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A clinical study of proximal tibial condyle fracture treated by locking compression plate

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Abstract

AIMS and Objectives of the Study: The aim of the present study was to study the functional outcome and duration of union in proximal tibial fractures treated with Locking Compression Plate.

Material and Methods: This study was a prospective study done on 26 consenting cases of proximal tibial fractures admitted to Shri B.M. Patil Medical College, Hospital and Research Centre, Vijayapur during October 2013 To August 2015 chosen based on the inclusion and exclusion criteria. Patients were informed about the study in all respects and written informed consent will be obtained. The follow up period was 6 weeks, 3months and 6months.

Inclusive Criteria: All Schatzkers classification type I to VI proximal tibial fractures in adults Aged 18 years and above of either sex.

Patients willing for treatment and giving informed and written consent.

Exclusive Criteria

Age group of less than 18 years.

Patients not fit for surgery, managed conservatively for other medical reasons. All open fractures of proximal tibia.

Patients with pathological proximal tibial fractures other than osteoporosis. Extraarticular fractures of proximal tibia.

Sample Size: With an average incidence rate of proximal tibial fractures 1.75% [0.5 – 3%] at 95% confidence interval and ± 5 margin of error the sample size is $n=26$.

$$n = z^2 \times p \times q / d^2$$

Hence 26 cases of proximal tibial fractures were included in the study.

Keywords: Giant cell tumour, Tendon sheath

Introduction

The knee joint is one of the major weight bearing joints in the lower extremity. Proximal tibial fractures are one of the commonest intra-articular fractures. Generally these injuries fall into two broad categories, high energy fractures and low energy fractures. Fractures of the proximal tibia are the results of high-energy injuries, and because of the lack of soft tissue coverage in this region, it is vulnerable and open fractures are commonly encountered. In such cases, the treatment of damaged soft tissues is of primary concern ^[1].

The majority of tibial plateau fractures are secondary to high speed velocity accidents and fall from height ^[2] Fractures result from direct axial compression, usually with a valgus or varus moment and indirect shear forces ^[3].

The aim of surgical treatment of proximal tibia fracture is to restore congruent articular surfaces of the tibial condyles maintaining the mechanical axis and restoring ligamentous stability eventually can achieve functional painless and good range of motion in the knee joint ^[4]. The various clinical studies established that bone beneath a rigid convention plate is thin and atrophic which are prone for secondary displacement due to insufficient buttressing and secondary fractures after removal of plate, fracture site take longer period to osteosynthesis due to interruption of vascular supply to bone due to soft tissue and periosteal stripping. So there was the birth of a new concept of biological fixation using the plates, otherwise called minimally invasive percutaneous plate osteosynthesis (MIPPO).

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But this was difficult as conventional plates needed to be accurately contoured to achieve good fixation, osteoporosis also posed the same problem of poor fixation.

with conventional plates this lead to the development of the internal fixators.5 Point contact-fix I later Point contact fix-II. As more and more concepts about biological fixation become clearer the innovation of plates progressed and lead to the development of less invasive stabilizing system. Research to combine these two methods has lead to the development of the anatomically contoured locking compression plate [6].

This new system is technically mature as it offers numerous fixation possibilities and has proven to worth in complex fracture situations and in osteoporotic bones. Follow-up, Duration after surgery: 6 weeks/ 3 months/ 6 months. Radiological evaluation – Check X-RAY knee joint with proximal 2/3rd leg Antero-posterior & lateral view

