Original Research Article

A Hospital Based Prospective Study to Assess the Outcome of the Trauma Patients with Tibia Fractures Treated with the Primary Fixation Using Rail Road System

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Abstract

Background: The ideal treatment of high-energy tibial plateau fractures is controversial. LRS is a unilateral rail system consisting of Shanz pins, rail rods and sliding clamps. The aim of this study to assess the efficacy of outcome of the trauma patients with tibia fractures treated with primary fixation using rail road system. **Materials & Methods:** A hospital based prospective study was conducted in department of Orthopaedics, Vardhaman Mahavir Medical college, Safdarjung Hospital, Delhi, India. Total 40 patients having Modified Gustilo Anderson Type IIIA and IIIB[9] were using rail road system to achieve bony union. Both male and female patients between the age of 18-60 years were included in the study. Bony and functional assessment was done by Association for the Study and Application of the Methods of Illizarov (ASAMI) criteria.[10] **Results:** Our study showed that the patients were between 18-60 years of age with a mean age of 43.6± 4.30 years. A total of 35 patients were male and 5 patients were female and road traffic accident (75%) being the most common cause of injury. All patients achieved good range of movements in the follow-up period. Among 40 patients, bony results as per ASAMI score were excellent in 70% (*n* = 28), good in 25% (*n* = 10), fair in 2.5% (*n* = 1) and poor in 2.5% (*n* = 1). Functional results were excellent in 80% (n = 32), good in 15% (n = 6), fair in 5% (n = 2). Majority of patients 26 (65%) operated within 12 h in our study and Bone union time was 20.67 ± 5.32 weeks after injury. **Conclusion:** Primary fixation using rail road system is very versatile tool as primary and definitive management of compound tibia diaphyseal fracture due to its ease of application, strong fixation, early weight bearing and high chance of bony union.

Keywords: Primary Fixation, Tibial Fracture, ASAMI Score, Rail Road System.

Introduction

The knee joint is complex and most commonly injured joint now because of increased motor vehicle accidents and sports related injuries. As it is a superficial joint, it is more exposed to external forces and gets easily injured[1].Tibial plateau fractures with intra-articular extension are very difficult to manage. Age, skin conditions, compartment syndrome and osteoporosis further increase the obstacles in the healing process.The ideal treatment of high-energy tibial plateau fractures is controversial. Open reduction and stable internal fixation helps in maintaining the articular surface and restoration of the mechanical alignment which allows early mobilization of knee[2,3].But, techniques of open reduction and internal fixation compromise the soft tissues and the rate of wound infection is relatively high[4].

Various other methods of treatment like hybrid fixation and now plate fixation using minimally invasive technique have been suggested. Each method has its own advantage and disadvantages.

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The development of locking implants has allowed the use of minimally invasive technique for unilateral plating with improvement in handling the soft tissue. There are lot of studies which assess the general outcome of these fractures but there are only few studies which assess the functional outcome of these fractures which is more important to the patient.

The usual protocol of treating compound fractures include initial debridement, external fixation, closure of wound and then, after the wound heals without any signs of infection intramedullary interlocking nail would be inserted[5-7]. The disadvantage of this technique is need for several operative procedures, longer period of hospital stay, increased chances of infection, financial burden and prolonged immobilization. To overcome these disadvantages Limb Reconstruction System (LRS) was considered as definitive management for open fractures. LRS is a unilateral rail system consisting of Shanz pins, rail rods and sliding clamps. With its modular attachments it is specifically designed to enable the surgeon to perform simple and effective surgery as it offers rigid fixation of fracture fragments, allows early weight bearing and reduces the economic burden[8]. The aim of this study to assess the efficacy of outcome of the trauma patients with tibia fractures treated with primary fixation using rail road system.

Materials & methods

A hospital based prospective study was conducted in department of Orthopaedics, Vardhaman Mahavir Medical college, Safdarjung Hospital, Delhi, India. Total 40 patients having Modified Gustilo Anderson Type IIIA and IIIB were using rail road system to achieve bony union. Both male and female patients between the age of 18-60 years were included in the study[9].

