

## ORIGINAL RESEARCH

# Study to evaluate functional and radiological outcome of proximal tibia fracture treated with locking compression plate

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Received: 17 February, 2023

Accepted: 20 March, 2023

## ABSTRACT

**Background:** Proximal tibial fractures are one of the commonest intraarticular fractures resulting from direct axial or indirect coronal compression forces. Fractures of proximal tibia are common & serious injuries which are difficult to treat because of its subcutaneous location of the anteromedial surface of the tibia. If it's not treated it may result in significant functional impairment. The aim of surgical treatment of proximal tibial fracture is to restore and preserve normal knee functions which can be accomplished by anatomical restoration of articular surfaces, maintaining mechanical axis, restoring ligament stability and preserving functional pain free range of motion of knee. **Materia and Methods:** This study is a prospective observational study done at department of Orthopedics, Chirayu medical college and Hospitals, Bhopal between January 2021 to June 2022, where 96 patients of proximal tibia fractures (Schatzker's type 1-6) were treated using locking compression plates and their functional outcome were assessed using knee society score and radiological outcome were assessed using sequential X-rays at 1, 3 and 6 month follow up. **Results:** There were more males affected than females and the mean age of male patients was 43.63 years and that of females was 46.58 years. The incidence was more on right side and patients were treated using Bi-columnar plate. LCP and LCP + CC screws. The mean duration of union was 19.79 weeks. Functional outcome was assessed using knee society score. 57 patients had excellent knee society score, 22 patients had good score, 10 patients had fair score and 7 patients had poor score. The mean knee society score was 81.37 which shows the functional outcome were excellent. **Conclusion:** A proximal tibial fracture should be treated in a way that balances soft-tissue treatment with fracture reduction and alignment. Tibial plates work well to treat intra-articular extension fractures and are particularly helpful when the soft tissue milieu around the proximal tibia is conducive to dissection. Bone grafting is not required for defects in the metaphyseal region, even in osteoporotic bone, thanks to the LCP internal fixator system, which functions as a single implant and prevents intraoperative and postoperative fracture collapse.

**Key-words:** Proximal tibia fractures, Knee society score, Locking compression plates.

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## INTRODUCTION

A man is as old as his knees! That's an old English quote which emphasize its importance in daily life. The knee is one of the three major weight bearing joints in the lower extremity. Proximal tibial fractures are one of the commonest intraarticular fractures resulting from direct axial or indirect coronal compression forces <sup>(1)</sup>Fractures of proximal tibia are common & serious injuries which are difficult to treat because of its subcutaneous location of the anteromedial surface of the tibia. If it's not treated it

may result in significant functional impairment <sup>(2)</sup> The schatzker classification system for tibial plateau fracture is widely used by orthopedic surgeons to assess the initial injury, plan management and predict prognosis.

It divides plateau fractures into 6 types

- 1) Lateral plateau fracture without depression.
- 2) Lateral plateau fracture with depression.
- 3) Pure central depression the articular surface is driven into plateau, the lateral
- 4) cortex intact.

- 5) Medial plateau fracture.
- 6) Bicondylar plateau fracture.
- 7) 6)Plateau fracture with diaphyseal discontinuity<sup>(2)</sup>