Functional Results

Classification system for the results of treatment-Rasmussen's scoring

Table 1: Rasmussen's scoring

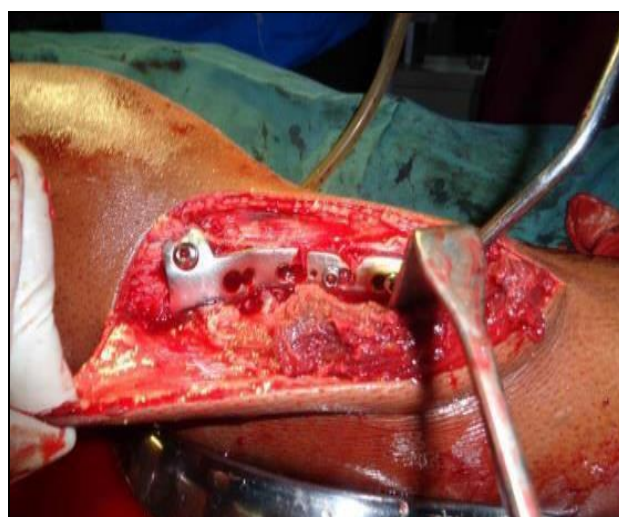
Rasmussen's Scoring	points	Outcome evaluation			
		Satisfactory		Unsatisfactory	
		Excellent	Good	Fair	Poor
Subjective complaints					
Pain No pain	6				
Occasional ache, bad weather Stabbing pain in certain positions Noon pain,	5				
intense, constant pain around knee after activity	4	5	4	2	1
Night pain at rest	2				
	0				
Walking capacity Normal walking capacity Walking outdoors at least 1 hr					
Short walks outdoors 15 min Walking indoors only Wheel chair or	6				
bedridden	4	6	4	2	1
	2				
	1				
	0				
Clinical signs					
Extension Normal	6				
Lack of extension(0-100) Lack of extension(>100)	4	6	4	2	1
	2				
Total range of motion At least 1400 At least 1200					
At least 900	6				
At least 600	5				
At least 300	4	5	5	2	1
00	2				
	1				
	0				
Stability					
Normal stability in extension and 200 flexion Abnormal instability 200 of	6				
flexion Instability in extension(<100) Instability in extension(>100)	5	5	4	2	2
	4				
	2				
Sum (minimum)		27	20	10	6



Orif Technique



Painting and Draping Incision



Open Reduction and Plate



Application of locking application of screws after fixed angle drilling



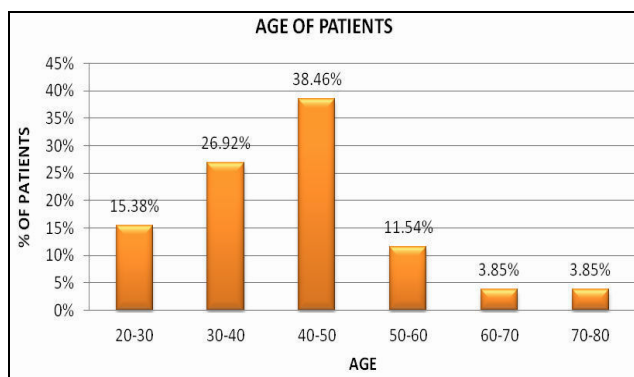
Closure

Results and Observations

1. Demographic Data Age Distribution

Table 2: Age

Age	No. of Patients	%	Mean	St. dev.
20-30	4	15.38	41.03	12.37
30-40	7	26.92		
40-50	10	38.46		
50-60	3	11.54		
60-70	1	3.85		
70-80	1	3.85		



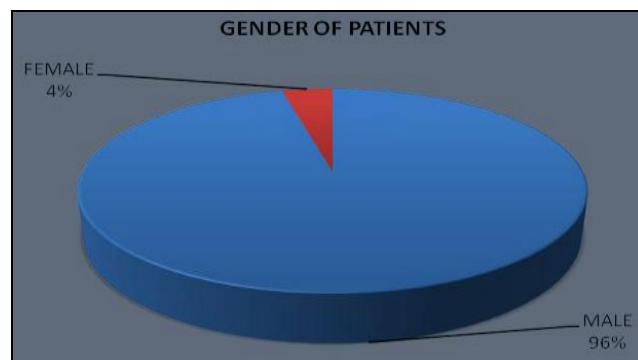
Graph 1: Age Distribution

In the present study on evaluation of the age distribution we found that of the 26 cases in the study most patients belonged to the category 40-50 years (10 patients, 38.46%). The mean age was 41.03 years.

