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Research Article

ROLE OF EXTERNAL FIXATOR IN THE MANAGEMENT OF COMPOUND FRACTURES FRACTURES OF LEG

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ABSTRACT

Introduction: Tibia is the most fractured long bone in the body. Not only are these fractures relatively common, but they are often difficult to treat. The subcutaneous location of the antero-medial surface of the tibia means that severe bone and soft tissue injury is not infrequent, and there is a high incidence of open fractures compared with other long bones. The use of external fixator has been popular since the 1970s and 1980s and it continues to be used for severe open fractures in the belief that the incidence of infection is less, as there is no metal implant across the fracture site and that the technique is associated with less vascular damage in tibia that are already compromised

Material and Method: In this study 25 patients with open fractures of both bones of the leg will be included. All the cases will be treated at Department of Orthopaedics, Guru Nanak Dev Government Hospital, Amritsar and will be followed for about 9 months.

Inclusion Criteria: Compound diaphyseal fractures of tibia (Type II, Type IIIa,b) as classified by Gustilo-Anderson grading

Results: Out of 25 cases 5 cases showed excellent results, 8 showed good results, 5 showed fair outcome, 7 showed poor outcome. 2 cases ended with amputation. Non union seen in 4 cases, and malunion in 7 cases.

Conclusion: External fixation is a good means of immediate fixation for grade 2 and grade 3 open fractures and helps in wound care without disrupting the vascular supply of an already compromised bone.

INTRODUCTION

An open fracture is defined as an injury where the fracture and the fracture hematoma communicates with the external environment through a traumatic defect in the surrounding soft tissue and overlying skin. It should be emphasized that the skin defect may not entirely lie over the fracture site and may lie at a distant site. It may communicate with the fracture under degloved skin. Hence any fracture associated with a wound in the same region must be considered to be an open injury until proven otherwise.[1]The tibia is the most commonly fractured long bone in the body. Not only are these fractures relatively common, but they are often difficult to treat.[2] The subcutaneous location of the anteromedial surface of the tibia means that severe bone and soft tissue injury is not infrequent, and there is a high incidence of open fractures compared with other long bones.[3] The use of the AO tubular external fixation for open tibial shaft fracture is not a new subject. It is simple, safe and a satisfactory method of fixation for that particular fracture (probably the commonest). It improves the functional result of severely injured limb.4The external fixation method enables early postoperative rehabilitation and functioning of extremities which reduces the time of treatment and provides good results.[5]

The management of open injuries is now in the "Era of functional restoration." Functional restoration is aided by aggressive wound debridement, early definitive fracture stabilization and early wound closure or cover to achieve bone and soft tissue healing as soon as possible. Surgeons have now realized that they should not succumb to the "triumph of technique over reason." Patients are often dissatisfied if they are left with a deformed or painful lower limb in the end of the treatment and often opt for a secondary amputation. The future will focus on identifying and understanding factors controlling healing of bone and soft tissue at a genetic and molecular level so that the treatments can be tailor made for each patient.[6]

MATERIALS AND METHODS

In this study, 25 patients with open fractures of both bones of the leg were included. All the cases were treated at Department of Orthopaedics, Guru Nanak Dev Government Hospital, Amritsar and were followed for about 9 months

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Patient selection

Inclusion criteria

1. Those patients who are above the age of 16 years.
2. Compound diaphyseal fractures of tibia (Type II, Type IIIa,b) as classified by Gustilo-Anderson grading

Exclusion Criteria

1. Patients with type I (Gustilo and Anderson classification) type fractures.
2. Patients with type IIIC (Gustilo and Anderson classification) type fractures.
3. Patients lost to follow - up.

After ensuring that the patient was fit for surgical intervention, external fixation was carried out as soon as possible under spinal or general anesthesia. The wound was debrided again if necessary and fracture was reduced and fixed externally

All patients were followed at monthly intervals till 9 months. During follow up patients was assessed clinically, radiologically and functionally. After radiographic confirmation of adequate union, the device was removed and a walking PTB cast was given for guarded weight bearing. It was removed there-after and the patient was allowed unsupported weight bearing.