Conventional methods like early open reduction and internal fixation have been associated with high levels of morbidity, substantial soft tissue complications such as wound breakdown and deep infection. To overcome these complications treatment using hybrid or circular wire external fixator is better option, but drawback like malunion, nonunion and pin track infections are common<sup>(3)</sup>. The aim of surgical treatment of proximal tibial fracture is to restore and preserve normal knee functions which can be accomplished by anatomical restoration of articular surfaces, maintaining mechanical axis, restoring ligament stability and preserving functional pain free range of motion of knee.<sup>(4)</sup> Recently more attention has been paid to the condition of the soft tissue envelope before surgical intervention. Thus, there arose a need for the birth of a new concept of biological fixation using the plates, also called as minimally invasive plate needed to be accurately contour to achieve good fixation, osteoporosis also posed the same problem for poor fixation with conventional plates<sup>(1)</sup>. As more and more concepts about biological fixation became clearer, the innovation of plates progressed leading to the development of less invasive stabilizing system (LISS). Research to combine these two methods has led to the development of AO locking compression plate. This new system has been regarded as technically mature. It offers numerous fixation possibilities proven to be worth in complex fracture situations and in osteoporosis and these are soft tissue friendly and have improved outcomes.<sup>(1)</sup> Locking plates in treatment of complex tibial plateau fractures hold many potential advantages, like increased holding power in osteopenic bones, unicortical purchase in periarticular region and ability to bridge severely comminuted meta-diaphyseal shaft areas successfully and stably. Thus, we evaluate the functional and clinical outcomes of tibial plateau fractures treated with locking plates<sup>(5)</sup>.

## MATERIAL AND METHODS

### STUDY DESIGN

Prospective observational study.

### STUDY SETTING

Department of Orthopedics at Chirayu medical college and hospital, Bhopal

### SAMPLE SIZE

Taking 50% as proportion of proximal tibia fractures, the sample size was estimated to be 96 (close to 100) at 10% level of error.

### STUDY DURATION

Study was conducted after approval from

institutional ethics committee for a period of 18 months (From January 2021 to June 2022)

## INCLUSION CRITERIA

- Patients aged 18 years and above, both males and females.
- Schatzker type 1 to 6.
- Open fracture grade 1 (according to Gustilo and Anderson classification)
- osteoporotic proximal tibia fracture

## EXCLUSION CRITERIA

- Patients aged less than 18 years
- Open fracture grade 2 and 3
- Patients who are medically unfit for surgery
- Pathological fractures from metastasis, benign bone tumors.
- Patients with associated distal tibial fracture of same limb.

## METHODOLOGY

The study was conducted in the department of orthopedics at CMCH, Bhopal for 18 months period and during this period 96 patients of proximal tibia fracture (Schatzker type 1 to 6) were treated with locking compression plate and the patients were reviewed both clinically and radiologically for a minimum of 6 months following operative fixation. All patients were subjected to a same protocol of investigation, temporary slab, ice fermentation and limb elevation to decreased swelling. All patients were operated under C-ARM in supine position. All patients were treated by anatomically contoured locking plate via minimal invasive technique. The side and number of plates to be used was decided as the fracture pattern, which was classified according to the Schatzker's classification using plain radiographs and three-dimensional reconstruction CT scans, which was done when needed. The depressed fracture was elevated in all cases. Postoperatively patients were given long knee brace support for 2 weeks, but isometric quadriceps exercises and intermittent knee range of motion were encouraged from the third day. Mobilization was started as soon as plain permitted; first with non-weight bearing, crutch support walking, followed by toe-touch crutch support walking and then progressive weight bearing depending upon tolerance and radiographic evidences of fracture healing. Patients were followed up regularly at intervals until fracture healing was seen. Radiological evaluation was done for union and functional assessment was done according to knee society score.