Gender Distribution

Table 8: Gender Distribution

Gender	No. of patients	%
Male	25	96.15
Female	1	3.85



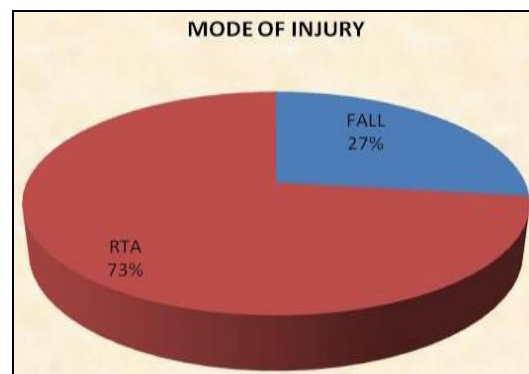
Graph 2: Gender Distribution

In the present study on evaluation of the gender distribution we found that of the 26 cases in the study most patients were males (25 patients, 96.15%)

Clinical presentation mode of injury

Table 3: Mode of Injury

Mode of injury	No. of patients	%
Fall	7	26.92
Rta	19	73.08



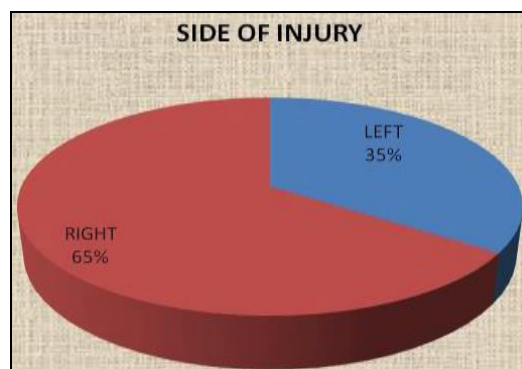
Graph 3: Mode of injury

In the present study on evaluation of the mode of injury we found that of the 26 cases in the study most patients were injured by vehicular accident (19 patients, 73%).

Side of injury

Table 4: Side of Injury

Side	No. of Patients	%
Left	9	34.62
Right	17	65.38



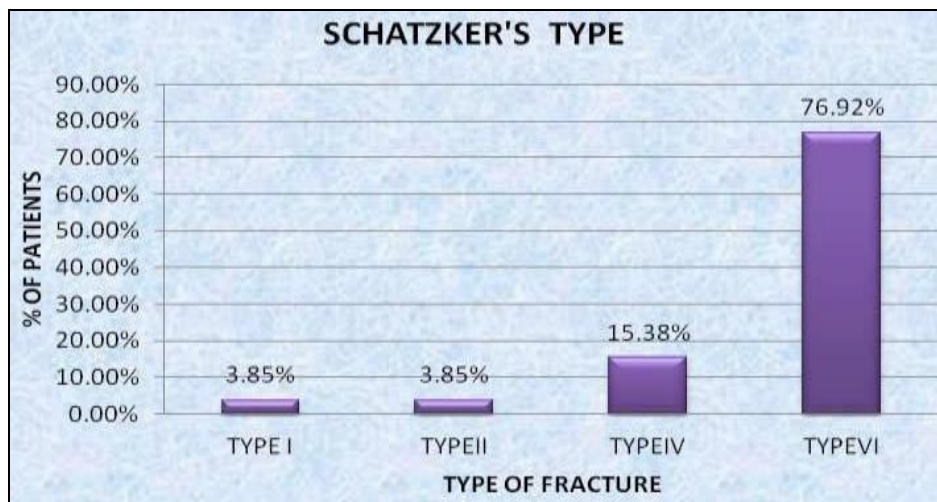
Graph 4: Side of Injury

In the present study on evaluation of the side of injury we found that of the 26 cases in the study most patients had a right sided injury (17 patients, 65.38%)

Type of schatzkers fracture

Table 5: Schatzker's Type

Schatzkers Type	No. of patients	%
Type I	1	3.85
Type II	1	3.85
Type IV	4	15.38
Typevi	20	76.92

