

## **Prospective Hospital-Based Study To Assess The Radiological Union And The Clinical Outcomes Associated With Dual Plate Osteosynthesis In Type V & VI Proximal Tibial Fracture**

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Received: 02-12-2021 / Revised: 28-12-2021 / Accepted: 09-02-2022

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Conflict of interest: Nil

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### **Abstract**

**Aim:** To assess the radiological union and the clinical outcomes associated with dual plate osteosynthesis in type V & VI Proximal tibial fracture.

**Methodology:** The present study was conducted in the department of Orthopedics Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India for 15 months. Total 50 patients who presented with Schatzker types V and VI tibial plateau fractures and who had been treated with minimally invasive dual locking and buttress proximal Tibial plate were included in the study. Following mention inclusion and exclusion criteria were included in study. Preoperative radiographs were reviewed and classified according to Schatzker classification system. All patients had a similar postoperative regimen and were followed up at regular intervals at 6, 8, 12, 24 weeks for at least 6 months. During each follow-up period, radiograph and functional score measure and also maintain the record of any complication during follow up period. Functional evaluation of knee joint was performed at least after 6 months according to Knee Society Scores.

**Results:** Out of 50 patients, 28 (56%) patients were male, while 22 (44%) were female. Age range of patients included was 18 years to 60 years, with mean age  $41.33 \pm 14.52$  years. 36 (72%) fractures were Schatzker type 5 fractures, and 14 (28%) were Schatzker type 6 fractures. 11 (22%) patients had left side fracture while 39 (78%) patients had right side fracture. Out of 50 patients, 27 (54%) achieved excellent knee score (80-100), 16 (32%) achieved good (70-79), 7 (14%) achieved fair (60-69) and no patient had poor (<60) knee score. Complications included 3 patients (6%) with superficial infection which were treated by I.V. antibiotics and surgical wound management and 1 patient (2%) with significant pain.

**Conclusion:** The overall functional and radiological outcomes are excellent to good in most of the cases which indicates that this technique is a good treatment option for type V and VI bicondylar tibial plateau fractures with less complications.

**Keywords:** Outcome, Osteosynthesis, Proximal Tibial Fracture.

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## Introduction

Knee injuries are more common in generalized trauma due to increase motor vehicle accident nowadays. Stiffness, arthritis and instability are major complication of intra-articular fracture of tibia. Soft tissue injury is usually a result of high velocity trauma due to axial loading combined with valgus / varus forces in complex tibial plateau injuries [1]. Various methods of treatment for complex and compound fractures are being used now days for restoration and maintenance of reduction of the fracture with ultimate aim of prevention of occurrence of late degenerative arthritis and stiffness.

Tibial plateau fractures have bimodal distribution, with high-energy trauma in younger patients and low-energy falls in elderly due to osteoporotic bone. The incidence is 10.3 per 100,000 population annually. High-energy trauma associated with soft-tissue injury, comminution and complex fracture geometry which further complicates the management of such fractures [2].

Till date common protocol of each type of complex Tibial plateau fractures has not developed. CT scan and MRI imaging techniques are more helpful to studies fractures pattern. Surgical management of proximal tibial fracture is evolving from open reduction and internal fixation to arthroscopic assisted minimally invasive surgery. Currently such injuries are being managed by single medial or lateral/dual plating, fixator (hybrid, ring, JESS fixator) along with plate depending upon need of injury pattern and surgical expertise of surgeons. Locking plates are widely used now days [3] and techniques of fixation are continuously in process of evolution from LISS (less invasive stabilization system) to peri-articular locking compression plate system (LCP) [4, 5].

The ideal treatment of high-energy tibial plateau fractures remains controversial. Open reduction and rigid internal fixation achieve the goals of anatomic articular congruity and mechanical alignment restoration, while allowing early knee mobilization [6-8]. But open reduction and internal fixation, specifically through compromised soft tissues, has historically been associated with major wound complications [9-11].

