Section: Orthopaedics

Original Research Article

TO ASSESS THE OUTCOMES OF PRIMARY STABILIZATION OF COMPOUND FRACTURES OF BOTH BONES OF THE LEG USING A COMBINATION OF FLEXIBLE NAILING AND EXTERNAL FIXATION

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ABSTRACT

Background: The most common site of fracture is tibial shaft and fractures occur as a result of a combination of an axial loading force and a coronal plane (varus/valgus) moment leading to articular shear and depression and mechanical axis malalignment. The aim of the present study was to evaluate the results of primary stabilization of compound fracture both bone leg with flexible nail along with external fixator.

Materials and Methods: In this study 25 patients with compound fractures of both bone leg were included. All the cases were treated at department of Orthopaedics in Guru Nanak Dev Hospital, attached Govt. Medical College, Amritsar and were followed for about 9 months.

Results: The mean age was 41.0±4.5 years with male predominance. Type of fracture was simple, open seen in 11 (44%) and open in 14 (56%) patients. In 16 (64%) cases, the mode of injury was RTA, in 5 (20%) was fall and in 4 (16%) was others. The mean duration of hospital stay was 5.08± 0.7 days. Gait following treatment was normal in 23 and mild limp was seen in 2. 23 were able to squat and 2 did not. 23 were able to run and 2 did not. Final functional outcome was good in 3 and fair in 22 patients.

Conclusion: Primary stabilization with flexible nail along with external fixator has a definite role in the management of compound fracture both bone leg. The technique offered better outcome with lesser post- operative complications.

Keywords: tibial shaft, fracture, varus/valgus.

INTRODUCTION

The tibial shaft is one of the most common sites of open fractures. Approximately 63% open fractures are involving tibia.[1] Tibial plateau of lmu joint is a major weight-bearing surface within the largest and most kinematically complex joint in the human body. Fractures occur as a result of a combination of an axial loading force and a coronal plane (varus/valgus) moment leading to articular shear and depression and mechanical axis malalignment. The position of knee flexion at the time of trauma dictates the fracture configuration. Many problems arise when tibial fractures are associated with soft tissue trauma. Soft tissue trauma is directly proportional to the energy dissipated in the collision during accident. Associated soft tissue trauma invites many complications such as non-union, delayed union and infection etc. The management of open fractures is regarded as an orthopaedic emergency and has always been a challenge to the orthopaedic fraternity.[2] The optimum treatment for open fractures of the tibia remains controversial; treatment options include closed reduction and cast immobilization, open

reduction and fixation either with plate or external fixators and closed reduction with intramedullary nailing. Thus, the present study was to evaluate the results of primary stabilization of compound fracture both bone leg with flexible nail along with external fixator.

MATERIALS AND METHODS

In this study 25 patients with compound fractures of both bone leg were included. All the cases were treated at department of Orthopaedics in Guru Nanak Dev Hospital, attached Govt. Medical College, Amritsar and were followed for about 9 months. The study was conducted after approval from Institutional Thesis and Ethical Committee. All the fractures were post-traumatic. An informed consent was taken from each and every patient before study and approval was taken from Ethical Committee of the Institution. The following inclusion and exclusion criteria was used-

Inclusion Criteria

1. Skeletally mature patient (closed physeal plates at bone ends).
2. Compound diaphyseal fracture of tibia (Type II, Type III a, b) as classified by Gustilo-Anderson Grading.
3. Only Open fractures were considered

Exclusion Criteria

1. Skeletally immature patient (open physeal plates at bone ends).
2. Patients with type I (Gustilo and Anderson Classification) fractures.
3. Tibial fractures with intra articular extension.
4. Pathological fractures.
5. Compound tibial fractures associated with ipsilateral fracture femur (floating knee).

Relevant history, biodata of the patient and consent of the patient was taken as inclusion criteria. General, systemic examination as well as local examination of the patient was done. Thorough assessment of patient was performed to rule out head/chest/abdominal/ spinal or pelvic injury.

