ORIGINAL ARTICLE

Functional outcome of complex tibial plateau fractures managed with closed ilizarov

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Abstract

Objectives: To determine the functional outcome of closed Ilizarov treatment in complex tibial fractures in terms of range of motion and stability of collateral ligaments of knee.

Methods: The descriptive case series was conducted at Ghurki Trust Teaching Hospital/Lahore Medical and Dental College, Lahore, from July 21, 2012, to January 20, 2013. After evaluation according to advance trauma life support protocol, patients were selected to undergo close Ilizarov. They were followed up for 3 months and functional outcome in terms of range of motion and stability was assessed. We went above-knee if ligaments were torn and the knee was unstable. The above-knee assembly was removed after 6 weeks and tibial fixator was removed at 12 weeks. Subject to fracture healing, full weight-bearing was started 2-4 week later. SPSS 17 was used for statistical analysis.

Results: Of the40 patients in the study, 33(82.5%) were males and 7(17.5%) were females with a mean age of 36.68±11.77 years (range: 15-55 years). Overall, 36(90%) patients had range of motion graded good to excellent, while and 37 (92.5%) had stability graded good to excellent.

Conclusion: Ilizarov fixation is an ideal method of treatment for tibial plateau fractures when extensive dissection and internal fixation are contraindicated due to trauma to the soft tissue, deficiency of bone stock, and bony comminution.

Keywords: External fixator, Ilizarov technique, Full weight-bearing. (JPMA 64: S-104 (Suppl. 2); 2014)

Introduction

Tibial plateau fractures are injuries with potentially devastating consequences. Management, especially of high-energy, complex tibial plateau fractures (Schatzker V and VI), continues to pose a challenge to the orthopaedics. These are difficult to treat. Standard open reduction and internal fixation (ORIF) either by dual plate or lateral locking plate has been successful in restoring osseous alignment, but surgical morbidity, especially deep infection and wound necrosis, has been reported frequently. The Ilizarov technique solves many such problems and provides a method of closed reduction and fixation that does not necessitate excessive soft tissue striping and avoids devitalisation of tissues.[1,2]

The Ilizarov circular ring fixator can also be a valuable option for high-energy fractures with gross intra-articular comminution (Association of Orthopaedics/Orthopaedic Trauma Association [AO/OTA] type C3), especially when associated with severe soft-tissue compromise. Achieving stability even in cases of bone comminution when internal fixation devices can do no better than tenuous fixation. Indirect reduction is achieved through ligamentotaxis by spanning the knee with Ilizarov. After anatomical alignment of the leg has been achieved, the articular surface can be reconstructed using indirect reduction and percutaneous fixation either by K-wires or olive wires.

The rates of union are comparable, but loss of movement is common and must be carefully monitored post-operatively. There is a low threshold for manipulation under anaesthesia.[3,4]

Pin-site infection in very proximal location can lead to septic arthritis knee, so pins must be placed outside the joint capsule 10-14mm distal to the joint line to avoid this complication.[5]

The advantages of circular small wire external fixator are minimum devitalisation of tissues, ruling out of the risk of wound breakdown, lower rates of infections, less intraoperative blood loss, shorter hospital stay, early weight-bearing and adjustability.[6]

The presence of fracture blisters or extensive subcutaneous haemorrhage and bruising does not hinder percutaneous placement of the wires which avoids additional devitalisation of the bone since the periosteal and endosteal blood supply are not further damaged.[7]

In a Greek study, 24 patients were treated with closed

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Ilizarov for complextibial plateau fractures. Of them, 13 patients achieved full extension i.e. 0-180° (excellent results) and flexion 110°-130° (good to excellent results) i.e. 54.2% achieved excellent range of motion. Besides, 17 patients achieved stability of the knee i.e. 70.8%.[8]

High-energy tibial plateau fractures treated with Ilizarov may yield a high percentage of cases exhibiting radiographic post-traumatic arthritis. However, all the objectives of fracture treatment are obtained, and the functional results remain satisfactory over time.[9]

Considering all the above-mentioned benefits, we planned the current study to assess the functional outcome of closed Ilizarov in complex tibial plateau fractures in terms of range of motion (full flexion and full extension) and stability (of collateral ligaments of knee). To the best of our knowledge, no local study on the subject is available in literature to date.

