Section: Orthopaedics

Original Research Article

EVALUATIONAL AND FUNCTIONAL OUTCOME OF TIBIAL PLATEAU FRACTURES USING LOCKING PLATES – AN OBSERVATIONAL STUDY

Sivakumar Veerabathiran[1], Shameer Ismail[2], Alif Nidal V[3]

[1]Consultant Orthopaedic Surgeon, Veera Hospital, Devakottai, Sivagangai District, Tamilnadu
[2]Associate Professor, Department of Orthopaedics, Dr Moopen's Medical College, Kerala, India
[3]Assistant Professor, Department of Orthopaedics, Dr Moopen's Medical College, Kerala, India

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Corresponding Author:
Dr. Shameer Ismail,
Associate Professor, Department of Orthopaedics, Dr Moopen's Medical College, Kerala, India.
Email: fritz4u@gmail.com

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ABSTRACT

Background: Tibial plateau fractures are challenging intra-articular injuries that may result in long-term functional impairment if not optimally treated. While conservative management is sometimes advocated, surgical fixation using locking plates aims to restore articular congruity, provide stable fixation, and allow early mobilization. This study assessed the evaluational and functional outcomes of tibial plateau fractures managed with locking compression plates.

Materials and Methods: This observational study included 30 adult patients aged 18–65 years with closed tibial plateau fractures classified according to Schatzker's system. Open fractures and medically unfit patients were excluded. All patients underwent open reduction and internal fixation (ORIF) or minimally invasive percutaneous plate osteosynthesis (MIPPO) with locking compression plates. Postoperative rehabilitation included early knee mobilization. Patients were followed for 12–60 weeks, with outcomes assessed by fracture union, range of motion, complications, and functional grading.

Results: ORIF was performed in 67% and MIPPO in 33% of cases. Mean union time was 14.6 weeks, with union duration significantly associated with fracture type ($p<0.05$). At final follow-up, outcomes were excellent in 63%, good in 33%, and poor in 3%. Functional range of motion >120° was achieved in 63%. Complications occurred in 16.7%, including valgus malalignment, instability, and knee stiffness.

Conclusion: Locking compression plate fixation of tibial plateau fractures ensures stable osteosynthesis, early mobilization, and favorable functional outcomes, with minimal complications when performed using proper surgical technique.

Keywords: Tibial plateau fracture, locking compression plate, functional outcome, internal fixation

INTRODUCTION

Tibial plateau fractures have been studied and reported extensively and exhaustively but still controversy exists over its management, whether surgical or conservative. Excellent results have been published in both groups. On one hand, we have got a group of surgeons who says that most of the tibial plateau fractures [85%] can be managed by conservative treatment and on the other hand, other group says conservative treatment means therapeutic nihilism and except for undisplaced fracture every tibial plateau fracture should be operated upon to achieve anatomical reduction and rigid internal fixation. Even undisplaced tibial plateau fractures should be operated, so that early mobilization of knee is possible.

Fractures of the upper tibia are difficult to treat, apart from the usual problems of confining patients to bed. Conservative treatment at any age may be complicated by knee stiffness, mal-union, non-union. Open reduction and internal fixation has been advocated using various implants including buttress plate, cancellous screw, external fixator etc to

achieve good fracture union and optimal knee function.

Fractures of tibial plateau are serious injuries that frequently results in functional impairment. The emphasis in treating displaced fractures is an anatomical restoration of articular surface, repair of soft tissue injuries and rigid internal fixation to obtain a stable painless knee joint with normal range of motion controlled by well-functioning muscles.

Objectives: Compare the evaluational and functional outcome of tibial plateau fractures using locking plates.

MATERIALS AND METHODS

The study was carried out in SRM Medical College and Hospital, Kattankulathur Chennai.2013-2015. The total number of cases studied were 30 with the youngest 18 years and oldest 65 years. In intention of this dissertation was to study the treatment of Tibial plateau fracture with locking compression plate to obtain a stable, pain-free, mobile joint to prevent the development of osteoarthritis.

