresh open diaphyseal fractures of tibia were selected in the study. All the cases with diabetic mellitus and associated head and abdominal injuries were excluded from the study. All the cases were divided in two groups equally 25 patients in group A, treated by N.A fixator and 25 patients treated with A.O fixator were selected in group B. Gustilo Anderson classification GII and GIIIA divided in two groups A and B. Initial primary care of wound was given in the emergency ward, any bone fragments that were protruding out was covered by sterile dressing. After counseling the patient and attendants regarding the condition of injury, its importance & possible complications, also explained about the method of treatment selected (Group A or Group B) then the patients were taken to the operating room. After an initial microbial swab, and antibiotic treatment, surgical toilet/ wound debridement and fixation of the fracture according to criteria AOEF/NAEF was done. The AO fixator was located in neutralization sort in case of comminuted and butterfly fragment fractures. Compression mode in patients of transverse, oblique and segmental fracture as to narrow fracture gap and improve stability. Relaxing skin incisions were placed nearly pin tracts avoiding the skin compression, bones were covered with overlying muscles, skin approximated with stay sutures. The foot and ankle were manipulated at the end of procedure to ensure absence of musculotendinous tethering by half pins. Regular dressing with appropriate antibiotics administration was done in postoperative wards. After 3-4 weeks, once the wound is clean and covered with healthy granulation tissue plastic surgeon opinion was sought and treated accordingly.

In NA fixator after checking the fracture reduction tightens the bolts with wrench with two fixator bars, primary closure were done in clean cases and contaminated cases left open for secondary closure. pin care is started after the initial post operative dressing has been removed wounds were inspected at the interval of 48-72 hours and repeat debridement was

done whenever required Pin sites are cleaned daily using hydrogen peroxide solution or antibacterial soap and water.

All patients were made to stand with support after 48 hours and toe touching was permitted as per the stability of the fixation diagnosed radiographically. All cases were followed with immediate postoperative radiographs and clinical assessment. Then followed through OPD weekly for one month then every three weeks for three months when discharged from hospital. Radiographs were taken and alternate dressings done in the OT.

After removal of Naseer Awais External Fixators sarmento plaster was applied for 03 to 04 weeks and followed in review clinic from 06 to 12 months. Record of all the cases were maintained in the proforma. include clinical and radiological assessments in the review clinics with view of healing of wounds, union of fracture, complications, and functional outcome.

RESULTS

Total 50 cases of open diaphyseal fracture of tibia were selected in this study. The mean age $\pm$ SD in group A (NAEF, n = 25) was 35.4 ± 9.22 years and 32.10 ± 9.69 years in groups B (AOEF, n = 25). Out of total cases, male were in majority as; in group A, male were 19(38.0%) and female were 6(12.0%), in group B males were 21(42.0%) and female were 4(8.0%). Table: 1.

The results of this study showed, majority of patients of RTA 15(30.0%) were in group A and 15 (30.0%) patients were with RTA in group B. Table: 1.

Wound presentation at the time of admission was observed in all the cases, 22(44.0%) were with clean 3(6.0%) with contaminated wound in group A, 19(38.0%) with clean and 6(12.0%) were with contaminated wound in group B. Table: 1

Mean $\pm$ SD union time was higher in group A (NAEF, n = 20) 22.6 ± 5.60 weeks than group B (AOEF, n=20) 18.1 ± 3.72 weeks (p value 0.004). Table No. 2

Original wound became infected in 4(16.0%) cases, no found infected surgical wound re in group A, original infected wound in group were found 3(12.0%) , and surgical infected wound were 2(8.0%). Table No. 2

In the group A (NAEF), pin tract infection 5(20.0%) cases, pin site osteolysis 5(20.0%), pin loosening 5(20.0%), pin site inflammation were in 3(12.0%) cases, which were cured by curettage of the outer cortex and oral antibiotics for a short period, 1(4.0%) patient went in infective nonunion and converted into Illizarrov external fixator. Table No. 2

In the group B, 1(4.0%) patient had delayed union, screw sites were infected in 3(12.0%) cases (2 proximal and 1 distal) while this were not found in group A. Table No. 2.

Knee stiffness was found in 2(8.0%) and Ankle stiffness was 3(12.0%) cases, in group A (NAEF) and 3(12.0%) in group B. Table No. 2

Four (16.0%) patients developed pain during walking, in group A (NAEF) and 2 (8.0%) in group B. Table No. 2.