The function outcome was evaluated by the "Modified Johner and Wruh's criteria."

S. NO.	CRITERIA	EXCELLENT	GOOD	FAIR	POOR
1.	NON-UNION	NONE	NONE	NONE	YES
2.	PERSISTENT INFECTION	NONE	NONE	NONE	YES
3.	NEUROVASCULAR INJURY	NONE	MINIMAL	MODERATE	SEVERE
4.	DEFORMITY				
	-VARUS/VALGUS	NONE	2-5°	6-10°	>10°
	-ANTERIOR/POSTERIOR	0-5°	6-10°	11-20°	>20°
	-ROTATION	0-5°	6-10°	11-20°	>20°
5.	SHORTENNING	0-5 mm	6- 10 mm	11-20 mm	>20 mm
6.	MOBILITY				
	-KNEE	NORMAL	>80°	75-80°	<75°
	-ANKLE	NORMAL	>75°	50-75°	<50°
	-SUB-TALAR	>75°	50-75°	<50°	
7.	PAIN	NONE	OCCASIONAL	MODERATE	SEVERE
8.	GAIT	NORMAL	NORMAL	MILD-LIMP	SIGNIFICANT LIMP
9.	ACTIVITIES				
	-STRENUOUS	POSSIBLE	LIMITED	SEVERELY LIMITED	IMPOSSIBLE
10.	RADIOLOGICAL UNION	CONSOLIDATED	CONSOLIDATED	UNION	NON-UNION

RESULT AND CONCLUSION

The present study was carried out in the department of Orthopaedics, Government Medical College, Amritsar, from August, 2014 to November, 2016. Twenty five patients presenting with open fractures of the leg were operated upon with External Fixator and followed up for a period of 9 months to evaluate bone healing, wound healing and the functional outcome.

The results of the study are summarized as follows

1. The age of the patients ranged from 18-70 years with the average age being 37.84 years.
2. Out of the 25 patients, 20 were male and 5 were females
3. Mode of injury was road side accidents in 19 patients, 2 patients had a history of fall, 3 patients gave a history of crush injury, 1 patient had a history of assault.
4. On the basis of Gustilo& Anderson classification, out of the 25 patient 9 patients were graded as Type 2, 8 patients each belonged to Type 3A and Type 3B.
5. Out of the 25 wounds, 7 healed with primary intention, 8 were allowed to heal by granulation tissue formation/ secondary intention, 7 cases were augmented by split skin grafting, in 3 cases fascio-cutaneous flaps were used.
6. Average time of healing is reduced to 1.6 months as compared to healing by secondary intention which is 4.5 months
7. 19 patients out of 25 patients showed union within 9 months, 6 patients showed non-union after 9 months.
8. The average time of union was 29.15 weeks or 6.8 months
9. 6 patients out of 25 showed mal-union, majority of which were highly communited fractures
10. 13 patients out of 25 patients presented with pin tract infections. Out of these patients 3 patients had persistent discharge even after 9 months of follow up.

Thus, it can be concluded that though the external fixator as a treatment in open tibia fracture is a valuable tool as it gives advantage:-

1. Less operative time.
2. Less intraoperative blood loss.
3. Easy access to the soft tissue
4. Easy wound management
5. Stable fixation

But the patients experience more complications as seen by the various studies comparing external fixation with un-reamed intramedullary nailing or using external fixation as temporary stabilizer with eventual conversion to intramedullary fixation which has the following benefits:-

1. Early time of union.
2. Early weight bearing.
3. No pin tract infections.
4. Low rate of non-union, mal-union and delayed union.
5. Less or no knee and ankle stiffness.

Hence it can be concluded that External Fixation for open tibia fracture is good option, especially keeping in view the socio-economic status of the majority of the population in this part of the country, who cannot afford multiple surgical procedures. However, proper care of the pin site and the wound site and early coverage of the bone play a very important role in the early union and bone healing.

