

ORIGINAL ARTICLE

Impacts of Circular Frame Fixator (Ilizarov) on Management of Compound fractures of proximal tibia

SAIFULLAH SOOMRO¹, ZAMIR AHMED SOOMRO²¹Assistant Professor Orthopaedics²Professor & Head of Department Orthopaedic

Department of Orthopaedic, Chandka Medical College Larkana, Sindh, Pakistan

Correspondence to Dr. Saifullah Soomro, Email: saifullahsoomro8585@yahoo.com, Phone :+92 342 2864474

ABSTRACT

Aim: To determine the outcome of patients diagnosed with complex fractures of tibial plateau with associated soft tissue compromise treated by using Ilizarov fixator.

Study design: Prospective observational study.

Place and period of study: Orthopaedic unit, Chandka Medical College SMBBMU Larkana from January 2021 to December 2021

Methods: Patients diagnosed with complex tibial plateau fracture with associated soft tissue compromise fulfilling inclusion criteria were enrolled in study. All participants were managed with Ilizarov fixator and it was removed when fracture was united clinically and radiologically. Outcome of patients was evaluated on the basis aggregate score of knee society score and knee functional score at 6month follow up.

Results: Twenty seven consecutive patients met the inclusion criteria, of which 19(70.37%) were male and 8(29.7%) were female. Average age of patients was 32.37 years. All fractures healed by the end of the 4th month. Ring fixator was removed routinely at 16th weeks after initial surgery in all patients. Transient peroneal nerve injury was found in 2 patients; no patients developed deep vein thrombosis, whereas pin site infection was most common complication and occurred in 5 patients (18.5%). According to knee society score results were excellent in 15(55.55%) patients, good in 08(29.62%) patients, fair in 03(11.11%) in patients and poor in 01(3.70%) patient. Practical implication most of proximal tibial plateau fractures with soft tissue compromise are kept under observation till the soft tissue status become favorable for open reduction and internal fixation, while fixing these type of fracture with Ilizarov fixator one can provide early relief to patients and results of this study will be help for operating surgeons while managing complex proximal tibia fractures.

Conclusion: complex tibial plateau fracture can be effectively treated with Ilizarov fixation method without any complication, when exposed reduction and interior fixation with plate is contraindicated due to compromised soft tissue.

Keywords: Tibial plateau, fractures, Ilizarov, fixation method, outcome, soft tissue compromise,

INTRODUCTION

Proximal Tibial fractures are severe injuries with possibly overwhelming results. Severe traumatic events results in proximal tibial fracture with multiple intra-articular extensions represent the major challenge for both the patient and orthopaedic surgeons. Major defects in the soft tissue, bone and ligamentous apparatus of knee can occur from these injuries which are evident in the form of swelling, degloving and blistering¹⁻⁷.

Complications of these high energy fractures include severe soft trauma requiring plastic surgery procedure, compartment syndrome, injury to neurovascular structures, ipsilateral femoral and tibial shaft fractures, cruciate and collateral ligament injuries and meniscal tears⁸⁻¹⁰.

There are several classifications of proximal tibia fractures but Schatzker et al described a classification system which is most commonly used and based on antero-posterior radiographs of knee. Schatzker classify tibial plateau fracture in to six types, these six types include (type I) split type lateral plateau fractures, (type II) split depressed lateral plateau fractures, (type III) depressed tibial plateau fractures, (type IV) medial tibial plateau fracture, (type V) bicondylar plateau fracture, (type VI) bicondylar fracture with metaphyseal disassociation¹¹. Among them type V and VI are most challenging injuries due to extensive bone and soft tissue damage causing swelling, degloving and blistering around knee¹²⁻¹⁵. Exposed direct reduction and interior fixation with plate and screws is considered effective modality but one has to wait for a week or two till swelling subside and blisters disappear which increase hospital stay and immobility of patient. Extensive approach is required for exposed direct reduction and interior fixation which inflicts trauma to already damaged soft tissue envelope and leading to wound necrosis and high rates of deep infection¹⁵⁻¹⁸.

The circular frame fixator (Ilizarov) can also be an appreciated selection for compound proximal tibial fractures with comminution, especially when there is much damage to soft tissue. Circular ring fixator Ilizarov has multiple advantages like less damage to soft tissue; no possibility of wound infection, blood loss during procedure is minimum, decreased duration of hospitalization, quick weight bearing and adjustability¹⁹⁻²⁰. Condition of skin does not cause any problem while putting percutaneous wires and wires do not cause additional damage to already compromised bone and soft tissues²¹⁻²².

The significance of this study is to create awareness among orthopaedic surgeons regarding the application of ring fixator Ilizarov in patients who has fracture of proximal tibia associated with soft tissue damage. In these patients keeping implant inside body has greatest possibility of having infection; on contrary one can achieve excellent results by applying external fixator Ilizarov without complications.

