

# MANAGEMENT OF OPEN DIAPHYSEAL FRACTURES OF TIBIA TREATED BY NASEER AWAIS EXTERNAL FIXATOR

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## ABSTRACT

A prospective study of open diaphyseal fractures of tibia in 68 patients managed and stabilized with locally made Naseer - Awais External Fixator (NAEF) was undertaken at the Department of Orthopaedics Liaquat University Hospital Jamshoro and Hyderabad, from April 2001 - March 2005. Inclusion criteria of study were open grade II, IIIA and IIIB according to modified Gustilo classification. Common mode of injury was road traffic accidents in 38 (55.88%). Age ranged between 8 - 60 years, average 30.76 years. Males were 60 (88.24%) and 8 (11.76%) females. We performed alternative compression and distraction at weekly intervals and dynamization at later stage to enhance bone healing. Sixty six fractures out of 68 united. Time to union ranged between 12 and 28 weeks, average 19.87 weeks. Major complications were pin tract infection in 08 (11.76%) patients, delayed union in 04 (5.88%) and nonunion in 02 (2.94%) patient.

## INTRODUCTION

Open diaphyseal fractures of tibia are common presentation at orthopaedic emergency and trauma centers. The most common site is diaphysis and the most common cause is road traffic accidents (*Irwin et al 1995*)<sup>9</sup>. The management of open fractures has been a challenging problem for an Orthopaedic surgeon, because he has to combat at two fronts simultaneously i.e. the management of soft tissue injury as well as of the fracture (*Muller ME et al 1992*)<sup>11</sup>. The use of external fixator has brought revolutionary changes in the field of Orthopaedic surgery. It provides skeletal stability, and allows early mobilization and thus reduces the hospital stay of the patient (*Putnam MD; Walsh- TM 1993*)<sup>13</sup>.

With improved design and better understanding of the principles that govern their safe and effective use, the external fixators have become indispensable tools in the hands of the experienced trauma surgeons (*Dr. Khaleeqe Ahmed Siddiqui 1995*)<sup>2</sup>. Extremity fractures are caused by either low or high-energy forces, and may be isolated or combined with other injuries. Low-velocity missiles do not pose the problems from bone and soft tissue damage that occur from high-velocity weapons or shot gun wounds (*Levy, A.S., Bromberg, J., and Jasper, D.: 1994*)<sup>10</sup>. Soft tissue damages also influence the hospital stay, consolidation time and frequency of osteosynthesis. The more severe the soft tissue trauma is, the more difficult the fracture healing will be (*Romnen PM. & bross - PL: 1992*)<sup>14</sup>.

The NAEF is uniaxial, has few components, is developed locally, and is cheap. It has performed the desired function (*Dr. Syed Muhammad Awais 1992*)<sup>4</sup>. The first Naseer-Awais External Fixator (NAEF-1) was developed and used in the Department of Orthopaedic Surgery King Edward Medical College and Mayo Hospital Lahore in early 1981. Since then based on the local experience different types of NAEFs have been developed and used in the management of different problems like fractures and for leg lengthening. The NA Fixator for leg lengthening and segment transport was introduced in 1988 and used for segment transport in a girl of 8 years (*Dr. Syed*

*M. Awais 1992*)<sup>5</sup>. The system has been successfully used for treatment of open fractures, segmental fractures, open fractures with segmental loss of bone, infected fractures, and leg lengthening in case of segmental bone defects and post-polio paralysis.

### **MATERIAL AND METHODS**

A Prospective study of treating open diaphyseal fractures of tibia by using locally made unilateral one plane configuration Naseer Awais External Fixator. This was carried out at Department of Orthopaedics Unit 1. Liaquat University Hospital of Medical and Health Sciences Jamshoro and Hyderabad from April 2001 - March 2005.

