

Radiological Outcome of Plating in Tibial Plateau Fractures Classified Through Modified Schatzker Classification

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Abstract:

Introduction: Constituting approximately one percent of all fractures and 8% of the fractures in elderly, tibial plateau fractures are considered to be common fractures. These fractures encompass various configurations involving medial, lateral or both plateaus with varied degrees of articular depressions and displacements. The objective of surgical fixation of tibial plateau fractures are pivoted on achieving anatomic reduction of the joint surface as well as restoring the mechanical alignment of the lower limb.

Objective: The aim of this study is to assess radiographic outcomes after surgical management (plating) of tibial plateau fractures and determine the fracture pattern with 3-dimension image.

Results: We observed in this study that three-dimensional imaging made pre operative planning easy and resulted in good radiological outcome of patient because in Schatzker type IV, V and VI posteromedial plating was done in some patients who had posteromedial fragment which was not observed in plain radiographs.

Conclusion: Modified Schatzker classification helps in clear visualization of fracture and therefore, apt treatment to each and every case.

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Introduction

Constituting approximately one percent of all fractures and 8% of the fractures in elderly, tibial plateau fractures are considered to be common fractures [1]. These fractures are significant because of their intra-articular nature, and numerous studies have been carried out on the management and outcome of such fractures.

55 to 70% of tibial plateau fractures involve lateral tibial condyle and isolated medial condyle fractures are found in 10 to 23% whereas bicondylar lesions account for 10 to 30% of the cases in the reported series. These fractures encompass various configurations involving medial, lateral or both plateaus with varied degrees of articular depressions and displacements. Just like any other disease, every fracture has its typical characteristic morphology along with its response to the treatment. As a clinician, it is crucial to determine the force of injury as considerable soft tissue and neurovascular damage are often associated with high-energy trauma. Apart from tibial plateau bony injury, one should always assess for meniscal tear and ligament injuries.

Various mechanisms of injury which cause tibial plateau fractures range from road traffic accidents to falls. These kinds of fractures occur when knee joint

is subjected to axial compression forces or indirect shearing forces. As the articular surfaces are involved, inappropriate management of tibial plateau fractures often advance to catastrophic consequences: pain, deformity, limited range of motion and eventually leading to osteoarthritis of the knee joint.[2]

The objective of surgical fixation of tibial plateau fractures is pivoted on achieving anatomic reduction of the joint surface as well as restoring the mechanical alignment of the lower limb.[3]

Mauricio Kfuri in year 2018 found the modified Schatzker classification of tibial plateau fractures is based on the template of the original Schatzker classification, to which he added information obtained from computed tomography. The advantage of this three-dimensional extension of the original Schatzker classification is that it makes use of a widely used and accepted classification system. In addition, it provides a simple method based on computed tomography morphology of the injury to localize the fracture and to provide a simple method of notation of the details of the injury. It also provides clear guides to preoperative planning which should hopefully help to avoid surgical mistakes and improve the outcomes of treatment. [4]

Daniel Xing Fu Hap in year 2019 concluded functional outcomes of surgically treated tibial plateau fractures are generally favourable. The functional results are largely dependent on the Schatzker type of the fracture and the force of impact causing injury. Poor functional outcome is conferred by high impact injuries as well as Schatzker Types IV to VI fractures. Majority of patients were able to return to work.[5]

Aims and Objectives

The aim of this study is to assess radiographic outcomes after surgical management (plating) of tibial plateau fractures and determine the fracture pattern with 3-dimension image.

Material and Methods

The study is a prospective and observational study conducted at Govt RDBP Jaipuria, Jaipur.

- Patient was admitted from OPD and emergency having tibial plateau fracture matching the inclusion criteria.
- Demographic data, History, Clinical examination was recorded in the study proforma. Standard Antero-posterior view and lateral view radiographs along with CT scan of the joint with 3D reconstruction were taken to assess fracture geometry.
- Above knee slab was applied to the affected limb. According to 3D CT, fracture classification was done. Fractures were classified according to Modified Schatzker classification.
- As per inclusion and exclusion criteria, patients were selected for the study after taking written and informed consent.
- Routine pre- operative investigations were done. Pre-anaesthetic evaluation was done before the surgery.
- Under anaesthesia, open reduction and internal fixation (ORIF) or minimally invasive percutaneous plate osteosynthesis (MIPPO)

with locking plate was done using image intensifier.

- Dressing and mobilisation was done post operatively as per clinical and radiological assessment.
- Partial weight bearing was started as per the evidence of radiological union.
- Full weight bearing was advised after radiological evidence of union.

Assessment of the Study

Radiographic assessment was done according to Modified Rasmussen Radiological Score by standard antero-posterior and lateral views.