## Materials and Methods:

The present study was conducted in the department of Orthopedics Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India for 15 months. 50 patients who presented with Schatzker types V and VI tibial plateau fractures and who had been treated with minimally invasive dual locking and buttress proximal Tibial plate were included in the study. Following mention inclusion and exclusion criteria were included in study. Preoperative radiographs were reviewed and classified according to Schatzker classification system.

## Inclusion criteria:

18-60 years old patients Schatzker type V, VI proximal tibial fractures.

## Exclusion criteria:

Fracture with ipsilateral neuro-vascular deficit, dislocation of knee joint, any previous pathology or fracture around knee joint.

Preoperative radiograph's Anteroposterior view and Lateral view and computed tomography (CT) scans were used to diagnose each bicondylar proximal Tibial fracture.

## Procedure:

Open injury patients were underwent surgical debridement within 8 hours of injury after received tetanus prophylaxis and intravenous

antibiotics for prevention of infection. The wound was radically debrided and profusely lavaged with 3 to 6 litres of normal saline. The wound was closed either primarily or after 48 to 72 hours after a repeat irrigation with normal saline and debridement, depending on the level of contamination and amount of soft tissue damage. Fracture was stabilized with external fixator Intravenous Antibiotics (cefuroxime, amikacin and metronidazole) were prescribed for the first 5 days.

Patient was operated before 24 hour or after 12 days when wrinkled sign of skin was present. All the patients in our study were managed by using open reduction and internal fixation with dual anatomical pre contoured locking plate in sterile O.T at our center. Patient position was supine on a standard radiolucent orthopaedics operating table, after application of tourniquet, and put the small round bolster below the knee joint with four small incision two on lateral and two on medial side of proximal tibia. Elevation of depressed fragments of articular surface done by the punch and mallet under guidance of image intensifier after making of cortical window on the affected side and fixed it with subchondral k wires initially. Medial anatomical pre-contoured locked plate was secured using locking screw. Laterally also anatomical pre-contour was inserted percutaneously to secure lateral tibial plateau fixation with 6.5 mm fully threaded cancellous screw in metaphyseal region and cortical screw in diaphyseal region of tibia.

Fixation of the medial column was performed first after taking an incision made on anteromedial border of the Tibial metaphysis, with dissection through the interval between the pes anserinus tendons and the medial head of the gastrocnemius. The anterolateral incision was started 1 to 2 cm lateral to the

Patella and extended distally over Gerdy's tubercle and 1 cm lateral to the crest of the Tibia. Subperiosteal dissection was limited to the fracture margins and the diaphyseal region where plate should be placed. Depressed fragments were elevated and supported with autograft harvested from iliac crest or allograft whenever it may require. Locking plates were applied once anatomic reduction had been achieved. Locking plate was used on the side with relatively more severe fracture comminution and the other side were fixed with a buttress plate [12, 13]. All patients had a similar postoperative regimen and were followed up at regular intervals at 6, 8, 12, 24 weeks for at least 6 months. During each follow-up period, radiograph and functional score measure and also maintain the record of any complication during follow up period. Functional evaluation of knee joint was performed at least after 6 months according to Knee Society Scores [14, 15].

If an intra-articular step-off of at least 2 mm measured on scaled radiographs it is defined as malreduction. Alignment of the proximal tibia was determined by measuring the Tibial plateau angle (the medial angle between the tangential line and anatomic axial of the tibia) on anteroposterior radiographs and the posterior slope angle (the angle between the tangential line of medial plateau and the perpendicular line of the anterior tibial cortex) on lateral radiographs; tibial plateau angle  $>90^\circ$  or  $<80^\circ$  or posterior slope angle  $>15^\circ$  or  $<25^\circ$  was considered as a malalignment of intraarticular surface of proximal tibia [15].

If there is an increase of 2 mm of Intra-articular step-off is defined as secondary loss of reduction, if an increase of  $3^\circ$  malalignment when compared with the first postoperative radiograph is defined as secondary loss of alignment [15]. If  $>3$

cortical unions during the follow-up period radiograph, consider as a bony union. Non-union was defined as no evidence of healing after 9 months [16].