The final functional outcome was assessed as per Johner and Wruh's criteria (1983) which is as follows:,[3]

Criteria	Excellent	Good	Fair	Poor
Nonunion/infection	None	None	None	Yes
Neurovascular injury	None	Minimal	Moderate	Severe
Deformity				
Varus/valgus	None	2-5	6-10	>10
Pro/recurvatum	0-5	6-10	11-20	>20
Rotation	0-5	6-10	11-20	>20
Shortening	0-5 mm	6-10 mm	11-20 mm	>20 mm
Mobility				
Knee	Full	>80%	>75%	<75%
Ankle	Full	>75%	>50%	<50%
Subtalar	>75%	>50%	<50%	
Pain	None	Occasional	Moderate	Severe
Gait	Normal	Normal	Mild limp	Significant
Activities				
Sternous	Possible	Limited	Severely limited	Impossible

Statistical Analysis

The data was systematically collected, tabulated and subjected to quantitative statistical analysis and relevant conclusions was drawn. SPSS version 21.0 was used. Chi- square test and Mann Whitney tests were applied. Results were expressed as frequency, percentages, mean±SD. P value less than 0.05 was considered significant.

RESULTS

The Mean± SD age was 41.0±4.5 years. Out of the 25 patients, 4 (16%) patients were in age group 20-30 years, 31-40 years had 9 (36%), 41-50 years had 7 (28%) and 51-60 years had 5 (20%) patients. Male 17 (68%) predominance was seen among the patients over female patients 8 (32%). In 16 (64%) cases, the mode of injury was RTA, in 5 (20%) was fall and in 4 (16%) was others. The mean±SD injury to surgery time was 3.12± 0.8 hours. In 14 (56%) cases, right limb and in 11 (44%) cases left limb was involved. Diabetes and hypertension was present in 3 (12%) each. Type of fracture was simple, open seen in 11 (44%) and open in 14 (56%) patients.

Complications noted were neurovascular involvement in 2 (8%), infection in 3 (12%) and shortening in 1 (4%) patient.

Table 1: Distribution according to scale & type of surgery

Clinical outcome		
	Mean	**SD**
Duration of hospital stay (days)	5.08	0.7
Time to union (weeks)	22.1	3.5
Time to return to work (weeks)	22.5	4.8
Radiological Outcome		
Varus/valgus angulation (degrees)	0.92	0.04
Antero-posterior angulation (degrees)	1.4	0.08
Limb length discrepancy (mm)	2.08	0.9

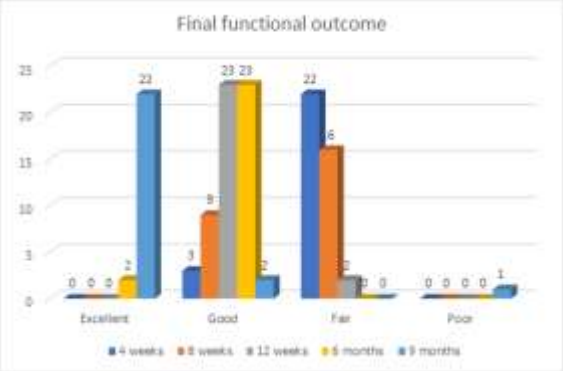
Functional outcome		
Gait following treatment	Normal	Mild limp
	23	2
Able to squat	Yes- 23	No- 2
Able to run	Yes- 23	No- 2

Table 1 showed that the mean duration of hospital stay was 5.08± 0.7 days, time to union was 22.1± 3.5 weeks, time to return to work was 22.5±4.8 weeks. Varus/valgus angulation was 0.92± 0.04 degrees, antero-posterior angulation was 1.4± 0.08 degrees and limb length discrepancy was 2.08±0.9 mm. Gait following treatment was normal in 23 and mild limp was seen in 2. 23 were able to squat and 2 did not. 23 were able to run and 2 did not.