Patients and Methods

The descriptive case series was conducted at Ghurki Trust Teaching Hospital/Lahore Medical and Dental College, Lahore, from July 21, 2012, to January 20, 2013. After evaluation according to advance trauma life support (ATLS) protocol, patients were selected using non-probability purposive sampling. Patients included were in the 15-55 years age group of either gender with tibial plateau fracture Schatzker's type V, VI closed ones that presented within 2 weeks. Complex tibial fractures along with fracture distal femur (ipsilateral) and associated ligament injury were also included.

All those selected volunteered to take part on the study and those who were not willing were excluded. Also excluded were cases of infected fractures (discharging sinus at site of fracture; severe osteoporosis diagnosed on radiograph; bleeding disorders (history and laboratory reports); knee arthritis/decreased joint space (radiograph); and stiff knee (clinical examination).

For the purpose of the study, 'functional outcome' was defined in terms of excellent range of motion and stability. 'Excellent range of motion' meant full extension 0-180° with no extension lag labelled as grade 1 (excellent result), and flexion 110°-130° at knee joint labelled as grade 1 to 2 (good to excellent result). 'Stability' meant stability of the knee collateral ligaments. 'Stable' was the clinically normal knee labelled as grade 1 and 'slightly unstable' meant the knee stable in extension and 5-10 degree instability in flexion i.e. grade 2. Stability was assessed clinically. 'Complex tibial fractures' meant Schatzker V and VI. 'Schatzker V' was defined as split medial and lateral tibial plateau (bicondylar). Metaphysis was still in continuity with the diaphysis. 'Schatzker VI' meant metapyseal fracture that could separate the articular surface from the diaphysis involving the medial, lateral, or both articular surfaces.

After receiving in the Emergency Department (ED), demographic history of the patients was taken. They were investigated and prepared for surgery. After taking informed consent, we applied close Ilizarov external fixator.

We had to go above-knee sometimes when ligaments were torn and the knee was unstable. We removed above-knee assembly after 06 weeks and the tibial fixator was removed at 12 weeks. We followed the patients for 3 months and assessed functional outcome in terms of range of motion (ROM) and stability. Subject to fracture healing, full weight-bearing was started 2-4 week later.

Data was evaluated and analysed using SPSS 17. Quantitative data, like age, full extension and full flexion, was presented in the form of mean ± standard deviation (SD). Qualitative data, like gender, excellent results of ROM and stability in terms of good to excellent was presented as frequency and percentage.

Results

Of the 40 patients in the study, 33(82.5%) were males and 7(17.5%) were females. The male-to-female ratio was 4.7:1 (Table-1).

There were 8(20%) patients in age group 15-25 years, 14(35%) in 26-35 years, 9(22.5%) in age group 36-45 years, and 9(22.5%) in age group 46-55 years. The overall mean age was 36.68±11.77 years (Table-2).

In terms of flexion, 4(10%) patients had between 90-100

Table-1: Gender distribution.

Sex	Frequency	Percentage
Male	33	82.5
Female	7	17.5
Male to female ratio	4.7:1	

Table-2: Age distribution.

Age (years)	Frequency	Percentage
15 - 25	8	20.0
26 - 35	14	35.0
36 - 45	9	22.5
46 - 55	9	22.5
Mean±SD	36.68±11.77	

SD: Standard deviation.

Table-3: Flexion range.

Flexion (degrees)	Frequency	Percentage
90 - 100	4	10.0
110 - 120	20	50.0
125 - 135	16	40.0
Mean±SD	119.22±10.84	

SD: Standard deviation.

Table-4: Extension lag.