Table No. 1; Baseline status of patients in both groups. (n = 50)

	Group A: NAEF n = 25(50%)	Group B: AOEF n = 25(50%)
Age (Mean+SD)	35.4 ± 9.22	32.10 ± 9.69
Gender		
Male	19(38.0%)	21(42.0%)
Female	6(12.0%)	4(8.0%)
Mode of injury		
Pedestrian		
RTA	4(8.0%)	2(4.0%)
Fall from height	15(30.0%)	15 (30.0%)
Machine Injury	5(10.0%)	8(16.0%)
Wound presentation		
Clean	22(44.0%)	19(38.0%)
Contaminated	3(6.0%)	6(12.0%)

Table No. 2: Post operative complications in both groups (n = 50)

Complications	Group A: NAEF N = 25 (100%)	Group B: AOEF N = 5 (100%)
Infected original wound	4(16.0%)	3(12.0%)
Infected Surgical wound	0	2(8.0%)
Non union	1(4.0%)	1(4.0%)
Delay union	0	1(4.0%)
Infected Entry point	0	1(4.0%)
Screw site infections	0	3(12.0%)
Pin tract infection	5(20.0%)	0
Pin site inflammation	3(12.0%)	0
Pain during walking	4(16.0%)	2(8.0%)
Pin site osteolysis	5(20.0%)	0
Pin loosening	5(20.0%)	0
Pin site hypergranulation	1(4.0%)	0
Ankle stiffness	3(12.0%)	0
Knee stiffness	2(8.0%)	3(12.0%)

Table No. 3; Range of Movements (n = 50)

Range of Movement:	A: NAEF n = 25(100%)	B: AOEF n = 25(100%)
Ankle:		
Limited dorsiflexion	5(20.0%)	0
Full ranged	20(80.0%)	25(100%)
Knee:		
Limited Flexion	3(12.0%)	5(20.0%)
Full ranged	22(88.0%)	20(80.0%)

Five (20.0%) patients of group A (NAEF) had mild limitation of ankle motion (mainly dorsiflexion) and 3(12.0%) were with Limited Flexion, patients of group B were without limitation of knee motion with a flexion ranges of 5(20.0%). Table No. 3.

DISCUSSION

Tibial shaft fractures are frequent since they account for 9.0% of all fractures.¹⁴ Open fractures of the tibia show a high-energy injury to soft tissue and bone with ensuring problems of infection and poor bone healing.¹⁵ This study has been conducted to compare the results of Naseer & Awais (N.A) fixator and A.O external fixator, in the managements of open tibial diaphyseal fractures. To evaluate results of open diaphyseal tibial fractures stabilization with A.O fixation and N.S fixation and compare their results along with postoperative complications and functional outcome.

In the present study, all the patients included under the study were between 18-60 years of age and the mean age + SD was 33.1 + 10.27 in group A(NAEF) and in group B (AOEF) was 30.8 + 7.76. While in Thakur and Patankar et al.¹⁶ suggested in study the mean age was 38 years which is similar to this study. Whereas Makhdoom A et al.¹⁷ also revealed similar observation. In the present study, out of 50 cases, 40(80.0%) were males and 10(20.0%) were females. This observation is comparable to the local study conducted by Makhdoom A et al.¹⁷ who showed 60 (88.24%) males and 08 (11.76%) females in his study. It was observed that males were more involved. This may be due to the differences in the life style. Another factor is social set up, most of the females remain confined to their homes in our society, and therefore they are less exposed to the risk of open fractures. Our results regarding the sex incidence are compared with that of S.K. Moda et al,¹⁸ This study was conducted in India, where the social setup is almost same.

In present study road traffic accidents remained the most common cause of open diaphyseal fracture, 30 patients (60.0%) out of 50 patients. Comparing to others, C.M.Brown et al,¹⁹ had 90% and Shahid Sultan 1993,²⁰ had 87.6% patients with road traffic accidents in their serials. This is because of ignorance of traffic rules, increases in number of vehicles, high speed, busy schedule, urgency to reach the destination and poor condition of roads in our society, are main reasons for road traffic accidents.

The mean time of bone union was 22.6 weeks (ranging from 13 to 32 weeks) in our study. Nila C. et al,²¹ achieved union in mean time of 16-20 weeks, Ayaz khan (2004),²² in 20 weeks and Thakar AJ et al,²³ in 20 weeks.

There was surgical wound infection found (8.0%), original wound infection was in 7(14.0%) of the cases

in this study. Pankaj Kumar and his colleagues (2004),²⁴ and Ricardo J et al (1997),²⁵ found 0% infection, S. Gopal et al,²⁶ found 9.5% and Shahid Sultan (2001),¹¹ 13% infection rate their serials. The lower rate of infection was because of awareness in patients to reach early at tertiary hospital and understanding of surgeon to perform early aggressive debridement, early stabilization and early soft tissue.

Pin tract infection is the most common complication of external fixation, there were 5 cases (10.0%) of pin tract infection in this study. Ricardo J et al,²⁵ Nila C et al,²¹ and M. Ayaz Khan et al,²² observed 20.5%, 11.4% and 47.4% in sequence pin tract infection rates in their serials.

The non union is main complication of external fixator, many authors called external fixator a machine of nonunion. We had 2 case (4.0%) of non union, all achieved union later with secondary procedures. Bhandari M. et al²⁷ and his colleagues, M J Iqbal et al²⁸ and M. Ayaz Khan et al,²² reported 14.2%, 9.6% and 5% in sequence rates of non union in type 111 open tibial fractures in their serials.

CONCLUSION

In this study concluded that AO external fixator is much better than Naseer Awais External Fixator. AO external fixator is simple and safe to apply, cost effective, minimal invasive, needs less operating time, hospital stay, union time, infection rate and gives good functional outcome and can be used as definite and successful management of open tibial fractures.

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