Table 2: Final functional outcome

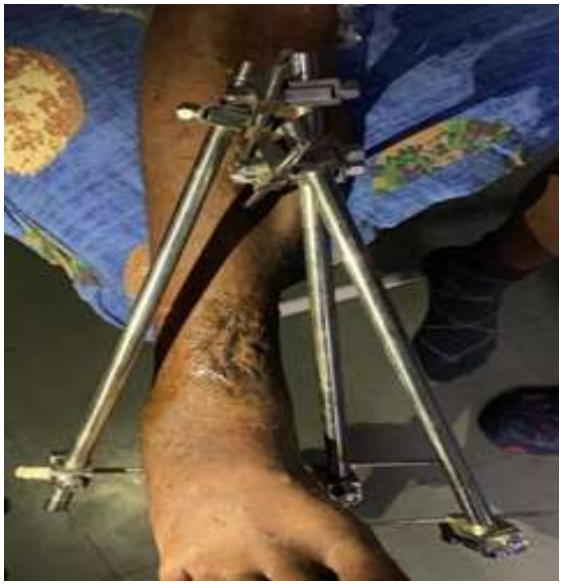
Outcome	4 weeks	8 weeks	12 weeks	6 months	9 months	P value
Excellent	0	0	0	2	22	0.02
Good	3	9	23	23	2	0.05
Fair	22	16	2	0	0	0.04
Poor	0	0	0	0	1	0.81

Table 2 showed that at 4 weeks, final functional outcome was good in 3 and fair in 22 patients. At 8 weeks, good in 9, fair in 16. At 12 weeks, good in 23 and fair in 2 patients. At 6 months, excellent in 2 and good in 23 patients and at 9 months, excellent in 22, good in 2 and poor in 1 patient.



Graph 1: Final functional outcome

CLINICAL PICTURES



IMMEDIATE POST – OPERATIVE

STANDING (WEIGHT BEARING) CLINICAL PICTURES

DORSIFLEXION AT RIGHT ANKLE JOINT

PLANTARFLEXION AT RIGHT ANKLE JOINT

FLEXION AT RIGHT KNEE JOINT

DISCUSSION

Tibia is the most frequent site of an open fracture, with incidence ranging from 49.4% to 63.2%. India has the highest road side accident rates in the world, one in every forty- two vehicle in country had met with an accident in 1986. A large proportion of vehicles involved were two wheelers. The lower limbs are involved in 49 .6 % of motor cycle accidents. By its very location the tibia is prone to frequent injuries. Furthermore, the blood supply of the tibia is more precarious, high-energy tibial fractures are associated with compartment syndrome or neural or vascular injuries. Open fractures have a higher infection rate than closed fractures and the rate increases with the increasing severity of the soft tissue injury. The risk of delayed union and non-union in closed, and open treatment is increased with comminution. The present study evaluated the results of primary stabilization of compound fracture both bone leg with flexible nail along with external fixator.

Age distribution

In our study age group 20-30 years had 4 (16%), 31-40 years had 9 (36%), 41-50 years had 7 (28%) and 51-60 years had 5 (20%) patients. The mean± SD age was 41.0±4.5 years. The mean age of patient in study by Pal et al[4] was 40 years. Ifesanya et al,[5] enrolled 160 patients with a mean age of 34.4±13.3 years (range: 4-66 years) and a peak of 21-50 years (74.4%). Sun et al,[6] found mean age of patients 46.83 ± 15.83 years.

Gender distribution

In our study, out of 25 patients, males comprise 17 (68%) and females 8 (32%). Pal et al,[54] had 26 males and 6 females in their study. Aslan et al,[7] studied 19 patients with 13 males and 6 females. Ifesanya et al[5] found that out of 160 patients, there were 99 men (61.9%) and 61 women. Sun et al,[6] found that there were 74 males and 17 females in their study.

