International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2018; 4(1): 148-156

www.orthopaper.com
Received: 22-11-2017
Accepted: 23-12-2017

Dr Siddesh Patil
Assistant Professor,
Department Of Orthopaedics,
SSIMS-RC, Davanagere,
Karnataka, India

Dr. Akshay MK
Junior Resident,
Department Of Orthopaedics,
Ssims-Rc, Davanagere,
Karnataka, India

Dr Ashwin Gobbur
Junior Resident,
Department Of Orthopaedics,
Ssims-Rc, Davanagere,
Karnataka, India

Correspondence
Dr Siddesh Patil
Assistant Professor,
Department Of Orthopaedics,
SSIMS-RC, Davanagere,
Karnataka, India

A prospective study of surgical management of tibial plateau fractures by locking compression plate

Dr Siddesh Patil, Dr. Akshay MK and Dr. Ashwin Gobbur

DOI: https://doi.org/10.22271/ortho.2018.v4.i1c.22

Abstract
Aim: To assess the clinical and functional outcome of surgically treated tibial plateau fractures with internal fixation by locking compression plated at SSIMS-RC, DAVANAGERE during JUNE 2015 TO FEBRUARY 2017.
Objectives
1. To re-establish the anatomy of articular surface of upper end of tibia and knee joint perfectly by operative treatment with internal fixation.
2. To assess the radiological union of fractures after internal fixation with locking compression plate.
3. To assess the functional outcome of knee joint

Materials and methods: Total number of cases studied were 30.
Inclusion criteria: Skeletally mature patients with tibial plateau fractures.
Exclusion Criteria: Patients with Gustilo- Anderson Type 3 compound tibial plateau fractures, Children with proximal tibial fractures in whom the growth plate is intact, patients with pathological proximal tibial fractures apart from osteoporosis, Patients managed conservatively for other medical comorbidities, Ipsilateral intraarticular fracture femur and patella.
Observation and results: Rassmussens criteria was used for evaluation of results. Out of 30 cases., we are able to achieve 66.66% excellent result and 20% good result(over all 86.66%, acceptable results) with our standard surgical care. in addition we have 13.33% fair and resultsinterm of functional outcome.
Conclusion: From this study we conclude that, surgical management of tibial plateau fractures gives excellent anatomic reduction, accurate axial and articular alignment with rigid internal fixation by locking compression plate and achieves a stable and functional knee joint. Preoperative soft tissue status and associated ligamentous injuries and their repair at right time, significantly changes the final outcome.

Keywords: Surgical management, tibial plateau fracture, locking compression plate

Introduction
The knee joint being one of the major weight bearing joints in the body, fractures around the knee (intra-articular) are one of the commonest orthopaedic injuries encountered in a trauma setup. They can be as a result of high energy trauma or low energy falls. The majority oftibial plateau fractures involve articular extension and can be a result of high velocity accidents and fall from height where fractures are due to indirect shear forces and direct axial compression respectively [12]. In older patients with osteopenic bones, a depression type of fracture in more common due to low resistence of their subchondral bone to axially directed loads. Until recently, internal fixation had not overtaken conservative methods as the primary choice of treatment. While it focuses on early mobilization and lesser morbidities, it fails to address soft tissue complications. The main aim of surgical treatment of tibia plateau fracturesis:
a) To restore articular congruity
b) To restore mechanical axis
c) To restore ligamentous stability

All of the above can achieve optimal functional, painless knee with good range of motions [4]. Initial treatment with conventional locking plates aimed at rigid internal fixation revealed that the bone that is in contact with the plate becomes thin and atrophic leading to complications like nonunion or secondary fractures after implant removal. Dr. Girdlestone in 1932 warned that “there is danger inherent in the mechanical efficacy of our modern methods, danger lest

the craftsmen forget that union cannot be imposed but may have to be encouraged. Where the bone is a plant with its roots in the soft tissue, and when its vascular connection are damaged, it often requires, not the technique of a cabinet maker, but the patient care and understanding of a gardener." [5] This gave rise to a new concept of fixation called biological fixation. The concepts of biological fixation consists of:

a) Indirect reduction
b) Adequate stability
c) Preservation of osteogenic potential
d) Limited bone-plate contact [6]