Inclusion Criteria

- Adult (aged over 18 years) both male and female
- Closed tibial plateau fracture
- Radiological diagnosis of fractures with classification based on SCHATZKERS CLASSIFICATION

Exclusion Criteria

- Open tibial plateau fracture
- Patient medically unfit for surgery

On admission demographic data was recorded and thorough history and clinical examination was done. We assessed the soft tissue injuries even in the closed fractures followed by radiological assessment of the fracture with Schatzker's classification. These cases would be studied on the basis of mechanism of injury, assessment of fracture by Schatzker classification & treatment with locking compression plate & their surgical and functional outcome with or without residual complication.

Emergency management of all life-threatening conditions was carried out in casualty with respect to – Airway, Breathing, Circulation, Monitoring of Vital parameters, including if any soft tissue injury and thorough Neurovascular assessment was carried out. After stabilization of vitals, radiograph of knee Anteroposterior, Lateral and 2 Oblique views respectively was carried out. The fracture pattern was grouped under Schatzker classification. CT scan was taken for Type IV, V,VI Schatzker to rule out for any Posteromedial fragment. Type II,III,IV Schatzker fractures were assessed and immediately taken for surgery, whereas for Type V, VI fractures with severe swelling were delayed and immobilized by applying skin traction or calcaneal pin traction, if needed even External fixator was also applied and surgery delayed till Wrinkle sign appears and later planned for ORIF. Type of Implant was decided according to radiographic study and CT scan and also depending upon the skin and soft tissue condition over fracture site.

- Lateral condyle fracture: Lateral approach with Lateral Locking compression plate
- Lateral condyle fracture +posteromedial fragment: Lateral approach and Posteromedial approach with Lateral Locking compression plate and LCP plate to Buttress posteromedial fragment
- Bicondylar Fracture: Lateral approach and medial approach with respective Lateral & Medial LCP
- Bicondylar Fracture+ posteromedial fragment: Lateral and posteromedial approach and fixed with 3 plates, Lateral & Medial LCP with LCP Buttress plate for Posteromedial fragment.

All cases done under spinal anaesthesia. Position of patient-Supine position with a bolster under operating knee with 20-30 knee flexion. Surgery proceeded under tourniquet control & with C-arm guidance. Exposure & Technique of reduction planned according to fracture pattern. Submeniscal Arthrotomy done if needed. Initially Posteromedial fragment if present, has to be fixed first with LCP buttress plate and only then condyles are fixed with LCP.

In the immediate postoperative period, care was given to the general condition, fluid balance, IV antibiotic and analgesics as per the protocol. This helped us to mobilize the patient faster. From second post of day range of motion allowed was 0-20° from the 5th day the range of motion was gradually increased, after suture removal full range of movement was allowed. Patient who had stiffness in the early postoperative period continuous passive motion exercise (CPM) were done daily with under careful supervision. Partial weight bearing was delayed until 6 weeks and full weight bearing allowed after radiological union. The first follow up was usually at 6 weeks and later on patients were followed up at regular interval of monthly visit till complete fracture union.

The course of fracture healing was documented radiologically with minimum 4 weeks interval. The moment of complete healing was defined as radiologically complete bone regeneration at fracture site. Evaluation of any possible loss of reduction, Assessment and analysis of any complication done during follow up. Follow up of our patients ranged from 12 weeks to 60 weeks.

RESULTS

The study involved 30 confirmed cases of tibial plateau fractures of either sex from October 2013 to September 2015. all cases were treated with open reduction / MIPPO with locking compression plate. The analysis of the patient data, intra operative date and post operative outcome as follows.

The study involved patients above 18 years of age. The average age was 41 years the largest group of patient from 30 to 50 years.

Table 1: Age in years

Age Distribution	All	%	Type II-IV Schatzker Fractures Group	%	Type V-VI Schatzker Fractures Group	%
≤ 30 years	3	10.00	1	6.25	2	14.29
31-40 years	10	33.33	4	25.00	6	42.86
41-50 years	10	33.33	5	31.25	5	35.71
51-60 years	7	23.33	6	37.50	1	7.14
Total	30	100	16	100	14	100

Table 2: Sex Distribution

Gender Distribution	All	%	Type II-IV Schatzker Fractures Group	%	Type V-VI Schatzker Fractures Group	%
Male	22	73.33	13	81.25	9	64.29
Female	8	26.67	3	18.75	5	35.71
Total	30	100	16	100	14	100
P value Fishers Exact Test			0.3188			