DISCUSSION

The present study comprised of 25 patients of the age group of 16 years and above afflicted with open fractures of both bones of the leg, admitted in the Department of Orthopaedics, Government Medical College, Amritsar during the period from August 2014 to November 2016 and treated using External Fixation.

Age

The results of our study show the average age of the patient is 37.84 years and the range between 21 years and 70 years. Most of the patients fall within the age group of 21-40 years of age, which is mainly due to the fact the open fractures of tibia and fibula are a result of high energy trauma, the susceptible population being that of the young male, who is highly mobile, always travelling for the purpose of leisure, work, education, etc. Al-Sayyad and Mohammed J conducted a study in which average age of the patients were 26 years.[7]

Sex

Males predominate females, that too by a very high ratio. In our study, the males account for 80% of the patients whereas females account for only 20% of the cases. This holds true, especially in a country like India where the work of earning the daily bread falls on the shoulders of the male sex and the females are the incharge of the household. Exceptions are there but they are far and few. Muhammad Imran Khan et al conducted a study In which 72% of the patients were male and 28% were the females. XIAO Bai-ping et al treated 120 cases with external fixator of which 86(71.67%) and 28.33% were females.[8]In our study 70% of the patients were male and 30% were females.

Mode of injury

Our study shows the mode of injury as road trsffic accidents in 76% cases. 8% cases were caused due to fall from height. 4% cases were a result of assault and 12% of the cases were a result of a crushing injury of the limb under a heavy load. The above facts again underscore our observation that the cause of open fractures is high energy trauma. The momentum of the traumatic event depends on the mass and the velocity of the parameter causing the trauma. Either both are high as in road side accidents or one of the parameters is extremely high as in crush injuries. Baral R et al[9] in 2010 had observed that more than 70 percent of their subjects had Road side accident as the cause of injury.

Fracture healing

19(76%) Out of the 25 cases united with an average time of 29.15 WEEKS OR6.8 MONTHS. All the 9(100%) fractures of TYPE II united. The average time taken by TYPE II fractures was 26.44 weeks or 6.1 months.6 (75%)out of 8 fractures of TYPE IIIA united. The average time taken by TYPE IIIA fractures was 30.33 weeks or 7.0 months. 4/8(50%) fractures of TYPE IIIB united. The average time of union was 33.5 weeks or 7.8 months. Golubović Iet al[10] in their study achieved Union in 76.2% patients and our result coincided with their study. Al-Sayyad and Mohammed J[11]in their study say average time of union to be 6 months. From our results it is seen that the severity of soft tissue injury plays an important role in fracture healing. More soft tissue causes avascularity of the bone and leads to delayed union.

Pin Tract Infection

In our study pin tract infection is seen in 13(52%) of the cases. All infections resolved after change of pin-site and intravenous administration of antibiotics, except 3 cases which showed persistent discharge even at 9 months of follow up. Clifford et al(1987) treated 42 cases of open tibial fractures and reported pin tract infections in 43% cases. Edge and Denham[12] in 1981 reported pin tract infections in 16(42%) out of 38 treated cases of open tibial fractures.

Mal-union

In our study 5 cases (20%) cases show mal-union. We also noted that mal-union depends not only upon the soft tissue injury but also upon the type of fracture. Complex and communited fractures (AO TYPE 32-C) accounted for 4 out of the above 6 cases. Whereas simple 2-piece fractures (AO TYPE 32-A) accounted for none of the above 6 cases. Other 1 case belonged to wedge fractures (AO TYPE-32-B). A study by B. Almazedi[13]in 2011 showed mal-union of 41.7%. Our study shows a lesser rate of mal-union because of the use of C-Arm guidance in fracture reduction and achieving anatomical reduction in all the cases.

Wound infections

In our study out of the 25 wounds, 7(28%) healed with primary intention, 8 cases (32%) were allowed to heal by granulation tissue formation, 7 cases (28%) were augmented by split skin grafts. In 3 cases (12%) fascio-cutaneous flaps were used to cover the bone.