The concept of biological fixation lead to the creation of minimally invasive percutaneous plate osteosynthesis also known as MIPO (MIPPO). While MIPO was theoretically better than open plating, the conventional plates ability to hold the bone rigidly enough was questioned, especially in osteoporotic fractures and clinically was not successful. [7] So a new concept of implant design lead to the creation of limited contact DCP and from it, the newer locking compression plates(LCP) [8], which was regarded as a technically more mature biomechanically and had the ability to give a stable fixation even in osteoporotic bones. This study aims at using this new system of plates fixation for tibial Plateau fractures.

Objectives of the study

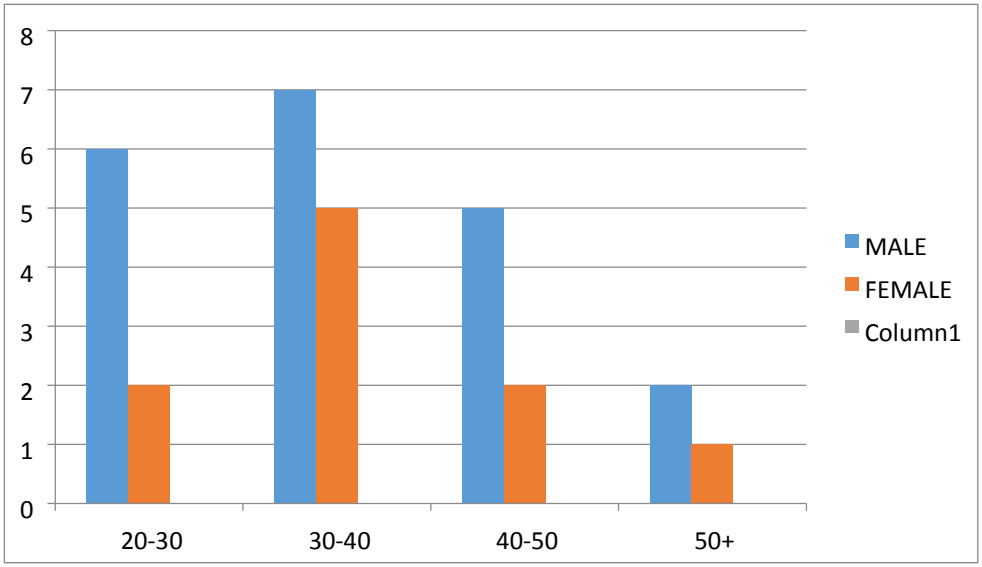
1. To re-establish the anatomy of articular surface of upper end of tibia and knee joint perfectly by operative treatment with internal fixation.
2. To assess the radiological union of fractures after internal fixation with locking compression plate.
3. To assess the functional outcome of knee joint.

Results

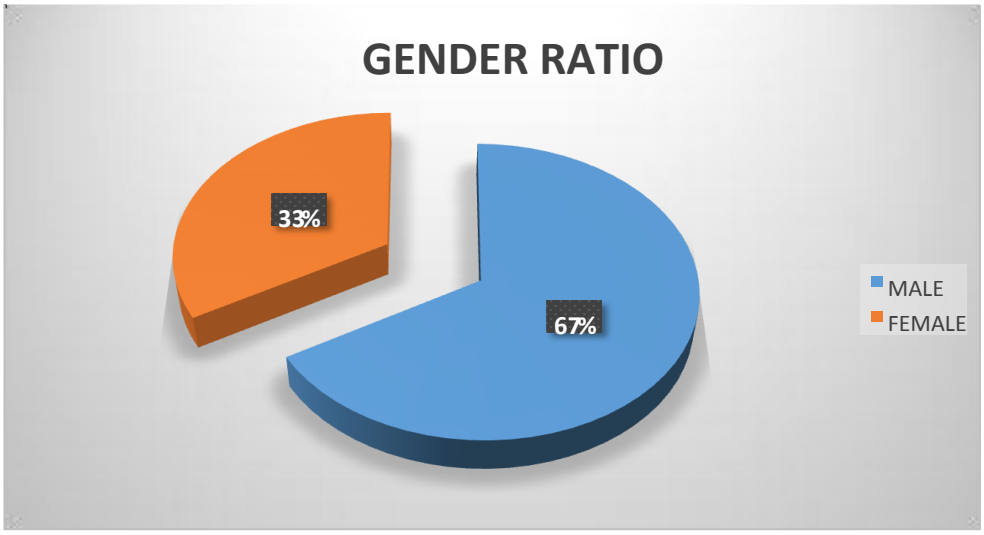
Our study included 30 patients with tibial plateau fractures. Most of the patients in our study are males in the age group of 25-50 years. Most of the fractures are intra-articular fractures.