MATERIAL AND METHODS

This prospective study was piloted in the unit of orthopedics at Chandka Medical College SMBBMU Larkana from January 2021 to December 2021 after getting permission from institutional review board and ethical committee of hospital. Patients diagnosed with complex fractures of tibial plateau and associated soft tissue compromise, without any gait disorder, which can understand and follow instruction in Urdu language and fulfilling inclusion criteria were enrolled. Inclusion criteria included All consecutive patients with complex tibial plateau fractures diagnosed on basis of history, clinical examination and radiological findings, either gender, patients with age over 18 years, Schatzker type IV, V and VI fractures, open fractures, fractures with massive knee swelling, patients having blisters around knee. Patients with age less than 18 years, Schatzker type I, II, and III fractures, multiple traumas, ipsilateral femur fracture, prior history of surgery on same tibia and

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patients with systemic diseases like rheumatoid arthritis, polio myelitis were excluded from study.

All patients were admitted through casualty department, where initial resuscitation of the patients was done according to acute trauma life support (ATLS) protocols. After primary and secondary surveys the local examination of injured leg was done to assess the status of skin for bruises, blisters, wounds and contamination. Distal neurovascular status of the limb was checked and documented. Intravenous antibiotic for infection prophylaxis, analgesics and muscle relaxant for pain control and tetanus prophylaxis were given. After that long leg back slab was given to provide temporary support to fracture and soft tissues. Per-operative radiographs the injured limb in anteroposterior and lateral views were taken to make diagnosis and classification of fractures. CT scan knee with 3D reconstruction were done in every patient to assess further fracture configuration and fracture delineation. After initial management patients were admitted in general ward and were schedule for surgery on next day. All patients were operated was Iizarov specialist having experience of more than 10 years.

Every participant was operated in spinal anesthesia, position of patient was supine on table, under pneumatic tourniquet control, and limb was prepared and draped in usual manner. Limb was kept on suspension frame and secured with single wire passed in calcaneus and distal femur each. Reduction of fracture in longitudinal axis achieved with linear traction and reduction of intra articular fracture was achieved with help of pointed reduction forceps and fixed with olive wire under guidance of image intensifier (C-ARM). Four rings were applied, two rings in condylar region, one middle ring distal to fracture component and fourth ring above the level of ankle joint. Acute compression was applied at fracture sites. Intravenous analgesics and antibiotics continued post-operatively. Physiotherapy with active range of motion at knee and ankle and full weight bearing was started on very next day. During stay at hospital all patients were demonstrated for dressing pin sites and how to keep pins, pins sites and frame clean.

All patients were followed clinically at 2, 6, 12, 16 weeks and at 6 months after the initial surgery. During each follow up visit patients were evaluated clinically for wound condition, frame stability, knee range of motion and weight bearing. Radiographs of knee in both plane AP and lateral planes were taken at the same time to assess pattern of fracture union and position of frame. Fracture regarded being healed when anteroposterior and lateral radiographs show callus for 3 or 4 cortices. Iizarov frame was routinely removed from all patients at 16 week follow up.

Final evaluation of patients was done at 6 months follow up visit after initial surgery and outcome results were calculated on the basis of knee society score and knee functional score²³. Knee society score method assesses the knee score by measuring pain, ROM, stability of knee joint and alignment of lower limb.

Knee function score evaluate knee on the basis of walking and stair climbing capabilities with deductions for weight bearing aids. These two independent scores are averaged to obtain a knee rating that was graded as follows: excellent (90-100, maximum score), good (80-89), fair (70-79), and poor (<70).

RESULTS

Mean surgical time was 68.32 seconds ranging from 53 to 103 minutes, hospital stay in close fractures was 4 days and in open fractures was 5-9 days and mean hospital stay was 6.5 days. Twenty seven patients were enrolled in our study on the basis the inclusion criteria, 19(70.37%) were male and 8(29.63%) were female. Average age of participant was 30.07 years, ranging from 18-65 years. 16 patients had fracture in right tibia while in 11 patients left tibia was involved. On the basis of schatzker classification 7 participants had type IV fracture, 9 participants had type V fracture and 11 participants had type VI fracture. Road traffic accident was mechanism of injury in most of patients (16 patients), while 7 patients had history of fall of heavy objects on work place and 4 patients fell from height. Open fractures were encountered in 12 patient while 15 patients had closed fractures.

Open fracture were classified according to Gustilo and Anderson Classification of open wound, among 12 open fracture 7 were type I and 5 were type II fracture. Plastic surgery team was taken on board for management of type II open fractures and was managed with debridement and antibiotics. No skin grafting or muscle flap was done.

All patients received bony union by the end of 4th month. Transient peroneal nerve injury was found in 2 patients, whereas pin site infection was most common complication and occurred in 5 patients (18.5%). Pin tract infection was diagnosed clinically by presence of skin erythema and purulent discharge and was treated with oral antibiotics for five days and pin site cleaning twice a day. No patient developed deep vein thrombosis, nonunion, mal union, skin contracture. No clinical and radiological signs of bone or joint infections were found in any patient.