None of the cases covered by flaps showed any signs of deep infection. Rotational flaps are a good and convenient method to cover the bone but we should wait at-least 1 week after the injury to confirm the viability of the skin and tissue. Cirney et al[14] in 1983 demonstrated both lower rates of infections and early wound healing when exposed bones were covered with myo-cutaneous flaps.

In the present study 1 out 7(14%) cases of SSG showed persistent infection, whereas cases that were left to heal by granulation tissue showed persistent infection in 2 out of 8 cases(25%).also wound healing in SSG patients came down to 1.6 months as compared to those healing by secondary intention which was 4.5 months. Clifford et al in 1987 reported soft tissue abcess in 9.5 % and deep osseous infections in 9.5% cases out of 42 cases observed. Our study shows 3 cases (12%) with persistent infections.

In our opinion, wherever the wound allows it should be covered with a split skin graft because the time of healing is greatly shortened and chances of hospital acquired infections is greatly reduced.

Tables

Age

The age of the patients ranged from 21 years to 70 years with average age being 37.84 years as tabulated in Table 1

Table 1 Age Incidence

Age	No. of Cases	Percentage
21-30	12	48%
31-40	6	24%
41-50	2	8%
51-60	2	8%
>61	3	12%
TOTAL	25	100%

Time Taken For Wound Healing

As tabulated in Table 2, In 1 (14%) of the 7 patients in which split skin grafting was done the infection persisted. In the remaining 6 patients there was no infection and the average time taken for wound healing was 1.6 months. Of the 8 patients in which the wound was allowed to heal by granulation tissue, the infection persisted in 2 patients (25%) and 6 healed completely with an average time of 4.5 months.

Table 2 Time Taken For Wound Healing

Procedure	No.of cases	Time taken for wound healing	Persistent Infection	Percentage
SSG	7	1.6 Months	1	14%
Granulation/Epithilization	8	4.5 Months	2	25%
Flaps	3	2 Months	0	0
Primary intention	7	0.5 Months	0	0

Fracture Healing- Time of Union

As tabulated ain Table 3,19(76%) out the 25 cases united with an average time of29.15 weeks or 6.8 months. All the 9 fractures of TYPE II united. The average time taken by TYPE II fractures was 26.44 weeks or 6.1 months.6 out of 8 fractures of TYPE IIIA united. The average time taken by TYPE IIIA fractures was 30.33 weeks or 7.0 months. 4 out of 8 fractures of TYPE IIIB united. The average time of union was 33.5 weeks or 7.8 months.

Table 3 Time of Fracture Healing

Fracture type	United cases	Percentage	Average union time
GRADE II	9/9	100%	26.44 WEEKS
GRADE IIIA	6/8	75%	30.33 WEEKS
GRADE IIIB	4/8	50%	33.5 WEEKS
TOTAL	19/25	76%	29.15 WEEKS

RESULTS

In our study the result was obtained following the "Modified Johner and Wruh's criteria." (As seen in table4)

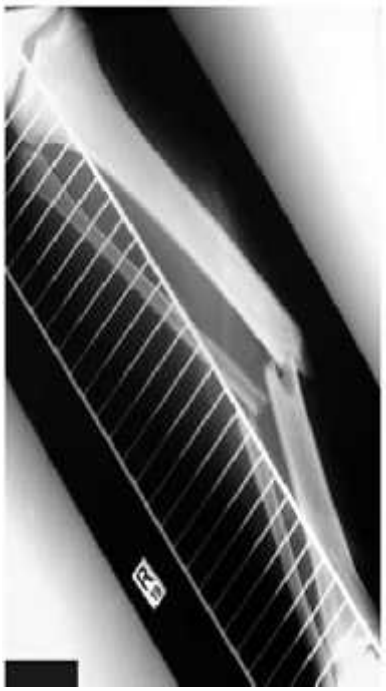
Table 4 Results

Outcome	No. of cases	Percentage
Excellent	5	20%
Good	8	32%
Fair	5	20%
Poor	7	28%
Total	25	100%

Figures

PRE-0P

POST OP



PRE-OP

PRE-OP

POST OP

UNION

RANGE OF MOTION

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