Mode of injury

In our study, in 16 (64%) cases, the mode of injury was RTA, in 5 (20%) was fall and in 4 (16%) was others. Vehicular road traffic crashes were the leading cause of injury accounting for 74 cases or 46.3% in a study by Ifesanya et al,[5] Sun et al,[6] found that in 65 case mode of injury was road traffic accident.

Injury to surgery time

In our study, the mean± SD injury to surgery time was 3.12± 0.8 hours. Ifesanya et al[5] found that the average time interval between injury and operative stabilization of the fractures was 11.1±13.4 days (range 1-75 days) with 50% of the fractures stabilized within the first week, 35% between the 2nd and 6th weeks and 15% after the 6th weeks of injury. Average timing of surgery was as follows: Plate osteosynthesis (73.5 days), external fixation (11.6 days), Anderson-Hutchin's technique (17.0 days), intramedullary nailing (19.5 days), others (15.2 days). Sun et al,[6] found that duration of injury to surgery time was 4.11± 1.2 hours and Pal et al,[4] found that duration of injury to surgery time was 4.5± 0.6 hours.

Limb involved

In our study, in 14 (56%) cases, right limb and in 11 (44%) cases left limb was involved. Ifesanya et al,[5] found that there were 65% left limb and 35% right limbs involvement. Sun et al,[57] found that in 42% were right and 58% were left limbs. Pal et al[4] found that right limb was involved in 55% and left in 45% cases.

Comorbidities

In our study, diabetes was present in 3 (12%) and hypertension in 3 (12%). Ifesanya et al,[5] found that diabetes was present in 12% and hypertension in 24% of cases. Pal et al[4] found that comorbidities were CKD in 5%, diabetes in 16%, hypertension in 11% and hypothyroidism in 4% cases.

Type of fracture

In our study, type of fracture was simple, open seen in 11 (44%) and open in 14 (56%) patients. Ifesanya et al[5] found that there were 62% open cases in their study. Sun et al[6] found that 56% were open fractures.

Associated symptoms

In our study, swelling was mild in 12 (48%) and moderate in 13 (52%) patients. All 25 (100%) patients had tenderness. Deformity was present in 20 (75%) and absent in 5 (25%) patients. Crepitus was present in 23 (92%) and absent in 2 (8%) patients. Ifesanya et al[5] found that associated symptoms were deformity (72%), crepitus (88%) and tenderness (100%) in their patients. Sun et al[6] found that crepitus was seen in 82% and deformity in 94% cases.

Functional outcome

In our study, functional outcome was assessed as per Johner and Wruh's criteria. The mean duration of hospital stay was 5.08± 0.7 days, time to union was 22.1± 3.5 weeks, time to return to work was 22.5±4.8 weeks. Varus/valgus angulation was 0.92± 0.04 degrees, antero-posterior angulation was 1.4± 0.08 degrees and limb length discrepancy was 2.08±0.9 mm. Gait following treatment was normal in 23 and mild limp was seen in 2. 23 were able to squat and 2 did not. 23 were able to run and 2 did not. At 4 weeks, final functional outcome was good in 3 and fair in 22 patients. At 8 weeks, good in 9, fair in 16. At 12 weeks, good in 23 and fair in 2 patients. At 6 months, excellent in 2 and good in 23 patients and at 9 months, excellent in 22, good in 2 and fair in 1 patient. The