Table 1: Age distribution

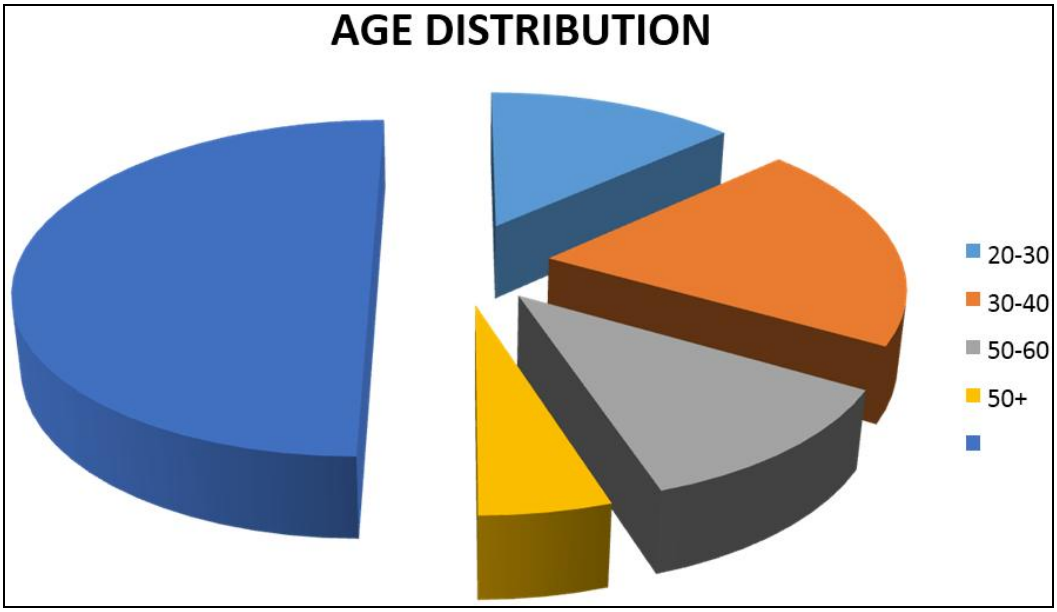
Age group	Male	Female	Total
20-30	6	2	8
30-40	7	5	12
40-50	5	2	7
50+	2	1	3
TOTAL	20	10	30



Graph 1: Age Distribution



Graph 2: Gender distribution



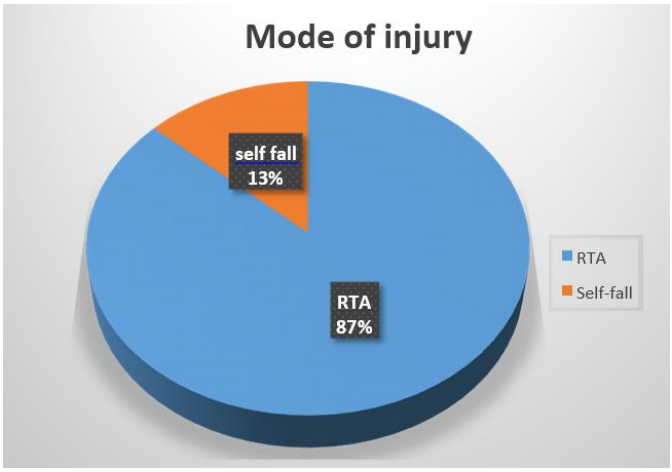
Graph 3: Age distribution

Data from the above table and graph indicate that tibial plateau fractures are common in age group 25-50 who happen to be most active group and travel more often than females compared to other age groups.

