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Functional Outcome of Ilizarov Technique in Managing Proximal Tibial Fracture in Combined Military Hospital, Rawalpindi

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ABSTRACT

Background: Tibial plateau fractures involve injuries affecting the major weight-bearing joint and result in functional impairment which can be prevented by implying competent treatment techniques including dual column plating, assisted reduction, internal fixation with plating and Ilizarov circular fixator. The objective of this study was to evaluate the functional outcome of Ilizarov technique in treating closed tibial plateau fractures.

Methodology: A Quasi experimental study was conducted in the Orthopedic department of Combined Military Hospital, Rawalpindi from 30th July 2019 to 29th January 2020. A total of 100 patients with tibial plateau fractures of Schatzker type III to VI, 20 to 60 years of age of either gender were included. In all patients, Ilizarov technique was performed. Data were entered in SPSS 22. Descriptive analysis was done for quantitative variables and percentages were calculated for qualitative variables. Chi square test was applied to determine association of variables with functional outcome.

Results: Mean age of patients was 37.42 ± 8.94 years. Out of 100 patients, 70% were males and 30% were females, 76% patients managed with Ilizarov technique in treating closed tibial plateau fracture had excellent functional outcome, 15% good outcome, 5% fair and 4% poor outcome. Functional outcome with respect to age, gender, BMI and DM showed statistically significant difference with p value 0.017, 0.016, 0.004 and 0.001 respectively.

Conclusion: Functional outcome of Ilizarov technique in treating closed tibial plateau fracture is significantly better.

Keywords: Ilizarov Technique, Orthopedic Fixation Devices, Tibial Fractures

Authors' Contribution:
[1]Conception; Literature research; manuscript design and drafting; [2,3] Critical analysis and manuscript review; ,[4,5]Data analysis; Manuscript Editing.

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Introduction

Tibial fracture is the most common long bone fracture due to its subcutaneous presence. Tibia plateau fractures are about 1.2% of all the

fractures. The majority of tibial plateau fractures involve the lateral plateau. Bicondylar fractures are not very frequent but they require freater competency and patience with treatment because of the complex configuration of the fracture and the related soft tissue injury. Tibial plateau fractures involve a set of injuries affecting the major weight-bearing joint resulting in functional impairment.[1]

The classification for tibial fractures proposed by Schatzker is most widely used. It divide them into two groups: the low energy and high-energy fracture patterns.[2] Reconstruction of high-energy fractures is a major challenge for the orthopedic surgeons. Schatzker type-V and VI injuries are the result of high energy trauma resulting in proximal tibial fractures involving both the medial and lateral tibial condyles. The soft tissue injury usually gives the idea of the underlying bony damage. A local study revealed percentage of open tibial fractures to be 42.6% and closed tibial fracture to be 57.4%.[3]

Presently different techniques are being implied for the treatment of tibial fracture including dual column plating, assisted reduction, internal fixation with plating and Ilizarov circular fixator.[4] The advantages of dual plating are visual reduction and maintenance of proximal tibial alignment, but soft tissue complications and damage to the periosteal blood supply are major concerns. Arthroscopy assisted reduction gives an advantage of the minimally invasive approach without violating the intra-articular structures but there is a high risk of iatrogenic compartment syndrome secondary to irrigation fluid extravasation. Internal fixation permits shorter hospital stays, enables the patients to return to normal functioning earlier and reduces the incidence of nonunion and malunion of the fractured bones, however bone loss under the plates and refractures after plate removal have been reported.[5] Pros and cons of each therapeutic method must be considered by the surgeon. External fixators may prove to show beneficial outcomes in case of lacerating soft tissue damage.[6] Ilizarov circular fixation is an ideal method of treatment for high-energy fractures of the tibial plateau especially where vast dissection and internal fixation are contraindicated because of soft tissue injury, deficiency of bone stock and bony comminution.[7] Rijal R et al and Mardani-Kivi M et al reported similar positive results regarding the efficacy of Ilizarov.[8,9]

Although previously, many studies are available on treatment with Ilizarov but these studies have shown large variation in results, so this study was conducted with the aim of re-evaluation of the functional outcome of ilizarov technique in treating tibial plateau fracture in local Pakistani population and its association with different variables.