Extension lag (degrees)	Frequency	Percentage
0	28	70.0
1 - 5	4	10.0
6 - 10	8	20.0
Mean±SD	2.0±3.2	

SD: Standard deviation.

Table-5: Range of motion.

Range of motion	Frequency	Percentage
Yes (Good to excellent)	36	90.0
No (Fair to poor)	4	10.0

Table-6: Knee stability.

Stability of knee	Frequency	Percentage
Yes (Good to excellent	37	92.5
No (Fair to poor)	3	7.5

degrees, 20(50%) between 110-120 degrees and 16(40%) between 125-135 degrees. The mean flexion was 119.22±10.84 degrees (Table-3).

Besides, 28(70%) patients had 0 degree of extension lag, 4(10%) between 1-5 degrees and 8(20%) between 6-10 degrees. The mean of extension lag was 2.0±3.2 degrees (Table-4).

Overall, 36(90%) patients had good to excellent ROM, while 4(10%) had poor ROM (Table-5).

As for stability, 37(92.5%) patients had stable knee, while 3(7.5%) had unstable knee (Table-6).

Discussion

The fractures of the tibial plateau challenge the orthopaedic surgeon due to the difficulties in restoring the complex bony architecture and the tenuous nature of the soft tissues. The treatment goal for tibial plateau fractures is to obtain a stable, aligned, painless and mobile knee with maintenance of articular surface as much anatomical as possible and to minimise the risk of post-traumatic osteoarthritis. In order to achieve this outcome the value of early joint mobilisation has been well established.[10,11] Fracture reduction and stable fixation is required to allow early joint motion. Ring fixators, like the Ilizarov system, utilise beam loading to create uniform support for the joint and stable fracture immobilisation to achieve fracture union. Recent biomechanical studies proved that Ilizarov fixator provides adequate mechanical stability for the fixation of tibial plateau fractures. This allows for early joint mobilisation without risking loss of reduction.[12,13]

Several studies have shown decreased complications when treating tibial plateau fractures with fine-wire external fixators. One study[14] reported a series of 38 patients treated with small-wire external fixators and had no incidences of non-union or septic arthritis. Another[15] reported 20 patients treated with Ilizarov and all patients achieved bony union, good to excellent ROM, stability and no osteomyelitis or septic arthritis. In a series,[7] 24 patients were treated with the Ilizarov circular fixator, and 13 achieved full extension, 7 less than 5 degrees of extension lag (>80% good to excellent result), 17/27 flexion >110 degrees of which 5 >130.22 knees were stable with respect to collateral ligaments. All fractures united, and there was no incidence of osteomyelitis or septic arthritis.

Alone stusy[16] reported similar results of 18 patients, none of whom developed wound dehiscence, infection, osteomyelitis or septic arthritis, also good ROM and rehabilitation. The current study is comparable to these studies in that no cases of wound dehiscence, infection, osteomyelitis or septic arthritis were encountered.

From these results it appears that an Ilizarov external fixator with or without limited open reduction, succeeds in providing stable fixation for these complex injuries without imparting added trauma to an already compromised soft tissue envelope, and provides good to excellent ROM.

Ilizarov external fixator also provides advantage of early full weight-bearing. Closed Ilizarov does not necessitate extensive soft tissue dissection and stripping so avoids wound dehiscence and necrosis and has lesser chances of infection typically associated with traditional plating technique.[8]

Pin tract infection is a universal complication and occurs almost in every case, but can be dealt with through

aseptic measures, proper cleansing and meticulous care.

Conclusion

The treatment of complex tibial plateau fractures with the Ilizarov fixator is safe and effective treatment option, and produces good functional results in terms of flexion an extension and stability of collateral ligament of knee without serious complications. Ilizarov fixation is an excellent tool and ideal method of treatment for tibial plateau fractures when extensive dissection and internal fixation are contraindicated due to trauma to the soft tissue, deficiency of bone stock, and bony comminution, especially in complex tibial plateau fractures. It also provides early full weight-bearing and good rehabilitation.

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