Table 2: RTA V/S Fall

Mode of injury	RTA	Fall from height
20-30	8	0
30-40	11	0
40-50	6	2
50 +	1	2
Total	26	4

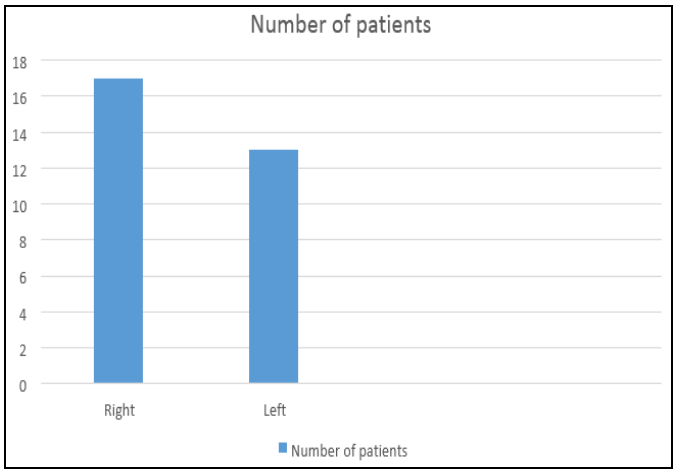
Data from the above table and graphs indicates that most common mode of injury is road traffic accident accounting to approximately 87% (26 out of 30 cases).



Graph 4: RTA V/S fall

Table 3: Laterality of Fracture

SIDE	Number of patients	Percentage
Right	17	56.66%
Left	13	43.33%
Total	30	100%

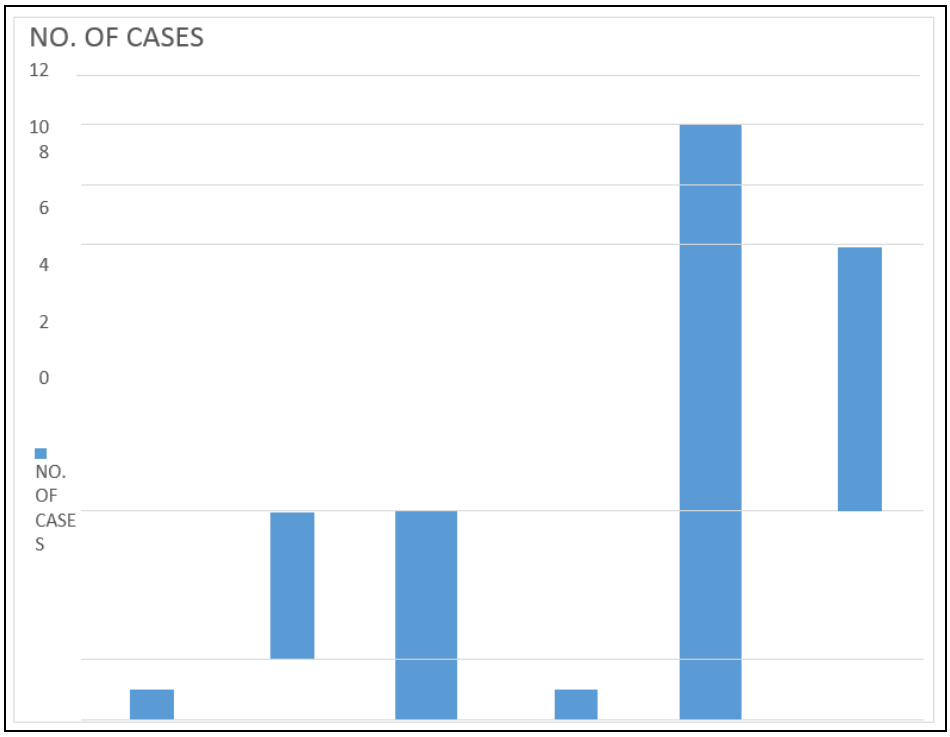


Graph 5: laterality of fracture

Most fractures are seen on right side compared to left side

Table 4: Incidence according to schatzkar's Classification

Schatzkar Type	No. Of Cases	Percentage
Type-1	1	3.33 %
Type – 2	5	16.66%
Type – 3	4	13.33%
Type- 4	1	3.33%
Type- 5	10	33.33%
Type- 6	09	30%
Total	30	100