Seventy five patients with 79 open diaphyseal fractures of tibia were initially managed and stabilized with NAEF. Eight patients were lost in follow up. Sixty eight patients were finally included in this study and were reviewed for 06 - 12 months weekly for 03 weeks then every 02 weeks for 08 weeks and then monthly. An inclusion criteria of this study was open Grade II, IIIA, and IIIB fractures according to modified Gustilo's classification.

All the patients were assessed in the casualty department, and after the required initial emergency treatment, the patients were wheeled on to the radiology department. Every patient had standard anteroposterior and lateral roentgenograms of the affected leg and the fracture configuration was recorded along with other associated injuries.

Initially wounds were washed with normal saline and hydrogen peroxide, gentle traction was applied and gross deformities reduced. Open wounds were covered with sterile dressings and the extremity was splinted by above-knee back slab. Pain relief was obtained by parenteral analgesics. Associated injuries were treated accordingly. Wound debridement was done under in all cases as soon as the patient's general and medical condition permitted. Active bleeders were ligated at the time of initial debridement. The specimens were collected for culture and sensitivity test before the debridement was carried out. ATS (Anti Tetanus Serum) and broad-spectrum antibiotics were injected to all the patients because these drugs were available in our hospital and later on changed according to c/s report.

Wound debridement was followed by stabilization of fractures with locally made N.A External Fixator either simultaneously or later if the fixator was not arranged. The naked bone and tendons were covered by either mobilizing the lateral and posterior muscles or by local muscle flap and fasciocutaneous flaps. All the wounds were left open after initial debridement and patients who did not arrange NAEF were dressed with swabs soaked in pyodine and normal saline solution and leg put into back and u-slab. Reduction and stabilization of the fractures were radiologically assessed on same or next day of the application of the NAEF. All the wounds were re-examined 48 hours after the initial debridement and the fractures were stabilized with NAEF in cases where this was not done during the first procedure. The wound was closed only if there was no sign of infection, oedema or swelling and if closure was possible without any tension. Otherwise the wounds were left open and dressed with swabs soaked in solution of pyodine, normal saline and flagyl.

Local muscle flap and fasciocutaneous flaps were rotated to cover the naked bone in 36 cases of type IIIB open tibial fractures. Injured limb was elevated post operatively. Active exercises were started day after the application of the NAEF or when patient could tolerate pain. All patients were mobilized non-weight bearing with crutches 02 to 03 days after the application of the NAEF if the swelling had subsided and the

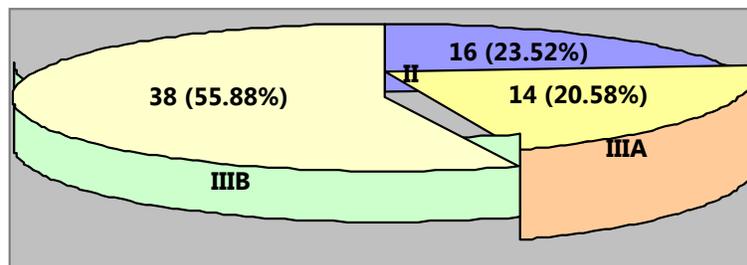
wounds improved. The limb was, however, kept elevated when patient was sitting or lying down. Partial weight bearing was allowed when wound had healed and there was visible callus on radiographs 04 to 12 weeks (9.58 weeks). Weight bearing was gradually increased to full weight bearing at 10 to 20 weeks (17.32 weeks). We performed alternative compression and distraction at weekly interval after first 02 to 03 weeks of fixation to enhance osteoblastic activity for achievement of early callus formation. Dynamization of external fixator was done when patient achieved full weight bearing. Pin entry sites were cleaned on alternate day and covered with pyodine soaked gauze. Loose clamps tightened whenever required. All patients were trained about the care of external fixator during their stay in hospital. Patients were discharged as wound healed (3.47 weeks) and were called for follow up in the out patient department, every 02 to 04 weeks and were x-rayed till fracture united. Fracture was declared united clinically when there was no tenderness and no movement at the fracture site, and radiologically when there was no fracture line visible and good amount of callus. Functional out come of limb was judged as range of movements. NAEF was removed when fracture was consolidated. The external fixator was replaced by below knee walking plaster for 02 to 03 weeks.

