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A prospective study on Functional outcome of Column-specific Fixation of Complex Tibial Plateau Fractures

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ABSTRACT

Introduction: Proximal tibia fractures are one of the commonest intra-articular fractures. Mechanism of injury usually is indirect coronal or direct axial compressive forces. Incidence of proximal tibial fractures is 1% of all fractures and 8% of the fractures in elderly. Most injuries affect lateral tibial condyle (55 to 70%) and isolated medial condyle fractures occur in 10 to 23% whereas the involvement of both condyle fractures is found in 10 to 30% of the reported series. Every different fracture type has its own characteristic morphology and response to the treatment. Apart from tibial plateau bony injury, meniscal tear and other ligament injuries of knee need to be assessed.

Material and Methods: This is a prospective study involving 60 patients with complex tibial condyle fractures with posterior column fractures. Preoperative computed tomography is taken with radiography for complete evaluation of fracture fragments even in the coronal plane. Fractures were classified as Schatzker type 4 or above with a posteromedial split depression. Plating is done with posteromedial locking compression for buttressing posteromedial fragment.

Result: Single-column fractures (Schatzker Type IV and Hohl and Moore Type I coronal split fracture), Two-column fracture (Schatzker type IV and type V), Three-column fractures (Schatzker Type V). In our study majority of patients were Three-column fractures, followed by Two-column fracture and Single-column fractures. Mean duration of surgery time of single column fractures were 65.41 minutes, two-column fracture 76.57 minutes and 94.91 minutes for Three-column fractures. After operative procedure, 18 (30.0%) patients got discharged on post op day-7, 12 (20%) patients on post op day-9, 10 (16.7%) on post op day-10 and 20 (33.3%) on post op day-12.

Conclusion: Based on our study we conclude that column specific fixation is a better option compared to conventional method of fixation as it provides better visualization, control over fragment, stable reduction and fixation of fragment. Even though radio-logical outcome is better

in posterior column fixation group, functional outcome remains to be same in both the groups. It requires long term follow up and large number of patient study to assess the effectiveness of posterior column fixation.

Keywords: Posterior column, proximal tibia plateau, three column classification

INTRODUCTION

Proximal tibia fractures are one of the commonest intra-articular fractures. Mechanism of injury usually is indirect coronal or direct axial compressive forces. [1] Incidence of proximal tibial fractures is 1% of all fractures and 8% of the fractures in elderly. [2] Most injuries affect lateral tibial condyle (55 to 70%) and isolated medial condyle fractures occur in 10 to 23% whereas the involvement of both condyle fractures is found in 10 to 30% of the reported series. [3]

Every different fracture type has its own characteristic morphology and response to the treatment. It is vital to assess the force of injury since high energy trauma is associated with considerable soft tissue and neurovascular damage. [4] Apart from tibial plateau bony injury, meniscal tear and other ligament injuries of knee need to be assessed. [5]

High velocity injury happened in automobile accidents and increase in incidence of road traffic accidents as a whole is creating an ever-growing problem. Since man has used to traveling at high speeds in the sitting position with the loading edge composed of flexed hind limbs, when the vehicle in which the subject is traveling stops suddenly, most of the impact is taken at first upon the knee joint the patella, then the tibia and femur in varying proportions of velocity and at various positions which is otherwise called as ‘Dash Board Injury’. [6] In other cases the stationary lower limb may be struck by a moving object; this is the most common pedestrian injury, the so called "BUMPER FRACTURE", since the bumper of most vehicles being placed roughly at knee height of the pedestrian. [7]

Due to the evolution of orthopedics, especially in orthopedic trauma, a better understanding of biomechanics, quality of implants, principles of internal fixation, soft tissue care, antibiotics and asepsis have all contributed to the radical change in the treatment of fractures. [8] Conservative treatment at any age may be complicated by knee stiffness, mal union, and non-union. Open reduction and internal fixation has been advocated using various implants including Buttress plate, cancellous screw, and external fixator etc to achieve good fracture union and optimal knee function. [9]

Thus we have advanced from the conservative approach to internal fixation in fractures as an acceptable mode of treatment. In spite of that, proximal tibia fractures remain challenging because of their number, variety and complexity in management. [10] In spite of many articles,

published in the past 50 years that have elaborated the problems of classification and results of various treatments the optimal method of management still remains controversial. [11]