### Results:

Out of 50 patients, 28 (56%) patients were male, while 22 (44%) were female. Age

range of patients included was 18 years to 60 years, with mean age  $41.33 \pm 14.52$  years. 36 (72%) fractures were Schatzker type 5 fractures, and 14 (28%) were Schatzker type 6 fractures. 11 (22%) patients had left side fracture while 39 (78%) patients had right side fracture.

**Table 1: Demographic, fracture details and complications**

Variables		Number of patients (%)
Gender	Male	28 (56%)
	Female	22 (44%)
Mean age (In years)		41.33 + 14.52
Type of fracture (Schatzker type)	Type V	36 (72%)
	Type VI	14 (28%)
Side of injury	Left	11 (22%)
	Right	39 (78%)
Complications	Infection	03 (6%)
	Wound dehiscence	00
	Unable to Work	00
	Significant Pain	01 (2%)
	Walking Difficulty	00
	Stiffness in Knee Joint	00

All the 50 patients of proximal tibial fractures were surgically treated with a combination of locking plate and or buttress plate with dual minimal invasive incision approach. Complications included 3 patients (6%) with superficial infection which were treated by I.V. antibiotics and surgical wound management and 1 patient (2%) with

significant pain. Malreduction or malalignment was not measured on the first postoperative radiographs. Minor pain in the knee was common complain of most of patients. Out of 50 patients, 27 (54%) achieved excellent knee score (80-100), 16 (32%) achieved good (70-79), 7 (14%) achieved fair (60-69) and no patient had poor (<60) knee score.

**Table 2: Functional Outcome Evaluate by Knee Society Scoring System**

Grading	Number of patients	%
Excellent	27	54
Good	16	32
Fair	07	14
Poor	0	0
Total	50	100

### Discussion:

The management of tibial plateau fracture is challenging, considering soft-tissue

complications, fracture comminution and morphology, and delayed complications such as varus collapse, stiffness, and arthritis [17, 18]. The goal of anatomic reduction and stable fixation can be achieved with dual plating, but associated complications include delay in soft-tissue healing and implant failure. With better understanding of fracture morphologies such as coronal split and posteromedial fragment, most of the surgeons have employed dual plating in these fractures to avoid secondary loss of alignment and reduction.

Biomechanical cadaveric studies have demonstrated that dual plate fixation of these fractures allows less subsidence and loss of alignment as compared to single plate fixation. Presence of posteromedial fragment in 33% of these fractures based on CT scan requires posteromedial buttressing, hence dual plating is recommended. Various studies have suggested that single midline incision has high complication rates in the form of wound healing and sepsis. This led to development of two-incision approach which allows for addressing the posteromedial and posterolateral fracture precisely and minimizing the wound complication rate [19, 20].

Other authors have reported similar good results with dual plating in this difficult subset of fractures. Chang-Wug Oh et al [21] reported the outcome of double plating in a series of 23 unstable proximal tibial fractures in 23 patients with a mean age of 54 years. All fractures healed at an average of 19 weeks. Twenty-one patients had excellent or good clinical and radiographic results. There was one case of shortening (1 cm), two cases of mild varus malalignment (less than 10°), and one case of superficial infection which healed after hardware removal. No deep infections occurred.

The advantages of dual plating over other types of fixations include-Coronal split of the medial condyle can be fixed separately with post-eriomedial plate, better reconstruction of articular surfaces, better distribution of forces along the axis of the bone, better load sharing capability with dual plates compared to single lateral plate alone. Dual plates resist displacement, medial condyle collapse and allow early mobilization of the knee joint [17-20].

Now a days, minimally invasive techniques (LISS system) are used commonly performed by surgeons, and there have found the excellent results in proximal tibia plateau fractures being treated exclusively by this technique. By this system minimizes the surgical complications by decreasing the soft-tissue stripping, to provide a rigid fracture reduction at fracture site and to decrease post-traumatic soft tissue injury [22-24].

### **Conclusion:**

The overall functional and radiological outcomes are excellent too good in most of the cases which indicates that this technique is a good treatment option for type V and VI bicondylar tibial plateau fractures with less complications.

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