Follow Up: It was at 2 weeks, 4 weeks, 8 weeks, 12 weeks, 16 weeks, and 24 weeks

Modified Schatzker Classification

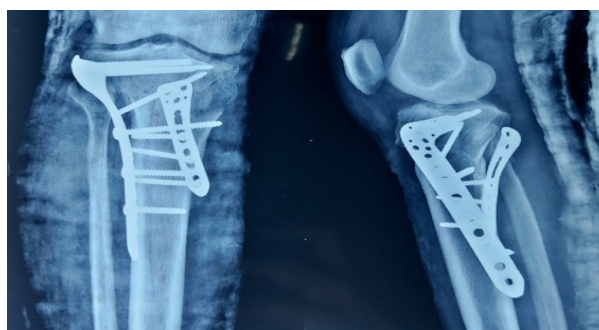
The advent of computed tomography allows for three- dimensional imaging of the proximal tibia together with the characterization of anatomical landmarks which delineate the four anatomical quadrants. This has made it possible to determine the architecture of the fracture and its spatial topography within the tibial plateau. We revisited the Schatzker classification applying the results of three-dimensional imaging.

The six principle fracture types of Schatzker remain the same. We are adding a new set of modifiers “A” (anterior) and “P” (posterior) to denote the quadrants involved in the six principle types. These modifiers are denoted in upper cases. In order to arrive at a three-dimensional localization of the fracture the surgeon must identify the main plane of the fracture and the place where the plane bisects the articular rim of the tibial plateau. Split wedge fractures of the tibial plateau will disrupt the articular rim at two points and will exit the metaphysis distally to the joint, at the apex of the wedge.

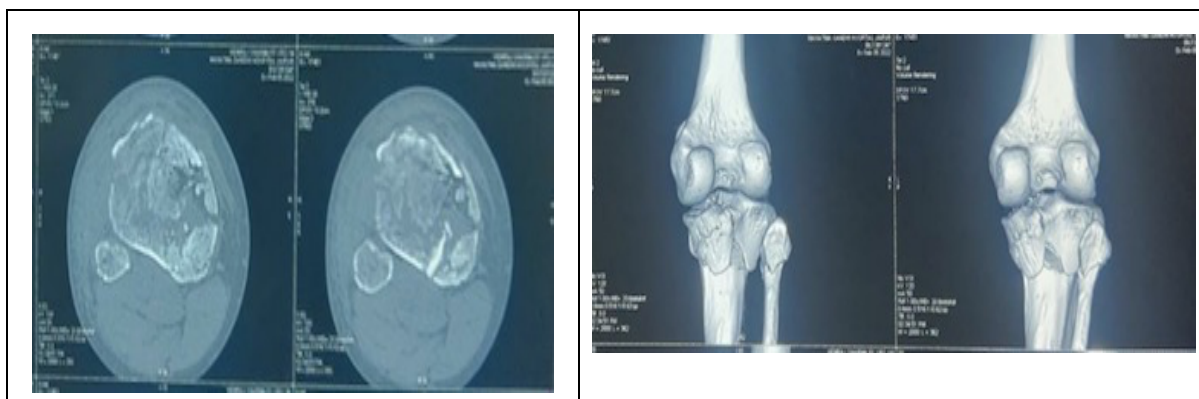
CASE 1:

40-year-old male history of RTA a Schatzker type V operated with dual plating.

A: Plain Radiograph Showing Bicondylar involvement and posteromedial fragment not visualised clearly



C: Post op X-ray Showing anterolateral and posteromedial plate



B: Axial and 3D CT images show modified schatzker type V AL, PM Classification



Clinical Photograph of Patient at 6-month follow-up

CASE 2: A 38 yrs. old male patient with alleged history of road traffic accident, sustained Schatzker Type IV fracture of right proximal tibia. The patients was operated with postero-medial plating.