difference found to be significant (P< 0.05). Donimath VS et al,[8] found that reamed group-20 cases had excellent results, 2 cases had good results, 2 cases had fair results and 1 cases poor. Unreamed group – 19 cases had excellent results, 3 cases, had good results, 2 cases had fair results and 1 case had poor result. Madhukar KT et al,[9] found that results were excellent in 33 patients (55%), good in 21 patients (35%), fair in 3 patients (5%) and poor in 3 patients (5%) of patients. Zaman T et al,[10] found that 47 (78.34%) patients had excellent, 7 (11.66%) patients had good and 6 (10%) patients had poor results. On the basis of the results obtained, it was shown that unreamed interlocking nail for treating type II and III A fractures of tibial shaft shows promising and effective results in terms of low rate of infection and fracture union. Pal et al,[4] found that union was achieved in all cases. Radiological outcome was found excellent in 68.75%, good in 18.75% and fair in 12.50% of cases treated by rail fixators whereas it was excellent in 56.25%, good in 18.75%, fair in 12.50% and poor in 12.50% of cases treated by ring fixators. Functional result was satisfactory in 75.00% of cases treated by rail fixator and 68.75% of cases treated by ring fixators whereas the corresponding rate of unsatisfactory was 25.00% vs. 31.25%. Aslan et al,[7] observed six cases as excellent, eight cases as good, two cases as fair, and three cases as poor.

Sun et al,[6] found that 91 cases of open fractures of distal tibia and fibula were treated with external fixator, and the fibula was fixed with non-fixation (group A, n = 35), plate-screw (group B, n = 30) and Kirschner wire (group C, n = 26). The excellent or good rate of ankle function was 69.70% in group A, 72.41% in group B and 84.00% in group C, with no statistical difference among the three groups (P > 0.05).

Complications

In our study, complications noted were neurovascular involvement in 2 (8%), infection in 3 (12%) and shortening in 1 (4%) patient. Zaman T et al[10] studied 60 open tibial diaphyseal fractures of which, 9 patients developed infection. Union was seen in 51 (85%) patients and delayed union was observed in 7 (11.66%) subjects. Two patients (3.34%) had non-union. Ifesanya et al[5] found that fifty-two complications occurred in 50 fractures (40.3%) with joint stiffness and chronic osteomyelitis each accounting for a quarter of the complications. Union was delayed in grade IIIb open fractures and those fractures treated with external fixation. Aslan et al[7] observed delayed union, non- union in 1 case each and osteomyelitis in 2 cases.

Ifesanya et al[5] found that complications occurred in 45.6% of the cases; secondary chronic osteomyelitis accounted for a quarter of the complications. Two patients required an amputation for gangrene following initial stabilization of the fractures (one was a Gustilo IIIc distal radial fracture, the other was a type IIIb tibial fracture). There was documented removal of infected implants in 10 patients after fracture union (average of 985.4 days after stabilization; range: 296-2,212 days). These were made up of eight plates and screws (3 femoral, 2 radial, 1 ulnar, ankle, and tibial) and 2 intramedullary nails (tibial and femoral). Two tibial external fixators were removed before fracture union due to severe pin track infection. Sun et al[6] found that 91 cases of open fractures of distal tibia and fibula were treated with external fixator, and the fibula was fixed with non-fixation (group A, n = 35), plate-screw (group B, n = 30) and Kirschner wire (group C, n = 26). The postoperative complications such as fractures delayed union and non-union in group C (2 cases, 8.00%) is less than that in group A (13 cases, 39.39%) and group B (11cases, 37.93%) (P < 0.05). The wound infection and needle-tract infection did not differ among the three groups (P > 0.05). The excellent or good rate of ankle function was 69.70% in group A, 72.41% in group B and 84.00% in group C, with no statistical difference among the three groups (P > 0.05).

CONCLUSION

The primary goals for tibial fractures remain the prevention of infection; maintenance of normal length, alignment and rotation of the extremity, minimization of additional damage to soft tissue and bone; protection of remaining circulation and providing of a mechanical environment which stimulates periosteal and endosteal responses and favors bone healing. Traditional treatment options for compound fractures of both bone leg are antegrade insertion of elastic intramedullary nails, open reduction plate fixation, and external fixator fixation. Primary stabilization with flexible nail along with external fixator has a definite role in the management of compound fracture both bone leg. The technique offered better outcome with lesser post- operative complications.

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