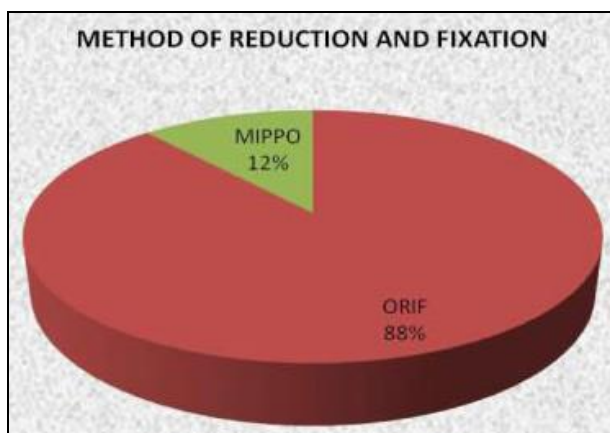


Graph 5: Schatzker's Type

Method of reduction and fixation

Table 6: Method of Reduction and Fixation

Method of reduction and fixation	No. of patients	%
ORIF	23	88.46
MIPPO	3	11.54



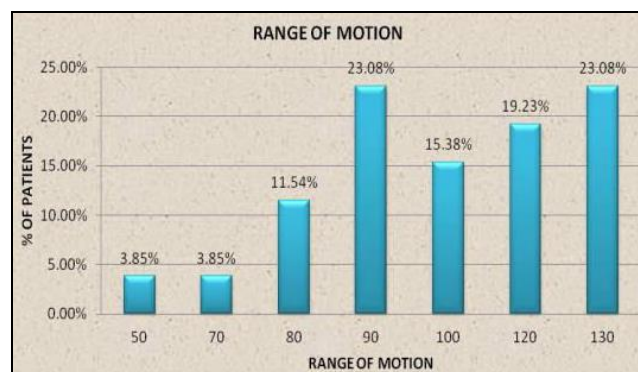
Graph 7: Method of reduction and fixation

In the present study on evaluation of the method of reduction and fixation we found that of the 26 cases in the study most patients were fixed by orif (23 patients, 88.46%).

Range of motion post Op

Table 7: Range of Motion

Range of motion	No. of patients	%	Mean	STDEV
50	1	3.85	103.07	22.22
70	1	3.85		
80	3	11.54		
90	6	23.08		
100	4	15.38		
120	5	19.23		
130	6	23.08		



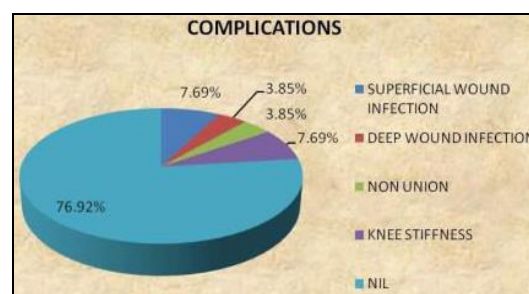
Graph 8: Range of Motion

In the present study on evaluation of the range of motion following surgery, most patients had a good range of motion of 1300 (6 patients, 23.08%).

Complications

Table 8: Complications

Complications	No. of patients	%
Superficial Wound Infection	2	7.69
Deep Wound Infection	1	3.85
Non Union	1	3.85
Knee Stiffness	2	7.69
Nil	20	76.92