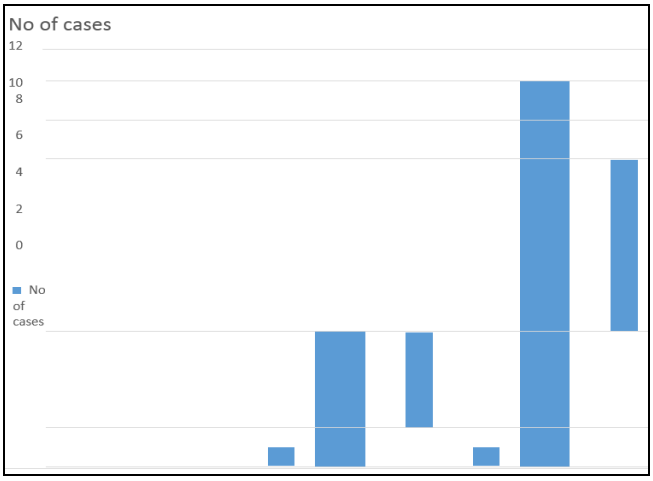


Graph 6: Incidence According To Schatzker Classification

In intraarticular fractures under schatzker classification, most of type 5 and 6 fractures (19 out of 30 cases) and just 1 being lateral condylar pure split fractures.

Table 5: Incidence according to A.O classification

A.O type	No of cases	Percentage
41A1	0	0
41A2	0	0
41A3	0	0
41B1	01	3.33%
41B2	04	13.33%
41B3	05	16.66%
41C1	01	3.33%
41C2	10	33.33%
41C3	09	30%
Total	30	100%



Graph-7: Incidence according to A.O classification

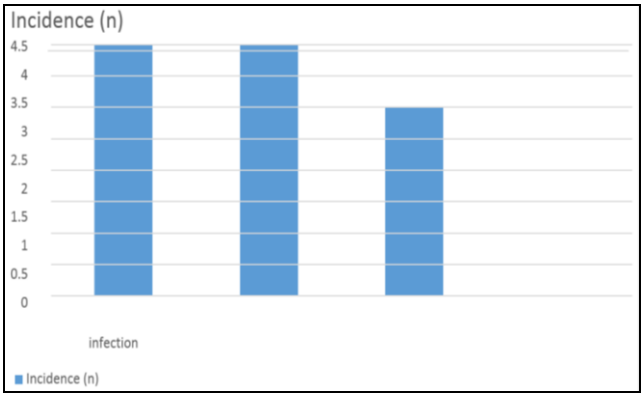
When AO classification is considered, again most people fall into 41C2, C3 groups which corresponds to shatzker type 5 and 6 classification

Complications

The most common complication encountered is soft tissue infection, at the immediate postop period or late occurance of wound dehiscence. All were treated aggressively with antibiotic cover and regular dressings. None proceeded to deep infection or secondary osteomyelitis and one implant has been removed due to infection after fracture union. There were no implant related complications, like screw back out or plate failure. Knee stiffness occurred in four patients with flexion limited to less than 90 degree at 6 months follow up. They were treated with physiotherapy and by 1 year follow up, it improved in two cases to more than 120degree. Two patient had persistent knee stiffness even after physiotherapy. Malunion in varus was seen in 3 cases and was not intervened as it did not affect the functional outcome. No cases of non-union was seen and is consistent with other studies as the proximal tibia is mostly metaphyseal bone.