On the final evaluation average knee range of motion was 120 degrees and ranged from 100 degrees to 140 degrees. All patients were pain free and were able to walk and climb stairs, 8 patients were using walking aids outside the home while rest were walking independently. All knees were stable in anteroposterior and mediolateral stress. According to knee society score results were excellent in 15(55.55%) patients, good in 8(29.62%) patients, fair in 3(11.11%) in patients and poor in 1(3.7%) patient.

Table 1: Demographic data of patients

Case	Age	Sex	MOI	SIDE	Fracture type
1	48	M	RTA	Right	IV
2	33	M	RTA	Left	VI
3	45	M	Work place	Right	VI
4	19	M	RTA	Right	IV
5	27	F	Pedestrian	Right	V
6	32	M	RTA	Left	V
7	47	F	RTA	Left	VI
8	65	M	FALL	Left	V
9	33	M	RTA	Right	IV
10	47	F	RTA	Right	VI
11	25	M	Pedestrian	Right	VI
12	27	M	RTA	Left	VI
13	29	F	RTA	Right	IV
14	31	M	Fall of object	Left	VI
15	42	M	RTA	Right	VI
16	55	M	Work place	Left	V
17	50	F	Fall of object	Right	IV
18	61	M	RTA	Right	VI
19	18	M	RTA	Left	V
20	21	M	RTA	Left	V
21	22	M	RTA	Right	IV
22	34	M	Fall	Right	V
23	38	F	RTA	Left	V
24	44	M	RTA	Right	V
25	59	F	RTA	Left	VI
26	18	F	RTA	Right	VI
27	37	M	RTA	Right	IV

Picture 1: knee with soft tissue compromise



Picture 2: Preoperative radiographs of knee anteroposterior and lateral views showing tibial plateau fracture



Picture 3: Postoperative radiographs of knee in anteroposterior view and lateral views



Table 2: Outcome of patients

Outcome	n	%age
Excellent	15	55.55%
Good	08	29.62%
Fair	03	11.11%
Poor	1	03.70%

Table 3: Complications

Complication	n	%age
Peroneal nerve injury	2	7.4%
Deep vein thrombosis	0	0%
Pin site infection	5	18.51%
Non union	0	0%
Osteomyelitis	0	0%
Compartment syndrome	0	0%

DISCUSSION

The principles of treating proximal intra articular tibial fracture are to obtain absolute reduction, rigid fixation, preservation of vascularity, early rehabilitation and functional knee. Traumatic osteoarthritis is main late complication and all efforts are made to reduce risk of it²⁴⁻²⁵.

Usually open reduction and internal fixation using two plates and screws is well-thought-out to be the paramount process for fixation of these fractures, as it stabilizes both medial and lateral columns of tibia²⁶⁻²⁷. Open reduction and internal fixation using plates and screws poses the high risk of complications to patients as it requires extensive soft tissue dissection of already damaged skin. Therefore high rate of complications remains associated with

this open technique. Jiang et al. reported a deep infection rate of 4.7% with dual plating and 7.3% if a less invasive stabilization system (LISS) was used²⁸.

To avoid these problems, less invasive technique with external ring fixator Ilizarov can be used as an approach to minimize surgery related further injuries to skin and soft tissues. It provides absolute reduction and rigid fixation of fractures to achieve fracture union without further damage to soft tissues. Watson et al. Proved that four olive wires combined with a lag screw provided the most stability, even when compared to plates and screws²⁹. This permits for early joint mobilization without risking loss of function.

A number of available studies have revealed reduced complications rates and excellent outcome results for compound proximal tibial fractures when fixed with circular frame external fixator (Ilizarov). Ferreira N et al¹⁷ reported on series of 13 patients treated with Ilizarov and had fracture union and excellent functional outcomes without severe postoperative problems. Khan MA et al³⁰ treated 14 patients with Ilizarov and achieved excellent outcome in 12 (54.54%) patients with minor complications in few patients. Farooq et al³¹ treated 40 patients with Ilizarov and achieved good to excellent results in 36 (90%) patients. Ranatunga IR et al³² in their retrospective review of 18 patients found good results of union of fractures and range of motion. Ferreira N and Marais L.C33 reviewed 54 consecutive patients with proximal tibia fractures involving both condyles fixed with circular frame external fixator (Ilizarov) and achieved the average knee society score of 81.6 out of 100. Lalic I et al⁷ achieved 78% excellent results based on ASAMI score in their 50 patients with compound fractures of proximal tibia managed with Ilizarov technique. The results of our study are equivalent to these studies in that we got excellent and good results in majority of patients with fewer minor complications.

Limitations: The limitations of this study include small number of patients, single centre study and single surgeon experience. A large multicentre prospective randomized trial would be required to validate the results.

CONCLUSION

In the limitation of our study we conclude that complex tibial plateau fracture can be effectively treated with Ilizarov fixation method without any major complication. This procedure actually produces gorgeous results and favorable outcomes when done in patients with severely damaged soft tissue envelop of leg in whom open reduction and internal fixation with plates and screws is less desirable.

Conflict of interest: None

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