Graph 9: Complications

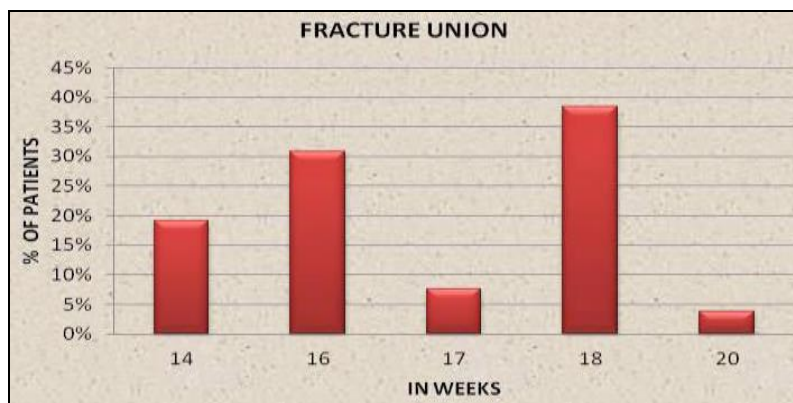
In the present study on evaluation of complications following surgery, 2 patients had superficial wound infection (7.69%) were treated by dressings and antibiotics. 1 patient had deep infection (3.85%) treated by debridement and antibiotics according to culture and sensitivity reports. 1 patient had non

union (3.85%) and was treated by replating with cancellous bone grafting from iliac crest. 2 patients had Knee stiffness (7.69%) treated by physiotherapy and range of motion exercises, 20 patients had no complications (76.92%).

Duration taken for the fracture union

Table 9: Fracture Union

Fracture union in weeks	No. of patients	%	Mean	Stdev
14	5	19.23	16.61	1.65
16	8	30.77		
17	2	7.69		
18	10	38.46		
20	1	3.85		



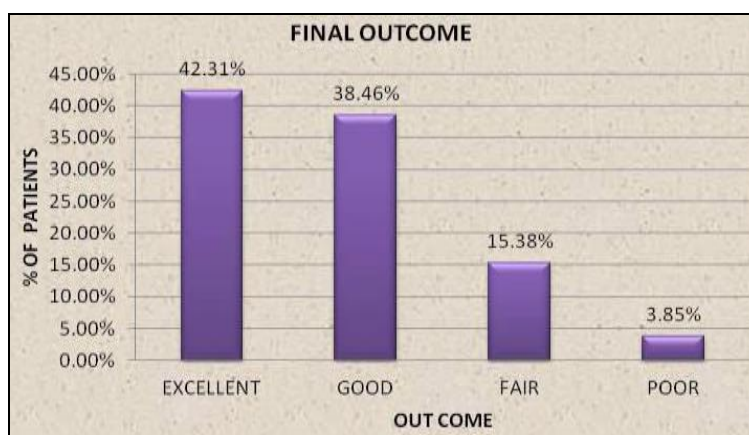
Graph 10: Fracture Union

In the present study on evaluation of the duration taken for the fracture union most patients had fracture union in 18 weeks (10 patients, 38.46%), the mean duration for fracture healing was 16.61 weeks.

Table 10: Final Outcome

Results	Patients	%
Excellent	11	42.31
Good	10	38.46
Fair	4	15.38
Poor	1	3.85

The Final Outcome



Graph 11: Final Outcome

In the present study on evaluation of the final outcome of the fracture most patients had excellent results (11 patients, 42.31%), The mean duration for fracture healing was 16.61 weeks.

Proximal tibial fractures treated with LCP can be manipulated under anaesthesia in the event of plate bending due to re-injury. Because LCP provide angular stability and technique of MIPPO retains the fracture biology, manipulation under anaesthesia may be justified in these cases.

The main purpose of the study is to evaluate outcome of the surgery. Hence all the patients included in the study are of the operative group. We have not included any conservatively managed group. Our study shows the effectiveness of the operative treatment as the articular surface was restored anatomically and fixed with suitable implant for early mobilization.