Table 6: Complications

Complications	Incidence (n)	Percentage
Superficial wound infection	04	13.33%
Knee stiffness	04	13.33%
Malunion	03	10%
Non-union	00	00



Graph 8: Complications

Other associated injuries include

- Contralateral femur fracture: 01
- Contralateral tibia shaft fracture: 01
- Head injury: 06
- Non-life threatening rib fractures: 04

Scoring of knee function

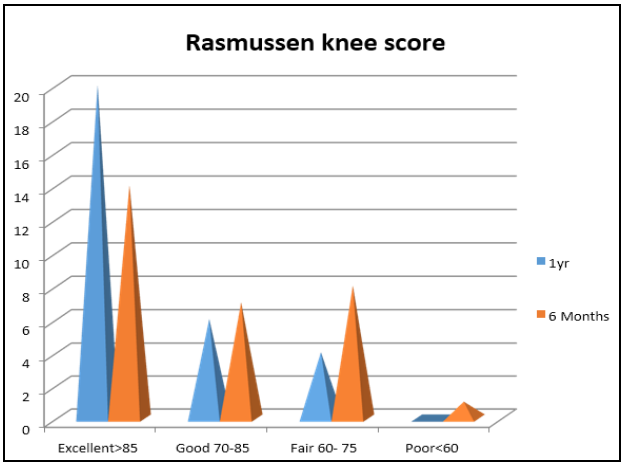
- The Rasmussen knee scoring system is used to score knee function @It assesses four areas namely

- Pain (3 points)
- Limitation of activity (3 points)
- Range of motion (3 points)
- Loss of quadriceps function(3 points)

- A total of 102 points are given and then rounded to 100 percent
- A score of more than 85 is considered excellent and 70 to 84 is considered good or satisfactory while 60 to 69 is considered fair and less than 60 is considered poor.
- According to this system the score in 6 months follow up and 1year follow up is shown in table and graph.
- Overall good to excellent outcomes have been seen in 85 % patients with no poor result at 1 year follow up.

Table 7: Rasmussen knee score at 6 months and 1 year follow up

Score	6 months follow up	1 year follow up
Excellent (greater than 85)	14	20
Good(70-85)	07	06
Fair (60-75)	08	04
Poor(less than 60)	01	00



Graph 9: Rasmussen knee score at 6 months and 1 year follow-up

Discussion

Tibialplateau fractures are one of the commonest fractures encountered in trauma setup and the fact that tibia is a major weight bearing bone with knee joint makes achievement of maximal functional outcome the primary goal of treatment. With increasing incidence of tibia fractures as a result of road traffic accident, surgical treatment is often always considered for optimum early functional outcome. In our analysis of results, we found that the age sex and occupation distribution directly correlates to the mode of injury being road traffic accident the population at risk are males in the age group 25-50 who often involve in high travelling activities. Females are mostly involved in indoor activities or travel less than males and males who don't travel are not exposed to high energy trauma and sustain fall from height. Most fractures are intraarticular and all fractures from fall from height are intraarticular. Intraarticular fractures when classified under schatzker classification, most are bicondylar fractures with just 1 being split fracture. When aAO classification is considered, again most people fall into types 41c2 and 41c3 groups with other groups being 41b1, 41b2, 41b3. All other groups have not been reported or treated with other types of fixation. Infection is the most commonly encountered complication (4 cases) infection either occurred as a postop complication or late complication as wound dehiscence it was treated aggressively with antibiotic cover and culture specific therapy. no case proceeded to deep infection of secondary osteomyelitis and one implant has been removed as a result of infection after fracture union. Knee stiffness occurred in 4 cases and in all cases it was due to prolonged immobilization. After POP removal physiotherapy was advised and in two cases, it returned to > 120 degrees of flexion but in one case who also had undisplaced ipsilateral femoral condyle fracture, it remained at 90 degrees and was considered fair outcome at the end of 1 year. Malunionin valgus position occurred in 3 cases as a result of malreduction intra –operatively, but there was no intervention done as it didn't affect the patient function much and the angulation was under acceptable limits. There was no cases of nonunion and all fractures had either united or were uniting by the end of 1 year followup. There were also no cases of implant related failures like screw back out or implant breakage. Two implants have been removed at the end of this study. Given the number of complications, we noted that joint stiffness has the most influence on functional outcome of knee than infection and malunion. In our series one patient had associated anterior cruciate ligament injury, he was treated with above knee POP cast till fracture unite and to wear knee support while walking and to undergo ACL repair in subsequent days. Inspite of all these complications we are able to achieve 66.66% excellent result and 20% good result (over all 86.66%, acceptable results) with our standard surgical care. in addition we have 13.33% fair and results interm of functional outcome. These results are comparable with other documented standard studies.