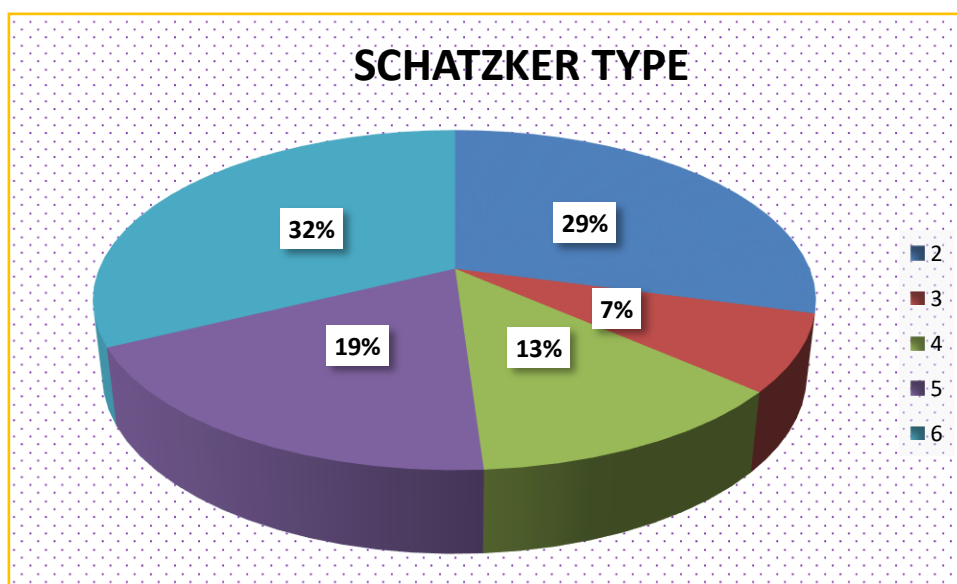
## RESULTS

In our study, there were more males affected than females. There were 65 males and 31 females. Mean age of male patients was 43.63 years and that of female patients was 46.58 years. The incidence was more on right side as compared to left side. The major cause of injury was RTA.

Out of 96 cases, 28 patients have Schatzker's type 2 fracture, 7 have type 3, 12 have type 4, 18 have type 5 and 31 have type 6 fracture.

#### TYPE OF FRACTURE

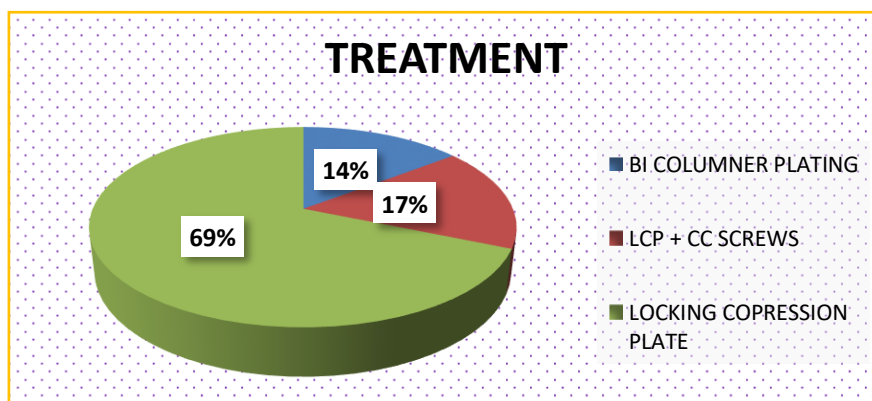
Schatzker's type	Count	Column n %
2	28	29.20%
3	7	7.30%
4	12	12.50%
5	18	18.80%
6	31	32.30%
Total	96	100.00%