Various other modalities of treatment for proximal tibia fractures like hybrid fixation and now locking compression plate fixation using minimally invasive percutaneous plate osteosynthesis MIPPO technique have also been suggested. Each method of treating the proximal tibia fractures has its own advantages and disadvantages. [12] The advancement in the treatment of proximal tibial fracture fixation by the locking compression plates has allowed the treating doctors, the use of minimally invasive technique for unilateral plating with care in handling the soft tissue. [13]

MATERIALS AND METHODS

This is a prospective study was done in the Department of Orthopaedics at Tertiary Care teaching Hospital from 2008 to 2018. 60 cases of tibial plateau fractures (Schatzker type 4, 5 and 6) surgically fixed with posteromedial plating and If adjunctive fixation of the lateral tibial plateau is required, such as in the case of bicondylar fractures, the leg is prepared and managed as needed for a standard approach to fracture fixation through an anterolateral approach or with percutaneous lateral-to-medial lag screws.

Inclusion criteria

Inclusion criteria were age above 20 years; closed tibial plateau fractures (Schatzker type 4, 5 and type 6) with posteromedial column fracture.

Exclusion criteria

Exclusion criteria were age less than 20 years; patients with a co-morbid medical condition; compound tibial plateau fractures; late cases with joint stiffness; late cases with infection; cases of more than 30 days duration.

Proper preoperative planning should be performed, including standard history taking, examination of the patient to find out other associated injuries including neurovascular assessments, complete radiological examination. CT scan was mandatory for all severe tibial plateau fractures. 3D reconstructive computerized tomography may be needed in some cases to visualize the fracture fragments. Ensure that all needed equipment is available, such as a tourniquet, a femoral distractor, osteotome, bone tamps, suture anchors, bone graft substitutes, small and large fragment standard or periarticular plates and screws or devices of choice. The analysis was done using criteria for Rasmussen radiologic assessment, oxford knee scoring system and the following results were obtained criteria for Rasmussen radiologic assessment.

RESULTS

In our study, total 60 patients were enrolled among the total, males were of 58.3% and females were of 41.7% (Table-1).

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Table 1: Distribution of gender

Gender	No. of patients	Percentage
Male	39	65.0
Female	21	35.0
Total	60	100

Table 2: Distribution of different age groups of patients

Age in years	No. of patients	Percentage
1-20	6	10
21-40	12	20
41-60	18	30
>61	24	40
Total	60	100

In table 2, in the age group of >61 years maximum incidence of fracture there.

Table 3: Distribution of different age groups of patients

Column fractures (N.)		No. of patients	Percentage
Single-column fractures (30)	Medial	10	16.7
	Lateral	12	20
	Posterior	8	13.3
Two-column fracture (18)	Lateral+ Posterior	9	15.0
	Medial + Posterior	6	10.0
	Lateral+ Medial	3	5
Three-column fractures (12)	-	12	20
Zero-column fractures (3)	-	3	5
Total		60	100

Single-column fractures (Schatzker Type IV and Hohl and Moore Type I coronal split fracture), Two-column fracture (Schatzker type IV and type V), Three-column fractures (Schatzker Type V). In table 3, in our study majority of patients were Three-column fractures, followed by Two-column fracture and Single-column fractures.

Table 4: Surgical treatment for tibial plateau fractures (injury mechanism, approach and main implant).

Column fractures (N.)		Knee Position	Possible force	N.	Approach	(Main) buttress plate
Single-column fracture	Medial	Extension	Varus	10	Medial	Medial
	Lateral	Extension	Valgus	12	Lateral	Lateral
	Posterior	Flexion	Valgus	5	Reversed L	Posterolate

s (30)						ral
			Varus	3	Posteromedial	Posterome dial
Two-column fracture (18)	Lateral+ Posterior	Flexion	Valgus	4	Lateral (+Reversed L)	Lateral
		Extension			Lateral	Lateral
	Medial + Posterior	Flexion	Varus	8	Reversed L	Posterome dial
		Extension			Medial	Medial
	Medial +Lateral	Extension	Valgus	16	Lateral	Lateral
			Varus		Medial	Medial
Three-column fractures (12)	-	Extension	Valgus	4	Lateral + posteromedial	Lateral
		Extension	Varus	3		Medial
		Flexion	Valgus	4	Lateral + posteromedial (or reversed L)	Lateral
		Flexion	Varus	1		Posterome dial

Table 5: Mean duration of surgery of patients

Column fractures	**Mean duration of surgery time (Minutes)**
Single-column fractures	65.41
Two-column fracture	76.57
Three-column fractures	94.91

In table 5, mean duration of surgery time of single column fractures were 65.41 minutes, two-column fracture 76.57 minutes and 94.91 minutes for Three-column fractures.