Table 3: Mode of Reduction

Mode of Reduction	All	%	Type II-IV Schatzker Fractures Group	%	Type V-VI Schatzker Fractures Group	%
ORIF	20	66.67	13	81.25	7	50.00
MIPPO	10	33.33	3	18.75	7	50.00
Total	30	100	16	100	14	100
P value Fishers Exact Test			0.0806			

Table 4: Surgical Approach

Surgical Approach	All	%	Type II-IV Schatzker Fractures Group	%	Type V-VI Schatzker Fractures Group	%
Lateral	22	73.33	14	87.50	8	57.14
Medial	2	6.67	2	12.50	0	0.00
LAT + PM	6	20.00	0	0.00	6	42.86
Total	30	100	16	100	14	100
P value Fishers Exact Test			0.0001			

There is a statistical association between surgical approach and type of fracture (p value < 0.05).

Table 5: Union Duration

Union Duration	All	%	Type II-IV Schatzker Fractures Group	%	Type V-VI Schatzker Fractures Group	%
≤12 weeks	2	6.67	2	12.50	0	0.00
12 – 16 weeks	22	73.33	12	75.00	10	71.43
>16 weeks	6	20.00	2	12.50	4	28.57
Total	30	100	16	100	14	100

Union Duration	All	Type II-IV Schatzker Fractures Group	Type V-VI Schatzker Fractures Group
N	30	16	14
Mean	14.63	14.19	15.14
SD	1.69	1.72	1.56
P value Unpaired t Test		0.0163	

There is a statistical association between union duration and type of fracture (p value < 0.05).

Table 6: Range of Motion

Range of Motion	All	%	Type II-IV Schatzker Fractures Group	%	Type V-VI Schatzker Fractures Group	%
> 120	19	63.33	9	56.25	10	71.43
> 90	11	36.67	7	43.75	4	28.57
Total	30	100	16	100	14	100
P value Fishers Exact Test			0.0035			

There is a statistical association between range of motion and type of fracture (p value < 0.05).

Table 7: Results

Results	All	%	Type II-IV Schatzker Fractures Group	%	Type V-VI Schatzker Fractures Group	%
Excellent	19	63.33	9	56.25	10	71.43
Good	10	33.33	7	43.75	3	21.43
Poor	1	3.33	0	0.00	1	7.14
Total	30	100	16	100	14	100
P value Fishers Exact Test			0.0213			

There is a statistical association between results and type of fracture (p value < 0.05).

Table 8. Complications

Complications	All	%	Type II-IV Schatzker Fractures Group	%	Type V-VI Schatzker Fractures Group	%
None	25	83.33	15	93.75	10	71.43
Valgus Instability	2	6.67	1	6.25	1	7.14
Valgus Malalignment	2	6.67	0	0.00	2	14.29
Knee Stiffness	1	3.33	0	0.00	1	7.14
Total	30	100	16	100	14	100
P value Fishers Exact Test			0.0004			

There is a statistical association between Complications and type of fracture (p value < 0.05).