Case No 1



Preoperative anteroposterior and lateral view immediate postoperative



6 Weeks Follow UP

3 Months Follow UP



6 Months Follow Up



Complete Extension



Complete Flexion

Full Weight Bearing

Case No 2

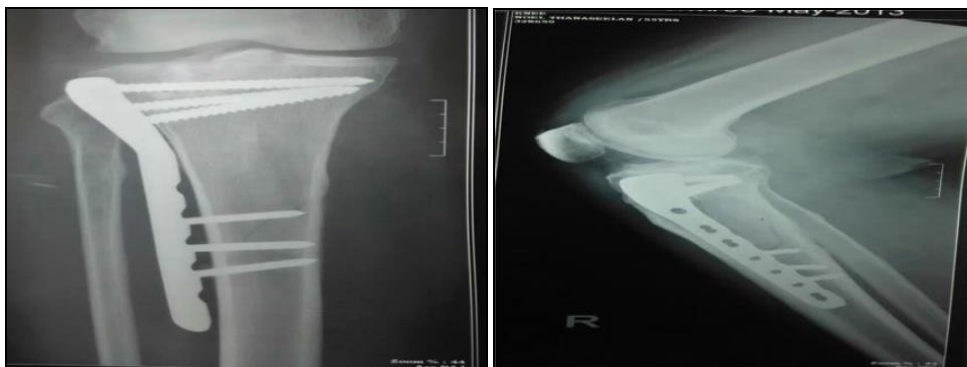


Preoperative anteroposterior immediate postoperative and lateral view AP and lateral view



6 Weeks Follow up

3 Months Follow up



3 Months Follow Up Ap View

3 Months Follow Up Lateral View



6 Months follow up

6 Months follow up shows union



Complete Extension

Complete Flexion

Full Weight Bearing

Case No 3



Preoperative-AP view and immediate postoperative AP lateral view lateral view



Flexion

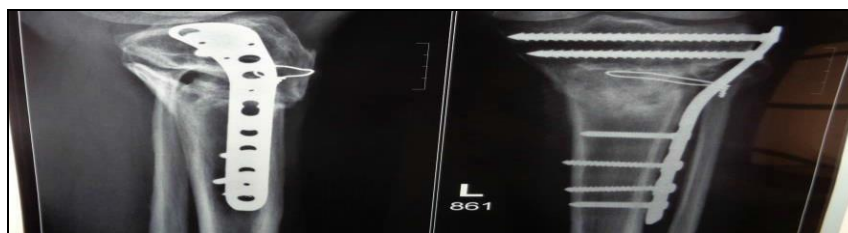
Extension lag of 10 degrees



Full Weight Bearing

Complications

Superficial Wound Infection



Nonunion

Fig 24: Clinical Photos and Radiographs

Demographic Data Age Distribution

In the present study on evaluation of the age distribution we found that of the 26 cases in the study most patients belonged to the category 40-50 years (10 patients, 38.46%).

In a study by Tang Xin *et al* (2012) [79] study on evaluation of the age distribution, the mean age was 45 years with a std. dev. of 11 years which is similar to our study.

Table 11: Result - Mean Age with different Authors

Study By	Year	Number of cases	Result- Mean age
Tang Xin <i>et al</i>	2012	42	20-65 years (mean 40 years)
G Thiruvengita Prasad	2013	40	22 to 61 years (mean 40 years)
Our study	2015	26	20 to 80 years (mean 40 years)

Gender Distribution

In the present study on evaluation of the gender distribution we found that of the 26 cases in the study most patients were males (25 patients, 96.15%).

In a study by Tang Xin *et al* (2012) [10] study on evaluation of

the gender distribution we found that of the 42 cases in the study most patients were males (30 patients) and females accounted for 12 cases of the total number. This gender distribution is similar to our study

Table 12: Result - Mean Sex distribution with different Authors

Study BY	Year	Number of cases	Result- Sex Distribution
Tang Xin <i>et al</i>	2012	42	30 males and 12 females
G Thiruvengita Prasad <i>et al</i>	2013	40	33 males and 7 females
Our study	2015	26	25 males and 1 female

Clinical Data Mode of Injury

In the present study on evaluation of the mode of injury we found that of the 26 cases in the study most patients were

injured by vehicular accident (19 patients, 73%).

In a study by Tang Xin *et al* (2012) [10]. Study on evaluation of the mode of injury most patients were injured due to RTA.

Table 13: Result - Mean Most Common of Injury with different Authors

Study By	Year	Number of cases	Result- Most common mode of injury
Tang Xin <i>et al</i>	2012	42	RTA.
G Thiruvengita Prasad <i>et al</i>	2013	40	RTA.
Our study	2015	26	RTA.