Table 6: After operative procedure patients discharged

On post op day discharge	**No. of patients**	**Percentage**
7^{th} Day	18	30
9^{th} Day	12	20
10^{th} Day	10	16.7
12^{th} Day	20	33.3
Total	60	100

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In table 6, after operative procedure, 18 (30.0%) patients got discharged on post op day-7, 12 (20%) patients on post op day-9, 10 (16.7%) on post op day-10 and 20 (33.3%) on post op day-12.

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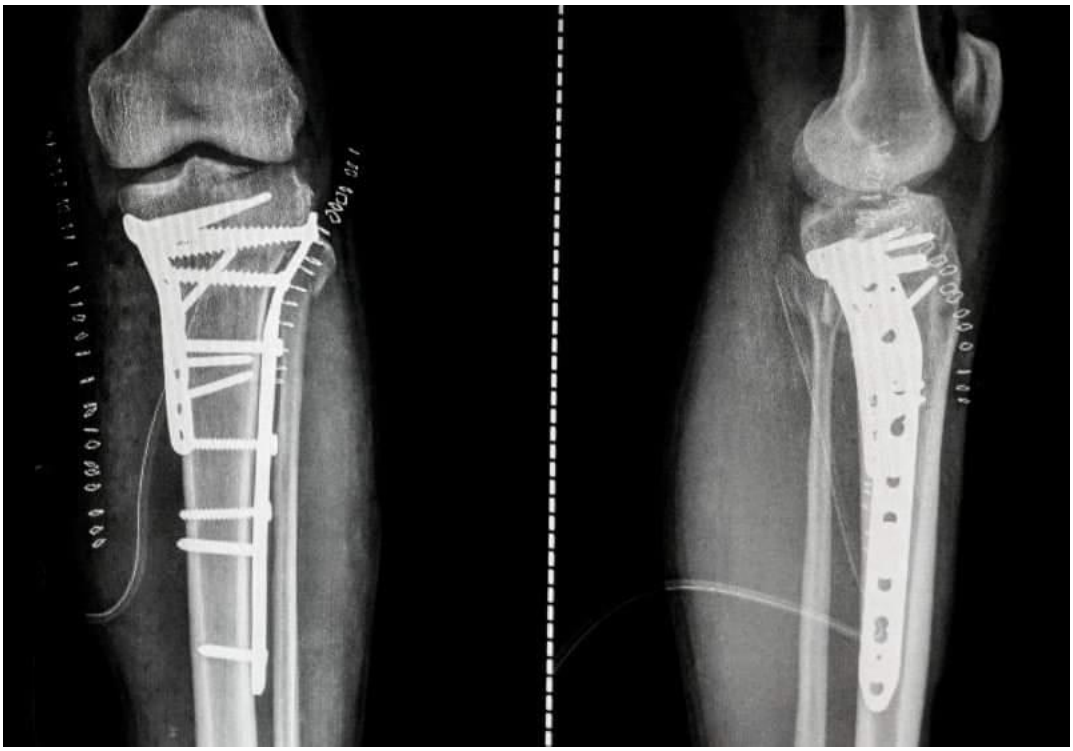

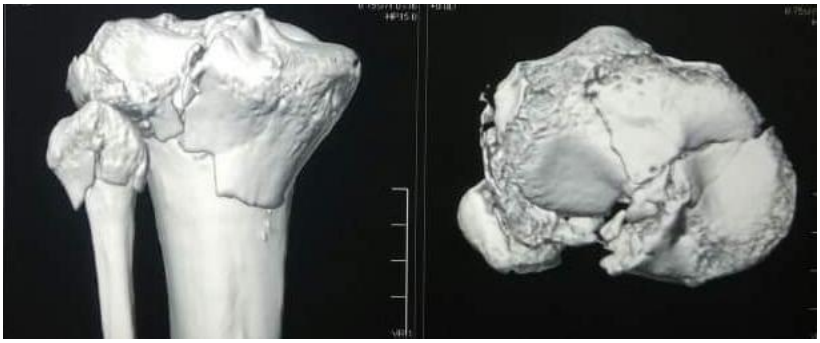

Table 7: Distribution of the Functional Outcome

Functional Outcome	No. of patients	Percentage
Excellent	36	60
Good	21	35
Fair	3	5
Poor	0	0
Total	60	100

In table 7, total 36 patients had an excellent functional outcome followed by 21 patients had a good outcome, and only three patients had fair functional outcome in our study.