#### TREATMENT TYPES

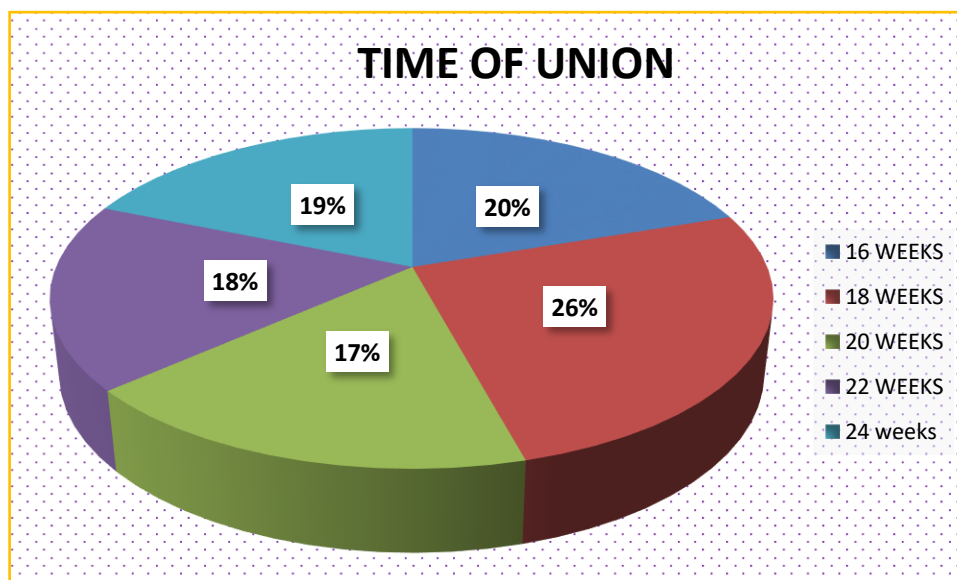
In our study, 14 patients were treated with bi-columnner plating, 16 were treated with LCP + CC screws and remaining 66 were treated with locking compression plates. Mean duration of union was found to be 19.79 weeks.

Treatment	Count	Column N %
Bi columnner plating	14	14.60%
Lcp + cc screws	16	16.70%
Locking copression plate	66	68.80%
Total	96	100.00%



**TIME OF UNION**

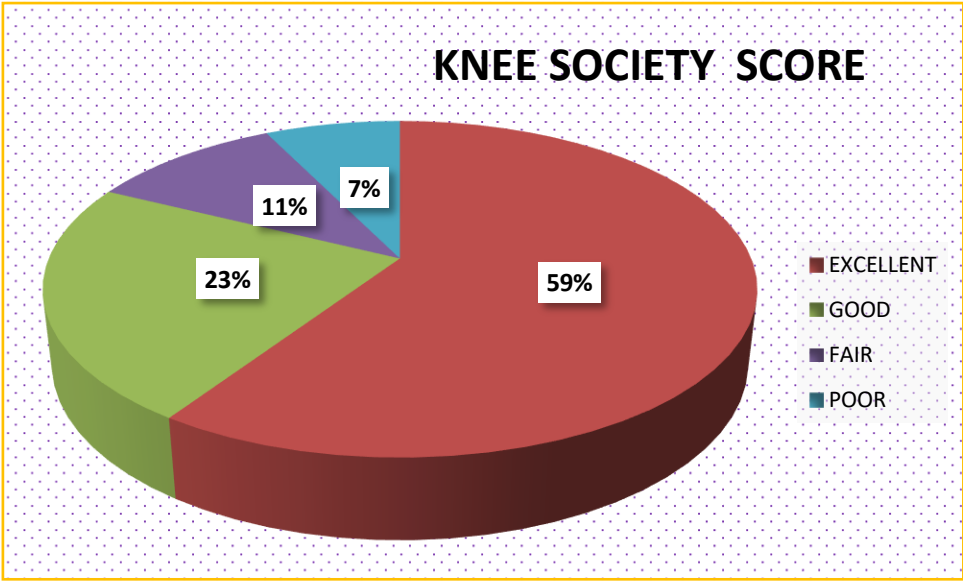
Time for union	Count	Column N %
16 weeks	19	19.80%
18 weeks	25	26.00%
20 weeks	17	17.70%
22 weeks	17	17.70%
24 weeks	18	18.80%
Total	96	100.00%
Mean $\pm$ SD	19.79 $\pm$ 2.82	

**FUNCTIONAL OUTCOME**

Functional outcome was assessed using knee society score. 57 patients had excellent knee society score, 22 patients had good score, 10 patients had fair score and 7 patients had poor score.

The mean knee society score was 81.37 which shows the functional outcome were excellent.