Methodology

A Quasi experimental study was conducted in the Orthopedic department of Combined Military Hospital, Rawalpindi from 30th July 2019 to 29th January 2020. Approval of study was taken from the Ethical Review Committee. Total sample size was 100 by taking 95% confidence level, 7% margin of error and taking excellent functional outcome of Ilizarov technique in treating tibial plateau fracture as 95%.[10] Non-probability, consecutive sampling technique was used. Patients with tibial plateau fractures of Schatzker type III to VI and duration of fracture <7 days with age of 20-60 years of both the genders were included in the study. Patients with concomitant injuries that may adversely affect the functional outcome of the patients, were excluded from the study. These concomitant injuries included ipsilateral femoral shaft fracture, ipsilateral acetabulum fracture and bilateral fractures as assessed on the x-ray, patients with chronic renal failure

assessed by history and s/creatinine >1.5 mg/dl and chronic liver disease assessed by history of disease and serum bilirubin >2.0 mg/dl, open fractures, patients with previous surgery of fracture and patients who were lost to follow up.

Informed written consent was taken from every patient. In all patients, Ilizarov technique was done under spinal anesthesia by the consultant orthopedic surgeon. In all the patients, minimal soft tissue manipulation, especially at the joint surface, was performed to reduce the fracture. This manipulation included fluoroscopy, arthroscopy, mini-open incision and adding two or three screws for anatomical maintenance of the joint surface. Then, a suitable Ilizarov ring with an appropriate diameter based on the diameters of the knee and leg was used and the distal rings were attached to the proximal ring with three special rods. At least three olive pins in two levels were also inserted in the tibial plateau. In the distal part of the fracture site, at least two Ilizarov rings, as hybrids connected to a 5-mm Schanz, were used. All patients were followed on regular intervals post-operatively and functional outcome was assessed at the end of 3 months according to the Jensen's Grading System. [8] It is the modified version of The Knee Scoring System of Hohl and Luck (1956). All the information regarding age, gender, duration of fracture, Body Mass Index (BMI), place of living, diabetes mellitus (DM), type of fracture (III/IV/V/VI) and functional outcome (excellent/good/fair/poor) was collected through pre-designed Performa.

Collected data were entered in SPSS version 22. Descriptive analysis was done for quantitative variables like age, BMI and duration of fracture. Qualitative variables like gender, diabetes mellitus, place of living, type of fracture and functional outcome were presented as frequency and percentages. An association of functional outcome with age, gender, duration of fracture, BMI, type of fracture, diabetes mellitus and place of living was determined by chi square test. P-value ≤0.05 was considered as statistically significant.

Results

Mean age of the patients was 37.42 ± 8.94 years. Majority of the patients 78 (78%) were between 20 to 40 years of age. Out of 100 patients, 70 (70%) were males and 30 (30%) were females, with male to female ratio of 2.3:1. Mean duration of fracture was 3.88 ± 1.34 days. Mean BMI was 27.96 ± 3.08 kg/m^2. According to Schatzker type, 20 (20%) patients were type III, 17 (17%) were type IV, 43 (43%) were type V and 20 (20%) were type VI. 25 (25%) patients had diabetes mellitus while 75 (75%) were disease free. 51 (51%) patients were from rural area while 49 (49%) belonged to urban areas.

76 (76%) treated with Ilizarov technique in treating closed tibial plateau fracture had excellent functional outcome, 15 (15%) good outcome, 05 (5%) fair outcome and 04 (4%) poor outcome.

Association of functional outcome with age, gender, duration of fracture, BMI, Schatzker type, diabetes mellitus and place of living was also evaluated using chi square test as shown in Table I. Functional outcome with respect to age, gender, BMI and DM showed statistically significant difference with p value 0.017, 0.016, 0.004 and 0.001 respectively, while other variables showed insignificant effect on functional outcome. Out of 78 patients who were between 20-40 years of age, 74% showed excellent outcome. While out of 22 patients who were between 41-60 years of age, 82% showed excellent outcome. Younger patients tend to show more positive functional outcome. Similarly, males particularly showed excellent functional outcome of 77% as compared to females with excellent functional outcome of

73%. Lean patients or decreased BMI (≤30 kg/m^2) resulted in better functional outcome of 77% as compared to obese patients who showed excellent functional outcome in 72% of the patients. Patients with no co morbid like diabetes mellitus displayed excellent functional outcomes as diabetes could hinder the healing process affecting the functional outcome.