Table 8: Mean functional score pre-and post-surgery among patients

Pre-and post-surgery	Mean±SD
Pre-operative	41.4±5.61
Post-operative	91.5±9.73

In table 8, the mean pre-operative functional score was 41.4 in our study, which improved to an average post-operative score of 91.5.

Table 9: Complication among patients

Complication	No. of patients	Percentage
No complication	30	50
Delayed wound healing	20	33.3
Infection	10	16.7
Total	60	100

In table 9, maximum number of patients were no complication. Only 20 patients had complication such as delayed wound healing. They were treated with antibiotics, regular dressing and wound healed One patient had deep infection in post op period at 10^{th} day, Patient was treated with surgical debridement, irrigation and polyethylene spacer exchanged.

DISCUSSION

Proximal tibia fractures which are one of the commonest intra articular fractures are occurring as a result of motor vehicle accident, accidental fall from height, violence etc. The management of

proximal tibia fracture has always been a subject of discussion because of their complexity and variety. Tibia plateau fractures are more commonly seen in the active, younger age group due to their exposure to high velocity motor vehicle accidents. Most common intra articular fractures were tibia plateau fractures, occurring as a result of RTA. Because of the complexity of injury and fracture pattern, management of these fractures are quite challenging for the Orthopedic surgeons. It is extremely important to adequately visualize the fragments, reduce the fracture and obtain stable rigid fixation. [14]

In our series, 39 were male and 21 were females. Mean age of the patients were 38.13 years with age ranging from 21 years to 60 years which is compared to study done by Eggli et al [15], in which maximum incidence of fracture were in males. In the age group of >61 years maximum incidence of fractures.

Of the total, we encountered 50.0% cases of one column fracture with posterior column involvement in 13.3% of cases. Two column fractures were encountered in 30.0% cases and posterior column was involved in 25.0% cases. Mean duration of surgery required for fixation of single column fractures were 65.41 mins. Two column fractures fixed with single plate (76.57 mins) had taken longer duration compared to dual plate (120 mins) fixation. For three column fracture fixation with dual plate were 94.91 mins, fixation with dual plate & one cc screw were 180 mins, fixation with single plate &cc screw were180 mins.

Posterior column fixation done in two column fractures had excellent mean radiological and functional outcome, mean range of movement were 0 to 130 degrees of flexion and in posterior column non-fixed group had good radiological score (mean) and excellent functional score (mean) with mean range of movements of 0 to130 degrees flexion.

total 36 patients had an excellent functional outcome followed by 21 patients had a good outcome, and only three patients had fair functional outcome in our study., which is contrary to study done by Sinha. [16] in which excellent functional outcome were seen in posterior tibia plateau fracture fixation group.

the mean pre-operative functional score was 41.4 in our study, which improved to an average post-operative score of 91.5. Our study is compared to study done by Rohra. [17] in which maximum patients has excellent radiological outcome.

Patients in our study encountered various complications, among which delayed wound healing was 33.3%. Out of 30 cases, we observed that posterior column fixation done in one column fractures had excellent radiological and functional score, range of movements achieved was 0 to 140 degrees of flexion.

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CONCLUSION

Proximal tibia fractures present with many different configurations, though different imaging modalities are available to give better fracture geometry, adequate surgical skills and specific column fixation are necessary to achieve proper fracture reduction.

In our study posterior column was not fixed in few cases as it could be the surgeon's choice or lack of expertise. Based on our study we observed that column specific fixation is a better option compared to conventional method of fixation as it provides better visualization, control over fragment, stable reduction and fixation of fragment.

Even though radiological outcome is better in posterior column fixation group, functional outcome remains to be same in both the groups. It requires long term follow up and large number study to assess the effectiveness of posterior column fixation. However column specific fixation requires surgeon's expertise and experience.

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