Knee society score	Count	Column n %
Excellent	57	59.40%
Good	22	22.90%
Fair	10	10.40%
Poor	7	7.30%
Total	96	100.00%
Mean $\pm$ sd	81.37 $\pm$ 10.789	

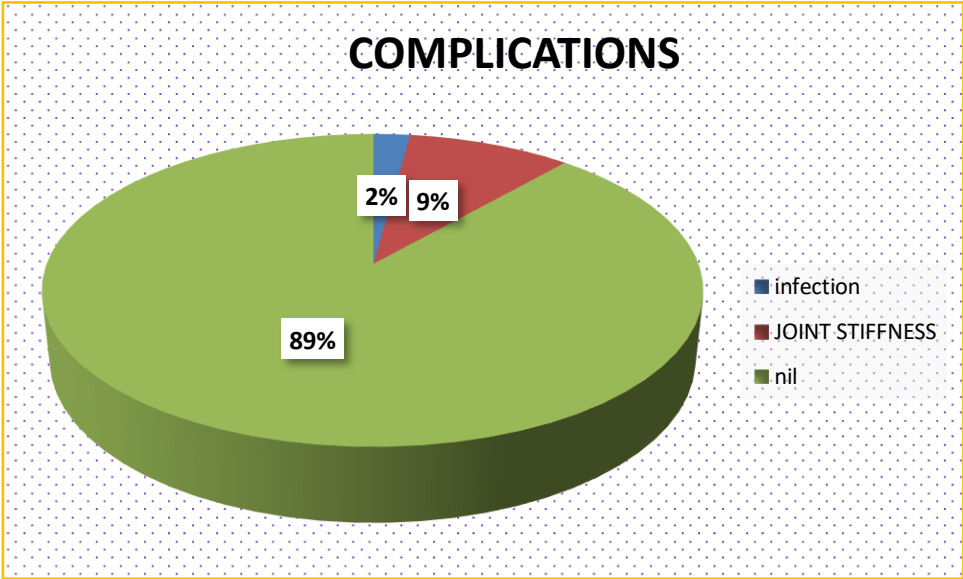


**COMPLICATIONS**

Out of all patients, 11 patients had complications. 2 patients had infection which subsides by intravenous antibiotic administration and 9 patients had knee joint stiffness.

Infection was seen in one patient with type 5 fracture and one patient with type 6 fracture. 7 patients with type 6 had joint stiffness while 1 patient with type 5 fracture had joint stiffness and 1 with type 3 had joint stiffness.

Complications	Count	Column n %
Infection	2	2.10%
Joint stiffness	9	9.40%
Nil	85	88.50%
Total	96	100.00%



**DISCUSSION**

For the surgeon, treating tibial plateau fractures is a very difficult task. High energy injuries are being caused by a daily rise in road accidents. These have an impact on the increasing number of complicated proximal tibial fractures seen by medical professionals. Low energy injuries like home falls

cause complex tibial plateau fractures in elderly adults with osteoporotic bones. The purpose of the procedure is to give the patient a pain-free, movable joint, and it requires a very high level of surgical expertise and technological knowledge. For a precise reduction of the articular cartilage, good surgical methods and implants are necessary.

Poor surgical technique used in early operations is to blame for the initial poor reputation of bi-column fixation of complicated tibial plateau fractures <sup>(6)</sup>. The orthopedic community was put on high alert regarding bi-column fixation because of the utilization of a single midline incision and the excessive soft tissue handling that resulted in a high frequency of wound breakdown and infection <sup>(7,8,9)</sup>. Since the invention of locking plates, isolated lateral plating with locking

compression plates and supporting medial fragment through screws passing through the locking plate <sup>(10,11)</sup> have become more common.

In our study, males outnumbered females. This is explained by the more active lifestyle of males and hence more chances of road traffic accidents. This is in accordance with the series of 14 patients reported by Eggli et al., in which 10 were male and 4 female <sup>(6)</sup>.

Study	Total no. patients	No. of males	No. of females
Eggli et al	14	10	4
Lee et al	45	21	24
Walia et al <sup>(12)</sup>	50	45	5
Our study	96	65	31

The mean age of patients in our study was 44.5 years (range 20yrs to 76yrs). This is almost similar to the mean age of 41yrs in Eggli et al study and 49.1 years in the Lee et al <sup>(13)</sup> study.