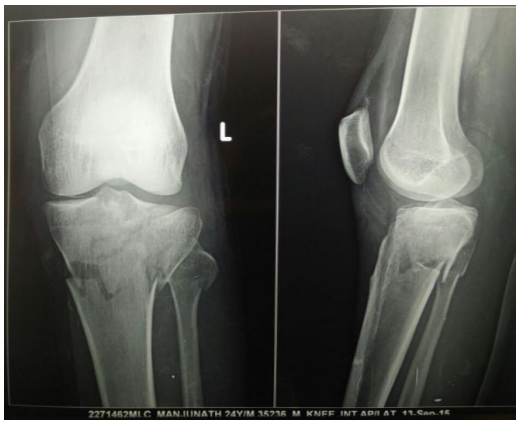
Joseph schatzker 2012	85% satisfactory
Seppo E 1993	85% satisfactory
Biggi et al 2010 [34]	92 % excellent to good
Rakesh Sharma et al (MIPO) [35]	93% excellent to good
Our study (2017)	87% excellent to good

Conclusion

At the end of our study, we conclude the following

- Tibia is a major weight bearing bone and its fractures are increasing as a result of high energy road traffic accident.
- These fractures require surgery for early optimal functional outcome by early mobilization and preventing stiffness of the knee due to cast.
- Pre-operative soft tissue status is important in deciding the time of surgery, inappropriate timing will lead to infection
- Locking screws give enough anchorage even in osteoporotic bone and have to be placed by drilling only through a sleeve.
- Bone graft is not a requisite as this area is largely metaphyseal and union rates are high.
- The preservation of soft tissue at the fracture site plays an important role in callous formation hence achieving quicker union rates.
- Care should be taken while placing the plate. It is precontoured for the anterolateral surface of the tibia and placing anywhere else will lead to implant prominence and wound dehiscence.
- Soft tissue complications rarely affect the knee function but should be treated aggressively with culture specific antibiotics and dressings, any negligence may lead to deep infection or secondary osteomyelitis.
- The balance between immobilization of the limb and stiffness of the joint should be well considered. A united fracture with a stiff knee hampers function of the knee and is a major deciding factor in patient satisfaction post-surgery.