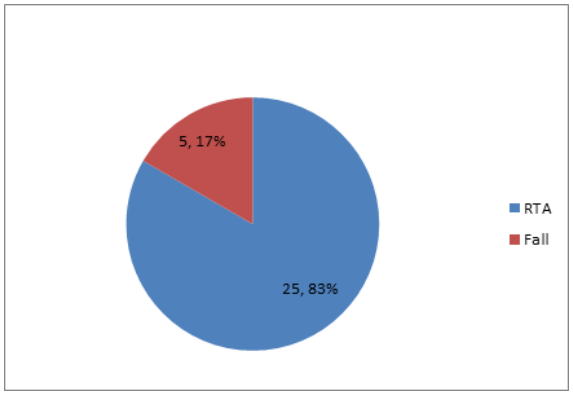

Figure 1. Pie chart showing Mode of Injury

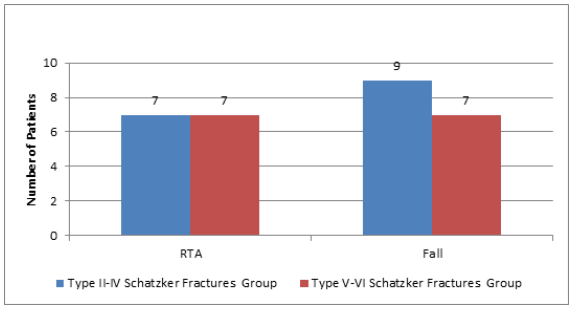

Figure 2: Bar Diagram Showing Side of Injury

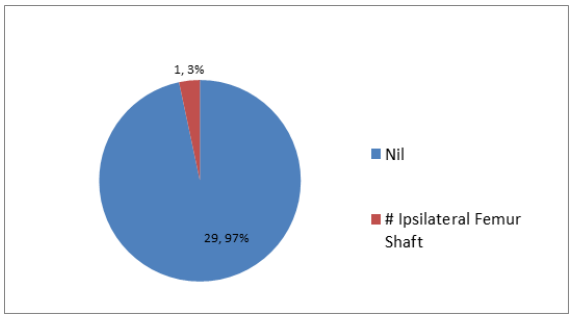

Figure 3: Pie chart Showing Associated Injury

DISCUSSION

Proximal tibial fractures, one of the commonest intraarticular fractures,[1] whose incidence is increasing due to RTA has continuously changing treatment options. Any fracture around the weight bearing joint like knee joint is of paramount importance as it would result in significant morbidity and quality of life. Hence the treatment of proximal tibial fractures has become a challenge for the orthopaedic surgeon.[2,3]

To overcome this difficulty and to restore the articular congruity and function of the knee joint with minimal injury to soft tissue, the innovators developed new technologies viz., MIPPO and locking compression plate system.[3,4] Keeping our aim of the study at high, we present the clinical outcome of surgical treatment of 30 tibial plateau fractures. The results were analyzed in terms of age of patients, sex distribution, Occupation of patients, laterality of fracture, mode of violence, analysis of the types, method of reduction and fixation, surgical approach and complications.

The majority of fracture occurred between the age of 18-65 years with maximum incidence involving the productive age group >40 years (56%) [Table 1]. Bone in 1981 also found that the majority of the patients are aged between 15-55 years with an average of 38.5 years. Seppo also showed age incidence 20-60 years with an average of 39.8 years which correlates with the present study.In our series majority of the patients were males 73% [Table 2], this can be attributed to our Indian setup where the female population largely work indoor and do not travel much. Occupationally proximal tibial fractures were seen in people with high level of activity, movement and travel. It is most commonly seen with people who travel more. In our study the commonest mode of injury being the road traffic accident 83% other being fall from height 16% [Figure 1]. In laterality of the fracture, right being 53% [Figure 2]. In the study only 1 patient had associated ipsilateral femur fracture whereas 29 patients (97%) had no associated injuries. [Figure 3]

In this series we studied 30 cases, out of them most of the patients fall into type III, type V and type VI Schatzker's classification. Different authors use different criteria for the surgical management of these fractures. SEPPO E. Honkonen conducted 130 tibial plateau fractures taking into consideration of

- Condylar widening of >5mm
- Lateral condyle step off >3mm
- All medial condylar fracture

In our series the indications for the surgery were the same standard indications as for the tibial plateau fractures. 3mm depression was considered as an indication for surgery in our series.[5,6]

In our series we used MIPO technique for reduction and fixation in 10 patients 33% [Table 3]. In which both duration of procedure and soft tissue injuries are less compared to ORIF technique, wound healing also better and faster compared to ORIF technique but it demands more surgical techniques. In our series we approached with lateral and postero medial incision in 6 patients this approach need less soft

tissue stripping from bone can contour plate to bone appropriately and easy to perform MIPPO technique,[7,8] and we preferred antero lateral approach 22 patients with lateral condylar displacement fracture and soft tissue injury on medial side of proximal tibia [Table 4].

In our series we had no cases of any purely implant related complications and average time for union of fracture was 14 weeks [Table 5].