Patients with immediate life-threatening conditions, closed fractures, osteoporotic fractures and Modified Gustilo Anderson Type I, II and IIIC were excluded from the study.

Methods

After an initial examination, and the exclusion of the right of life-threatening conditions, patients will receive intravenous (iv) antibiotic therapy and tetanus immunoglobulin. Pre-operative treatment is complete blood profile, renal profile, coagulation profile, viral markers, and x-rays of the affected limb in the horizontal planes.

Under spinal anesthesia, and the site-specific binding to a depth of wound-treatment was carried out, followed by the application of the LRS application. Stab incisions were followed by a blunt dissection until they reach the bone. Shanz pins were placed in the proximal and distal to the fracture site following the rail rods and clamps.

For a basic description, without the loss of bone mass, and the LRS is applied during the acute surgery, and recommended the immediate transfer of weight. In patients with bone loss, and the method of compression distraction was given a 1-mm for every week alternatively as a result of the immediate post-operative period. Patients and their families are to be interpreted and learned from compression-distraction techniques with a cyclic rate of 1 mm per day or on alternate basis. If the needed skin grafts and flap surgery was performed within 3-4 weeks. At each follow-up, clinical and radiological evaluation for the pin tract infection was carried out and presence of callus. Bony and functional assessment was done by Association for the Study and Application of the Methods of Illizarov (ASAMI) criteria[10].

Results

Our study showed that the patients were between 18-60 years of age with a mean age of 43.6± 4.30 years. A total of 35 patients were male and 5 patients were female and road traffic accident (75%) being the most common cause of injury (table 1).

Table 1: Demographic profile of patients

DEMOGRAPHIC PROFILE	No. of patients (N=40)	Percentage
AGE GROUP		
18-35 yrs	15	37.5%
35-45 yrs	20	50%
45-60	5	12.5%
Mean±SD	43.6±4.30	
GENDER		
Male	35	87.5%
Female	5	12.5%
MODE OF INJURY		
RTA/bike	30	75%
Fall from height	6	15%
Others	4	10%

All patients achieved good range of movements in the follow-up period. Among 40 patients, bony results as per ASAMI score were excellent in 70% (*n* = 28), good in 25% (*n* = 10), fair in 2.5% (*n* = 1) and poor in 2.5% (*n* = 1). Functional results were excellent in 80% (n = 32), good in 15% (n = 6), fair in 5% (n = 2) (table 2).

Table 2: Bony and Functional results as per ASAMI criteria.

Bony and Functional results as per ASAMI criteria.		No. of patients (%)
BONY CHANGE		
Excellent	Union, no infection, deformity<70, limb length discrepancy <2.5 cms	28 (70%)
Good	Union + any two of the following: No infection, deformity<70, limb length discrepancy <2.5 cms	10 (25%)
Fair	Union + any one of the following: No infection, deformity<70, limb length discrepancy <2.5 cms	1 (2.5%)
Poor	Nonunion/refracture/union+infection+deformity>70 + limb length discrepancy > 2.5 cm	1 (2.5%)
FUNCTIONAL OUTCOME		
Excellent	Active, no limp, minimum stiffness (loss of <15 knee extension/< 15 dorsiflexion of the ankle), no reflex sympathetic dystrophy, insignificant pain	32 (80%)
Good	Active with one or two of the following: Limp, stiffness, RSD, significant pain	6 (15%)
Fair	Active with three or all of the following: Limp, stiffness, RSD, Significant pain	2 (5%)
Poor	Inactive (unemployment or inability to return to daily activities because of injury)	0 (0%)
Failure	Amputation	0 (0%)

The average hospital stay for the patients was 8 days and as compared to multi staged surgery financial burden was reduced by 42%. The average time of return to work for the patients was 24 days.