Table 14: Type of the Fracture

Study By	Year	Number of cases	Result- Most common mode of injury
Tang Xin <i>et al</i>	2012	42	11 Schatzker type IV, 19 Schatzker type V fractures, 12 Schatzker type VI fractures.
G Thiruvengita Prasad <i>et al</i>	2013	40	20 Schatzker type V fractures, 20 Schatzker type VI fractures.
Our study	2015	26	1 Schatzker type I 1 Schatzker type II 4 Schatzker type IV 20 Schatzker type VI

Range of motion

In the present study on evaluation of the range of motion

following surgery, most patients had a good range of motion of 1300 (6 patients, 23.08%).

Table 15: In a study by Prasad *et al*. 80 most patients had 120° and above knee flexion which is a finding similar to our study

Study By	Year	Number Of Cases	Result- Most common range of motion
G Thiruvengita Prasad <i>et al</i>	2013	40	120°
Our study	2015	26	1300

Time for fracture union

In the present study on evaluation of the duration taken for the fracture union most patients (10 patients) had fracture union in 18 weeks (38.46%). The mean duration for fracture healing

was 16.61 weeks.

In a study by Prasad *et al*. [11] all patients had had union in 8-22 weeks (average 14 weeks).

Table 16: Result - mean Time of Fracture unit with different Authors

Study By	Year	Number of cases	Result- time for fracture union
G Thiruvengita Prasad <i>et al</i>	2013	40	8 -22 weeks (average 14 weeks).
Tang Xin <i>et al</i>	2012	42	average 18 weeks
Our study	2015	26	14 -20 weeks (average 18 weeks).

Final Outcome of the Fracture

In the present study on evaluation of the final outcome of the fracture most patients had excellent results 11 patients (42.31%)

In a study by Tang Xin *et al* (2012) ^[10] study on evaluation of

the final outcome of the fracture most patients with surgical approach had excellent results In a study by Prasad *et al.* ^[11] study on evaluation of the final outcome of the fracture most patients with surgical approach had excellent results.

Table 17: Result - mean Final Outcome of the fracture in most cases with different Authors

Study By	Year	Number of cases	Result- final outcome of the fracture in most cases
G Thiruvengita Prasad <i>et al</i>	2013	40	Excellent (30 patients)
Tang Xin <i>et al</i>	2012	42	Excellent
Our study	2015	26	Excellent (10 patients)

Discussion

In our study the following were the details of the observations made

Type I fractures 1 in number, male patient, due to fall is operated using anterolateral approach with ORIF. 1300 ROM without any deformity and no complications, excellent result.

Type II fractures 1 in number, male patient, due to fall is operated using anterolateral approach with ORIF. 1300 ROM without any deformity and no complications, excellent result.

In our study no Type III fractures were seen Type IV fractures 4 in number, 3 male patients with right sided injury and 1 due to fall, all cases were operated with ORIF with an average 900 ROM knee stiffness in one case.

In our study no Type V fractures were seen Type VI fractures 20 in number, 19 male patients with 11 right sided injury 16 due to RTA and 4 due to fall one female with left sided injury due to fall, 17 cases were operated using anterolateral approach with ORIF with an average 1000 ROM with knee stiffness in one case. 3 cases antero-medial approach with ORIF and MIPPO in 3 cases with an average 1100 ROM.

Clinical Studies by Various Author's with Locked Plate Fixation Tibial plateau fractures can benefit from locked plating in fractures with instability, metaphyseal comminution, and osteoporosis. Gosling *et al.* ^[12] in a multicentre study, reported 23% postoperative malalignment and 14% loss of alignment when high-energy bicondylar proximal tibial fractures were treated with laterally placed LISS plate only.

Phisitkul *et al.* ^[13] reported immediate postoperative and delayed loss of alignment in 22% and 8% of cases, respectively, when lateral LISS plate was used in proximal tibial fractures.