### **RESULTS**

In our study 16 fractures were classified as type II, 14 type IIIA and 38 type IIIB. Age of the patients ranged from 08 to 60 years (average 30.76 years). There were 60 (88.24%) males and 08 (11.76%) females. Common mode of injury was road traffic accidents 38 (55.88%), 14 (20.58%) were caused by firearms, 06 (8.82%) had fall from height, 06 (8.82%) sport injuries and 04 (5.88%) were bomb blast victims. The time lapse between injury and arrival at hospital ranged between 02 to 96 hours (average 24.2 hours). Time between admission in hospital and primary procedure ranged from 02 to 08 hours (average 5.02 hours). The time lapse between admission and application of NAEF varied from 05 hours to 07 days (average 56.78 hours). This delay in application of external fixator was because of financial problems on the part of patient and other associated medical conditions.

The fixator was in situ between 14 to 26 weeks (21.58 weeks). Out of 68 cases 66 united. Time to union ranged between 12 to 28 weeks (19.87 weeks). Major complication was pin tract infection in 08 (11.76%) patients. Delayed union in 04 (5.88%) patients, and non-union only 02 (2.94%) patient.

**GRAPH 1** Distribution of soft tissue injury according to Gustilo's classification



**TABLE 1  
MODE OF INJURY**

MODE OF INJURY	NO. OF PATIENTS	PERCENTAGE
Road Traffic Accident	38	55.88%
Firearm Injury	14	20.58%
Fall From Height	06	08.82%
Sport Injuries	06	08.82%
Bomblast	04	05.88%

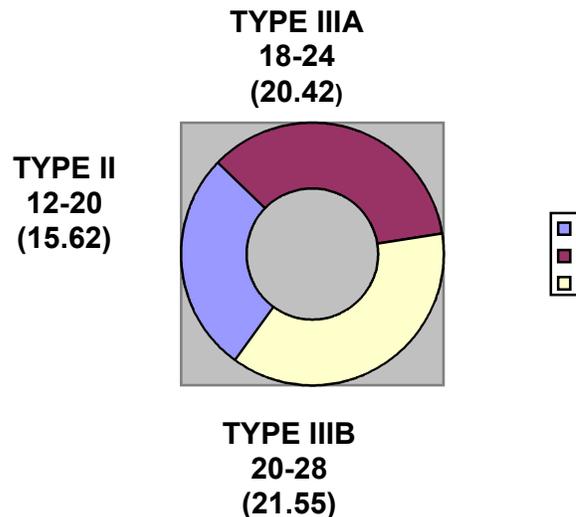
**TABLE 2  
SITE OF FRACTURE**

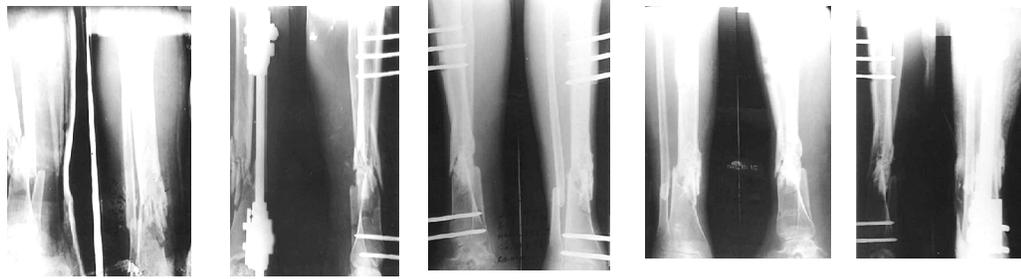
S.NO.	SITE	NO. OF PATIENT	PERCENTAGE
1.	Middle 3 <sup>rd</sup>	36	52.94%
2.	Distal 3 <sup>rd</sup>	24	35.29%
3.	Proximal 3 <sup>rd</sup>	08	11.76%