Majority of patients 26 (65%) operated within 12 h in our study (table 3) and Bone union time was 20.67 ± 5.32 weeks after injury (table 4).

Table 3: Showing trauma to surgery interval.

Time of surgery	No of patients(n = 40)	Percentage
Surgery within 0–12 h	26	65%
Surgery within 12–24 h	8	20%
Surgery after >24 h	6	15%

Table 4: Mean ± SD of weight bearing and union

Weight bearing and union	Mean±SD
Partial weight bearing (weeks)	3.53 ± 2.98
Full weight bearing (weeks)	8.62 ± 4.62
Bone union time (weeks)	20.67 ± 5.32

Discussion

Open fractures of tibia are very common in this modern world because of high velocity road traffic accidents. Although newer and better treatment approaches for the management of open fractures are available, open fractures remain to be one of the important challenges in orthopaedic trauma. The various modalities of treatment available for tibial compound fractures are minimal osteosynthesis, biological fixation and internal fixation with intramedullary nailing or external fixation with different types of fixators.In our study, maximum cases were found in age group of 18-45 years i.e. 35 cases (87.5%) with mean age of 43.6 years which is comparable to Mahantesh Yellangouda Patil et al[11] where mean age were 42 years. There were 35 (87.5%) male and 5 (12.5%) female patients in our study which is comparable to the findings of Pal et al[12] and Memon et al[13] where maximum cases were male (80%). We had 30 patients who had sustained Road Traffic Accident (75%), and 6 (15%) patients fall from height, it is comparable with study of Piwani et al[14] and Beltsios et al[15] where mode of injury was found to be road traffic accident in 76.66% and 76.42% cases respectively.Majority of patients 26 (65%) operated within 12 h in our study. Delay in surgery was due to the excessive time taken in transportation of patient from rural location to a tertiary care hospital and associated life-threatening conditions which does not allow to intervene early for management of compound fractures. The timing of initial surgical intervention has wide variance within the literature. Historically, the 6-h rule has been employed as the time limit within which an open fracture should be taken to the operating room for initial debridement. Many factors influence this parameter including the operating room availability, surgeon availability, and the patient's physiologic status. Harley et al[16] found no increase in infection rate and non-union rate, when debridement took place up to 13 h after the injury.In our study, Bone union time was 20.67 ± 5.32 weeks after injury. These results are comparable to study by Ajmera et al[17], Olson[18] where Limb reconstruction system was used as definitive mode of treatment with mean bony union time of 24 weeks and 22 weeks respectively. Bony and functional outcome was assessed by ASAMI score. Among 40 patients, bony results as per ASAMI score were excellent in 70% (n = 28), good in 25% (n = 10), fair in 2.5% (n = 1) and poor in 2.5% (n = 1). Functional results were excellent in 80% (n = 32), good in 15% (n = 6), fair in 5% (n = 2). Which was comparable to study by Ajmera et al[17], Patil et al[19] and Pal et al where they found excellent results in 76%,67% and 68.75% respectively; good results in 12%, 25% and 18.75% respectively; fair result in 4%, 4% and 10% respectively; poor results in 8%, 4% and 2.5% respectively. Functional results was also satisfactory in 80% cases which is comparable to functional outcome by Pal et al[12] (75%) and Lakhani et al[20] (75%).The complications of nailing or fixators with acute docking are shortening, soft tissue healing problems, increased morbidity,multiple surgeries,prolonged hospital stay and its consequences like deep vein thrombosis, bed sores, nosocomial infection which eventually leads to increased chances of mal union and non-union and increased financial burden[21]. In a study conducted by Edward in 1988, Grade III open tibial fractures were treated with external fixator, where in 93% of the fractures united well and 89% patients had satisfactory clinical function[22].

Conclusion

Primary fixation using rail road system is very versatile tool as primary and definitive management of compound tibia diaphyseal fracture due to its ease of application, strong fixation, early weight bearing and high chance of bony union.

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