In our series one patient developed knee stiffness due to femur shaft fracture treated with IM nailing and physiotherapy and regain 70° of flexion, and 2 patients developed 10° of valgus instability [Table 6]. The period of immobilization was again individualized depending on the stability of fixation.[8-10] The benefits of early knee mobilization include reduced incidence of knee stiffness and improved cartilage healing (regeneration) and promotion of good callus formation and remodeling.[11-13]

Inspite of all these complications we are able to achieve 63% excellent result and 33% good result [(over all 90%), acceptable results] with our standard surgical care. In addition, we had 3% poor results in term of functional outcome.[14,15] These results are comparable with other documented standard studies [Table 7,8].[16]

CONCLUSION

Locking compression plating of tibial plateau fractures provide adequate stability and articular congruity to provide excellent functional outcome with early restoration of knee function and minimal complications.[17-20]

REFERENCES

1. Mills WJ, Work SE. Open reduction and internal fixation of high energy tibial plateau fractures. Orthop Clin Nolrth am 2002;33:177-98 IX
2. Brooke L Ballard, Jennifer M Antonacci, Michele M Templewong, Alexander Y, Hui BS, Barbara L, et al. Effect of tibial plateau fracture on lubrication function and composition of Synovial fluid. 2012 May 16; 94A(10):899.
3. Shu-Qing Wang, You-Shui Gao, Jia-Qi Wang, Chang-Ing Zhang, Jiong Mei, Zhi-Tao Rao. Surgical approach for high-energy posterior tibial plateau fractures. IJO 2011;45(2):125-31.
4. Fltzpatrick DC, Doornik J, Locking plate in osteoporetic bone J Ortho Feb 2009. (Reference 41)
5. Thomas A Russell, Ross K Leighton. Comparison of autogenous bone graft and endothermic calcium phosphate cement for defect augmentation in tibial plateau fracture: A multi center prospective, randomized study. JBJS Am 2008;90(10):2057-61.
6. Snow, martyia; Thompson, Graham; Turner, Philip GJ ortho trauma 22(2):121-125 Feb 2008.
7. Messmer P, Ragazzoni P, Gross T. New stabilization techniques for fixation of proximal tibial fractures (LISS/LCP). Ther Umsch 2007;60:762-67.
8. George Haidukewych, Stephen A, David Huebner, Daniel Horwitz and bruce Levy. J orthop 2005;16:300-328.
9. Gonzalez HY, Mortan, Sainchez JF, Erasun RC. Early results with the new internal fixator system LCP and LISS: Prospective study. Acta Orthop Belg 2007;73(1):64.
10. Fulkarson E, Egol KA, Kubiak EN, et al. Fixation of diaphyseal fractures with a segmental defect a biomechanical comparison of locked and conventional plating techniques. J. Trauma 2006;60(4):83035.
11. Susan, Standing Knee in Gray's anatomy. Newell RIM, Davies MS, edts. 29th edn, Spain, Elsevier Churchill Livingstone;2005 p.1471-86.
12. Bjorkenheim JM, Pajarinen J, Savolainen V. Internal fixation of proximal humeral fractures with a locking compression plate. Acta Orthop Scand 2004;75(6):741-5.
13. Egol KA, Su E, Tejwani NC, Sims SH, Kummer FJ, Koval KJ. Treatment of complex tibial plateau fractures using the less invasive stabilization system plate. J trauma 2004;57:340-46.
14. Cole PA, zlowodzkim, kregor PJ. Treatment of proximal tibial fracture using LISS. J orthop trauma 2004:18;528-535. (Reference 36)
15. Ring D, Kloen P, Kadizielski J, Halfet D, Jupiter JB. Locking compression plates for the osteoporotic nonunions of the diaphyseal humerus. Clin Orthop Relat Res 2004 Aug;425:50-4.
16. Wagner M. General principles for the clinical use of the LCP. Injury 2003 Nov;34, Suppl 2:B31-42.
17. Sommer C, Gautier E, Muller M. For clinical application of the LCP. Injury 2003 Nov;34, Suppl 2:B43-54.
18. Stoffel K, Dietaru. Biomechanical testing of the LCP how can stability in locked internal fixator be controlled. Injury 2003 Nov;34, Suppl 2:B11-9.
19. Netter FH. Anatomy. In: Teterboro new Jersey Icon learning system. 3rd edn. 2003 p.488-94.
20. Whittle AP, Wood II GW. Fracture of lower extremity. Chapter 51. In:Campbell operative orthopedics. Camale ST ed. 10th edn, Vol.3. New Yock, Mosby;2003 p.2782-2796.