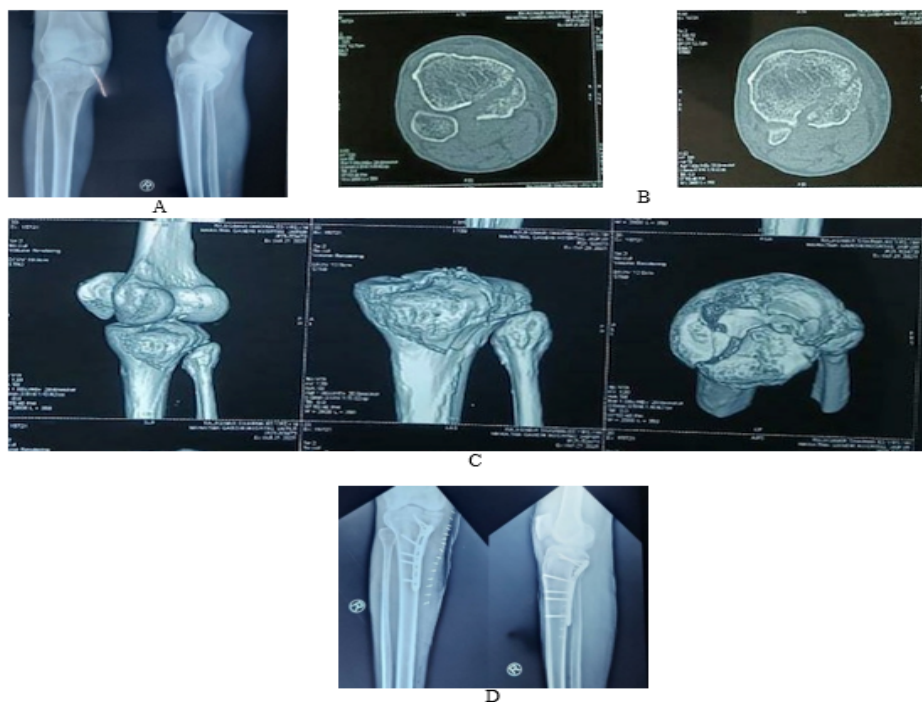


Fig A: Plain Radiograph AP and Lateral Reveal medial condyle fracture; **B-C:** CT Axial and 3D show precise location of split revealing posteromedial fracture line giving it modified schatzker classification type IV-P; **D** post of x-ray with posteromedial plating.



Clinical photos of patient at 6 month follow up

Result and Discussion

Type of Fracture and Percentage of Cases: According to Modified Schatzker's Classification:

Table 1: Frequency of type of fractures [2]

		No. of cases	Percentage
I	A	0	0
	P	1	3.33
II	A	2	6.66
	P	2	6.66
III	A	5	16.66
	P	2	6.66
IV	A	3	10
	P	1	3.33
V	AL, AM	3	10
	AL, PM	5	16.66
	PL, AM	0	0
	PL, PM	0	0
VI	AL, AM	1	3.33
	AL, PM	2	6.66
	PL, AM	2	6.66
	PL, PM	1	3.33

Modified schatzker Classification

It was observed before the study that management protocol and position of plating changed after 3d CT findings. therefore, in this study we advised 3d CT to every patient and preoperative planning was made accordingly. Position of plating was decided based on the modified schatzker classification (three-dimensional classification).

We observed in this study that three-dimensional imaging made preoperative planning easy and resulted in good functional and radiological outcome of patient because in Schatzker type IV, V and VI posteromedial plating was done in some patients who had posteromedial fragment which was not observed in plain radiographs.

For determination of class of fracture in modified schatzker classification there are three point that determine if the fragment is Anterior or posterior. two points on tibial plateau and other on the apex. if the apex lies anterior to equator it is A and if the apex lies posterior, it is given the suffix P.

Position of Plating: Dual plating with posteromedial plate was done in 2 cases (6.66%) and Posteromedial plating was done in only 1 case (3.33%). This position of plating was decided after preoperative planning based on 3D CT and modified schatzker classification. Lateral locking plate was done in 66.66% cases and anteromedial plate was done in 3 out of 30 cases (10%).

Table 2: Different plating methods

Plating methods	No. of cases	Percentage
Lateral	20	66.66
Antero-medial (AM)	3	10
Postero-medial (PM)	1	3.33
Dual- Lateral+ Antero-medial	4	13.33
Dual- Lateral + Postero-medial	2	6.66
Total	30	100.0

Radiological Results: In the total 30 cases that were included in our study who were treated surgically, 10 cases had outstanding results, 16 cases gave good results, 4 cases gave fair results and only 0 case had poor results.

It was observed retrospectively that the case with fair outcome had high velocity injury (type V- VI)

Table 3: Radiological results

	Radiological results	
	No. of cases	Percentage
Excellent	10	33.33
Good	16	53.33
Fair	4	13.33
Poor	0	0
Total	30	100

Despite of having Majority of cases in present study were type V schatzker classification in contrary to other studies who had most common type as type I and II (40% in best resulting study), our radiological outcome was found satisfactory in 90 % of cases as preoperative planning was based on three dimensional imaging and modified schatzker classification that lead to proper positioning of locking plate.

Conclusion

High velocity proximal tibia fracture requires good visualization of fracture pattern to plan better preoperatively. This three-dimensional staging (Modified Schatzker classification) takes into account whether the fracture fragment is anterior and posterior. It also helps in clear visualization of fracture and therefore, apt treatment to each and every case. High velocity injuries (Schatzker IV, V, VI) had good function and radiological outcome

after preoperative planning through three dimensional staging.

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