**TABLE 3  
METHODS OF WOUND COVERAGE**

Method	No: Of Patient	Percentage
Local Muscle Flap	26	38.24%
Split Skin Graft	16	23.53%
Closure with Release	12	17.65%
Incision Local	10	14.70%
Fasciocutaneous Flap	04	05.88%
Cross Leg Flap		
Total	68	100%

**GRAPH 2  
UNION TIME OF OPEN DIAPHYSEAL FRACTURES OF TIBIA (IN WEEKS)**





### COMMINUTED FRACTURE DISTA 3<sup>RD</sup> TIBIA/FIBULA



### SEGMENTAL FRACTURE OF TIBIA

#### DISCUSSION

Liaquat University Hospital Jamshoro and Hyderabad is a tertiary care institute, which provides medical facilities to urban as well as rural population. Most of the patients belong to poor socio-economic class and majority is from rural areas. Further more due to illiteracy and lack of knowledge these patients submit themselves to unqualified persons (Potter's, Bone setters, and Barbers) present in their local areas and by the time they reach this institution, they have lost most precious time and have developed complications.

*Dr. Shahid Sultan in 1993<sup>3</sup>* observed incidence of open fractures of tibia at 09 to 70 years out of 73 patients. *Andrew N et al 2000<sup>1</sup>* reported 190 patients ages ranged from 16 to 69 years' average 36 years.

There were 60 (88.24%) males and 08 (11.76%) females. Male and female ratio was 7.5:1. 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 1994*<sup>16</sup>. This study was conducted in India, where the social setup is almost same. In this study male: female ratio was 14:1.

In present study road traffic accidents remained the most common cause of open diaphyseal fractures of tibia. Thirty eight (55.88%) out of 68 cases were related to automobile accidents. This is because of ignorance of traffic rules and increased motorization in our society may also be the possible causes. The second cause was firearm injuries 14 (20.58%). This fairly high incidence of firearm injuries can be explained on the basis of increasing terrorism and lawlessness and dispute over the lands in our society. *Dr. Shahid Sultan 1993*<sup>3</sup> reported series of 73 patients. The most common cause was road traffic accident 64 patients. *Dr. Khaleeqe Ahmed Siddiqui 1995*<sup>2</sup> reported series of 48 cases 24 patients affected by road traffic accidents and 08 (16.66%) had firearm injures. *Prof. Muhammad Aslam Ghaloo 1997*<sup>12</sup> reported series of 35 patients, 21 (60%) were injured in road traffic accidents and 11 (31%) were the victims of firearms.

*Modified Gustilo's classification*<sup>6,7,8</sup> was used in our series to classify the soft tissue injures. In present study out of total 68 patients, 38 (55.88%) were type IIIB fractures. 16 (23.54%) had type II open fractures and 14 (20.58%) patients sustained type IIIA open fractures. *Dr. Khaleeqe Ahmed Siddiqui 1995*<sup>2</sup> studied 48 patients out of whom 30 (61.22%) were type IIIB open fractures. *S. Gopal et al 2000*<sup>15</sup> reported 84 open fractures of tibia out of which 79 were type IIIB. *Andrew N et al 2000*<sup>1</sup> reported 195 open fractures tibia with sot tissue defects out of which 178 (91%) were G IIIB.

The mean time for fracture union was 19.87 weeks in present study, as compared to 20 weeks reported by (*Thakur AJ and Patnakar J. 1991*)<sup>17</sup>.

## **CONCLUSION**

We conclude that locally made NAEF is cost effective, and well tolerated by patients as compared to other sophisticated dynamic axial fixator, because most of patients belong to poor socio-economic conditions and easy to apply in our circumstances. This study has established that application of Alternative compression and distraction helps to enhance healing of the fracture in the open diaphyseal fractures of tibia.

Finally it can be concluded from our study that this method and apparatus offers the simple approach and a new option in the management of open diaphyseal fractures of tibia.

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