Marsh *et al.* ^[14] presented a series of 21 complex tibial plateau fractures treated with monolateral external fixation and limited internal fixation and reported a 14% rate of malalignment Weigel and Marsh. ¹⁵ presented a 5-year follow-up after treatment of 24 high-energy tibial plateau fractures with limited internal fixation and a monolateral external fixator.

In a study by Shiva Naik *et al.* ^[14] they showed that locking compression plate is an important armamentarium in treatment of fractures around knee especially when fracture is severely comminuted and in situations of osteoporosis. Jain *et al.* ^[17] showed that applied with proper understanding of biomechanics, LCP is one of the best available options for management of challenging peri- and intra-articular fractures especially of proximal tibia Patil *et al.* ⁸⁶ and co workers in a

study Comparing the fixation of proximal tibial fractures by nonlocking buttress versus locking compression plate by had almost same results in both groups and concluded that Considering its high cost, LP should only be used, where it is more advantageous than conventional plate.

In a study by Peter A. Cole. ¹⁵ Internal fixation using the LISS was performed at an average of 7.1 days (range: 0-29 days) after the injury. Twenty-two fractures were operated (within the first 24 hours. The implants used for the fractures in this series included 6 5-hole, 43 and 28 13-hole fixators. The mean number of locking screws used in the proximal articular segment was 4.9 (range: 3-7 screws), and the mean number of screws used in the distal segment was 4.8 (range: 2-6 screws). In 53 patients, adjunctive implants were used for periarticular fixation, which included 6 plates (small fragment plates), 1 K-wire, and articular lag screws in 49 fractures.

Allograft bone grafting was performed in 9 cases of tibial plateau fractures, where voids from depressed plateau fracture fragments had to be filled and buttressed.

Conclusion

Displaced tibial plateau fractures are best managed operatively. Optimal knee function is achieved by accurate anatomical reduction and secure fixation followed by early mobilisation to attain functional arc of motion.

For minimally displaced fractures with minimal bone defects percutaneous fixation suffices where as for more comminuted fractures open reduction and internal fixation is mandatory.

Post operative rehabilitation protocol in terms of non-weight bearing and achieving satisfactory range of motion needs to be strictly adhered to, in order to obtain optimal functional results.

In our study we found that proximal tibial locking plate provides complete union and early mobilisation to attain better functional outcome.

Summary

The study was a prospective study conducted on 26 consenting patients who presented with proximal tibial fractures admitted to Shri B.M. Patil Medical College, Hospital and Research Centre, Vijayapur during the period October 2013 to August 2015. The main purpose of the study was to evaluate outcome of the surgery of the study group; hence all the patients that included in the study are of the operative group. We have not included any conservatively managed group. The age distribution we found that of the 26 cases in the study most patients belonged to category 40-50

years (10 patients, 38.46%) The gender distribution we found that of the 26 cases in the study most patients were males (25 patients, 96.15%) The mode of injury we found that of the 26 cases in the study most patients were injured by vehicular accident (19 patients, 73.08%) The side of injury we found that of the 26 cases in the study most patients had a right sided injury (17 patients, 65.38%) The type of schatzker's fracture we found that of the 26 cases in the study most patients had a type vi (20 patients, 76.92%) The type of approach we found that of the 26 cases in the study most patients had anterolateral (20 patients, 76.92%) The method of reduction and fixation we found that of the 26 cases in the study most patients had ORIF (23 patients, 88.46%)

The range of motion following surgery, most patients had a good range of motion of 1300 (6 patients, 23.08%) Complications following surgery, most patients had no complications. 2 patients had superficial wound infection (7.69%), 1 patient had deep wound infection (3.85%), 1 patient had non union (3.85%) and 2 patients had knee stiffness (7.69%),

The duration taken for the fracture union most patients had fracture union in 18 weeks 10 patients (38.46%). The mean duration for fracture healing was 16.61 weeks The final outcome of the fracture most patients had excellent results 11 patients (42.31%). The mean duration for fracture healing was 16.61 weeks.

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