Clinical and radiological photographs
Case No. 1



Preop- Xray

Immediate Postop 1 Month Follow Up

2 Month Follow Up

6 Month Follw Up

1 Year Follw Up

United Fracture

Clinical Photographs

Standing

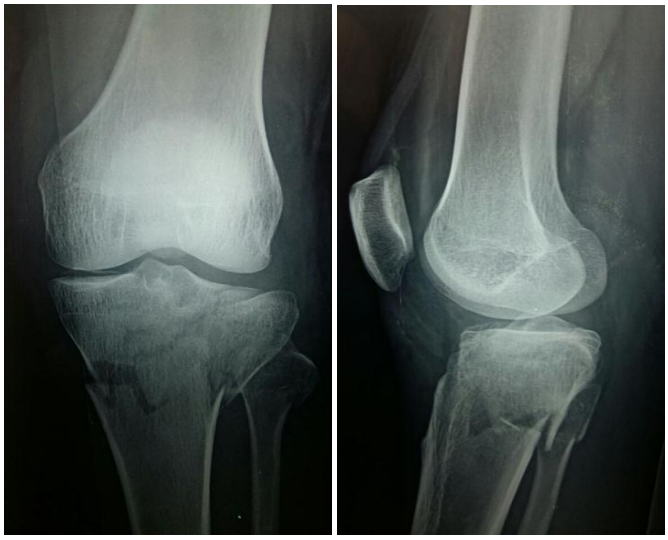
Squating

Sitting Cross LEG

Extension

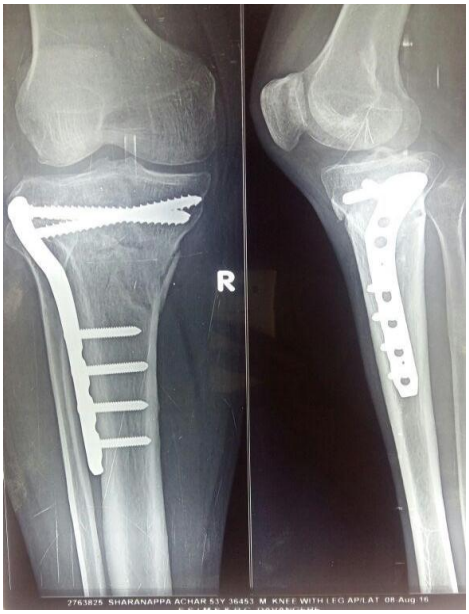
Straight Leg Rise

Case No: 2



Preop - Xray

Knee Flexion

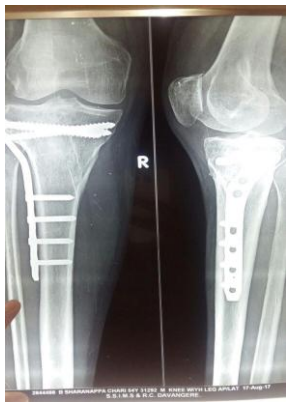


Immediate post op

3 month post-op

1 month post op

2month post-op



6 month follow up

1 year follow up

Sitting cross leg

Squatting

Flexion

Extension

Summary

- We studied 30 patients with tibial plateau fractures with intra articular extension
- The study was done from September 2015 to September 2017
- Age ranged from 20 -60 years with majority being in 25-50 years range with a largerly male preponderance
- This reflects that patients with active lifestyle who travel are at risk
- Majority of fractures belongs to AO type 41c2, 41c3 (corresponding to schatzker type 5 and 6 classification)
- Patients were followed upto 12 months
- Mean time for fracture union was 20 weeks
- Complication were encountered in 9 patients, with skin infection in 4, knee stiffness in 4 with malunion in 3 patients.
- No implant related complications occurred
- No case of non-union occurred
- We conclude that LCP by biological fixation for tibial plateau fractures gives good results with knowledge of LCP and its working principles.

Reference

1. Schulak DJ, Gunn DR Fracture of the tibialplateaus. clinOrthop 1975; 109:166-167.
2. Kovak KJ, Hulfut DL. Tibial plateau fracture: Evaluation and treatment. J Am AcadOrthopSurg 1995; 3(2):86-94.
3. Biyani A, Reddy NS, Chaudhary *et al.* The results of surgical management of displaced tibial plateau fractures in the elderly. Injury 1995; 26(5):291-297.
4. Wagner M. General Principals for the clinical use of the LCP. Injury 2003; 34(2):B31-42.
5. TerryCanale S, James H. Beaty. Campbell' Operative Orthopaedics 12th ed. Philadelphia; Elsevier Mosby: 2013, 3.
6. De Coster TA. Nepola JV, Choury GY. Treatment of proximal tibia fracture. A ten year follow up study.clinorthopRelat Res. 1994, 196-204.
7. Sommer C, Gautier E, Muller M. For clinical application of the LCP. Injury 2003; 34(2):B43-54.
8. Stoffel K, Dietaru. Biomechanical testing of the LCP how can stability in locked internal fixator be controlled. Injury 2003; 34(2):B11-9.
9. Ch Thomas, Athanasiov A, Wullschleger M, Scheutz M. Current concepts in tibial plateau fractures ActachirorthoptraumatolCech. 2009; 76(5):363-73.
10. EgolKA, Su E, Tejwani NC, Sims SH, Kummer FJ, Koval KJ. Treatment of complex tibia plateau fractures using less invasive stabilization system plate. J trauma 2004; 57:340-46.
11. Mazone CG, Guanche CA, Vrahas MS. Arthroscopic management of tibia plateau fractures. Am J Orthop 1999; 28:508-15.