**Mohammad Ali Tahririan, Seyyed Hamid Mousavitadi, and Mohsen Derakhshan<sup>(14)</sup>** in their clinical study comparing the functional outcomes of tibial plateau fractures treated with locking plate fixation by knee society score, found a score of 80.2 for locking plate. Average range of knee flexion was found to be 122.3 degrees for locking plate. In our study, locking plate was used for all the cases. Average knee society score was found to be 81.4 and average knee flexion was found to be 110 degrees. So, functional outcome in our study was almost similar to above study.

**Chang-Wug Oh <sup>(15)</sup> et al** in their study on double plating of (twenty-three) type V and type VI proximal tibial fractures using minimally invasive percutaneous osteosynthesis found Eighteen patients with excellent,

three patients with good and two patients with fair results. average knee range of motion was found to be 123 degrees.

In our study, 49 patients belonged to type V and VI fractures. Average range of flexion achieved by type V and type VI was found to be 104 degrees. Twenty-seven patients had excellent, eleven patients with good, 4 patients had fair and 7 patients had poor results.

Dual plate gives better biomechanical strength and rigid construct thereby better control of both columns thus avoiding late collapse.

In our study, there was no late complications like loss of reduction and malalignment with unilateral plating for type V and type VI fractures. Functional outcome at midterm follow-up is similar to those two studies with dual plating.

Choice of the procedure/implant should be based on the fracture pattern, bone quality and intraoperative reduction.

#### Case 1

Name	Nandramjain
Age	52 years
Sex	Male
Mode of Injury	RTA
Side injured	Right
Schatzker's type	Type II
Procedure	ORIF with lateral plate (LCP)
Post-op complications	Nil
Knee ROM	120 degrees
Radiological union	16 weeks
Knee Society Score	94
KSS Result	Excellent

**PRE OP**



**1 MONTH FOLLOW UP**



**3 MONTH UP**



## 6 MONTH FOLLOW UP



## CLINICAL IMAGES



## CASE 2

Name	Sohan jain
Age	40
Sex	Male
Mode of Injury	RTA
Side injured	Left
Schatzker's type	Type V
Procedure	ORIF with
Post-op complications	Nil
Knee ROM	90 degrees
Radiological union	20 weeks
Knee Society Score	78
KSS Result	Good

## PRE OP





## POST OP



## 1 MONTH FOLLOW UP



## 3 MONTH FOLLOW UP



## 6 MONTH FOLLOW UP



## CLINICAL IMAGES



## CONCLUSION

High-energy trauma can result in proximal tibia fracture.

Unsolved is the issue of how to treat intra-articular tibial plateau fractures.

Based on the patient's bone quality, fracture pattern, and intraoperative fracture reduction, the surgical procedure and implant choice should be made.

The condition of the soft tissues prior to surgery and when they are repaired significantly affects the outcome.

Tibial plates work well to treat intra-articular extension fractures and are particularly helpful when the soft tissue milieu around the proximal tibia is conducive to dissection.

Long plates placed throughout the length of the fracture provide sufficient support to promote soft tissue healing and fracture union.

A proximal tibial fracture should be treated in a way that balances soft-tissue treatment with fracture reduction and alignment.

Bone grafting is not required for defects in the metaphyseal region, even in osteoporotic bone, thanks to the LCP internal fixator system, which functions as a single implant and prevents intraoperative and postoperative fracture collapse.

Therefore, a bone defect will repair by developing a callus.

Tibial plateau fractures were treated quickly by secondary fracture union utilising the MIPPO procedure. As a result, this approach achieves strong bone union across the fracture considerably quicker than open reduction & internal fixation because to reduced soft tissue injury, which results in less disruption of the proximal tibia's blood supply.

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