Table I: Association of Functional Outcome with all Variables

VARIABLES		FUNCTIONAL OUTCOME				p- Value
		Excellent	Good	Fair	Poor	
Age Groups (Years)	20-40	58	14	01	05	0.017
	41-60	18	01	03	00	
Gender	Male	54	12	00	04	0.016
	Female	22	03	04	01	
Duration of Fracture (Days)	≤3	25	08	02	01	0.366
	4-6	51	07	02	04	
BMI (kg/m^2)	≤30	58	13	00	04	0.004
	>30	18	02	04	01	
Schatzker type	III	18	00	02	00	0.073
	IV	13	02	00	02	
	V	30	10	00	03	
	VI	15	03	02	00	
Diabetes Mellitus	Yes	19	00	04	02	0.001
	No	57	15	00	03	
Place of Living	Rural	40	04	03	04	0.101
	Urban	36	11	01	01	

Discussion

Ilizarov external fixation meets all the treatment needs of a patient with tibial fractures which makes it attractive for the orthopedic surgeon. Ilizarov is advantageous in terms of reduction of closed or mini-open fracture with low risk of wound infection, early mobility, functional loading and weight bearing, continuous improvement in reduction and alignment of the bones resulting in early recovery to proper functioning. [11] For cases which may require knee replacement in future, external fixation via

ilizarov is a better option as compared to internal fixation as no extensive incisions are made for ilizarov, no soft tissue cover is needed and no introduction of hardware inside the body is required. A study compared internal fixation and Ilizarov external fixation for complex tibial plateau fractures which concluded that the number and severity of complications are increased with open reduction and internal fixation while Ilizarov external fixation leads to short hospital stay and functional mobility is achieved earlier. [11]

In the present study 76 (76%) patients treated with Ilizarov technique for managing closed tibial plateau fracture had excellent functional outcome, 15 (15%) good outcome, 05 (5%) fair and 04 (4%) poor outcome. In contrast, another study reported excellent results in only around 15%, good in about 60%, fair in about 20% and poor in only 3%. [12] In accordance with our results, a study by Bari et al in 2014 has shown excellent results in 73.68% patients. They operated on 40 patients with Ilizarov external fixator and had 28 patients with excellent, 9 patients with good, 2 with fair and 1 patient with poor result. [13] Similarly, Aziz MA et al has shown satisfactory outcome in 90% of patients. [14]

The present study also showed that the functional outcome of the ilizarov technique is associated with age as younger patients give better results as compared to elderly, gender as males responded more positively to the treatment as compared to females, BMI with less than 30kg/m^2 and patients with no DM correspond to better response to ilizarov treatment.

Farooq U et al evaluated closed Ilizarov fixator for high grade fracture of tibial plateau in 40 patients. The patients were on follow up for 3 months. The results showed 90% patients acknowledging good to excellent range of motion and about 95% appreciated excellent stability. The study further concluded that Ilizarov fixation is an ultimate treatment option for tibial plateau fracture when open osteosynthesis is contraindicated due to soft tissue trauma. [15]

Subramanyam et al evaluated 30 patients for external fixation with or without minimal internal fixation. The study concluded that the Ilizarov external fixator with or without minimal internal fixation provides satisfactory outcome for complex tibial plateau fractures. [16] A local study showed that outcome of 22 patients treated with Ilizarov were satisfactory out of 26 patients. The study concluded that hybrid external fixator allows early joint movement and reduces risk of serious complications. [17] Aseri et al operated on 32 patients and had excellent results in 16, good in 13 and fair in 3 patients. [18] Jahan et al in 2017 showed excellent results in 15 patients and fair in 4 patients. [19] Kumar J el al conducted a retrospective study on 59 patients having high-energy intra-articular proximal and distal tibial fractures treated with Ilizarov fixator. The study showed that Ilizarov is a reliable minimal invasive procedure. [20] Another study showed 27 patients with excellent results out of 30 operated cases. [21]

In contrast to the present study, another study by Berven H et al. compared the external fixation with Ilizarov and internal fixation with locking plates while treating proximal tibia fractures with a complete metaphyseal component. The study revealed shorter healing time with internal plating for the management of proximal tibia fractures as compared to Ilizarov. Complications like heterotopic ossifications and superficial infections after internal plating were also less. [22] However, endorsing the results of present study, a study by Bove F et al. determined the effectiveness of circular external fixation compared to fixed angle locking plates while treating complex tibial plateau fractures. According to the

Association for the Study and Application of the Method of Ilizarov criteria, the circular external fixation showed around 60% excellent functional outcome making it superior to plating [23]

This study not only added to the data in the existing literature but also provided the local statistics as our population is different from the western population socially, ethnically and lifestyle habits. However, some limitations were seen as the study was conducted on a small sample size within a single setting. Further longitudinal studies with larger sample size and multicenter are recommended.

Conclusion

Excellent functional outcome of Ilizarov technique in treating closed tibial plateau fracture is quite high. So, it is recommended that Ilizarov technique should be used as a first line treatment for closed tibial plateau fracture in order to reduce the morbidity rate.

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