ISSN: 0975-1556

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2021; 13(3); 329-335

Original Research Article

A Prospective Evaluation of the Utilisation of a Locking Compression Plate in the Treatment of Tibial Plateau Fractures in Adults

Rajendra Prasad[1], Kumari Nutan[2]

[1]Assistant Professor, Department of Orthopaedics, Nalanda Medical College and Hospital, Patna, Bihar, India

[2]Assistant Professor, Department of Obstetrics and Gynecology, Nalanda Medical College and Hospital, Patna, Bihar, India

Received: 06-05-2021 / Revised: 20-06-2021 / Accepted: 16-07-2021
Corresponding author: Dr. Kumari Nutan
Conflict of interest: Nil

Abstract

Aim: To study of management of tibial plateau fractures by locking compression plate in adults. **Methods:** A prospective study was conducted in the Department of Orthopaedics, NMCH, Patna, Bihar, India, for the period of 1 year. 50 patients with tibial plateau fractures above 18 years of age were included in the study. Age group adults (>18 years) radiologically diagnosed tibial plateau fractures and open fractures Gustillo Anderson type I and II. All tibial plateau fractures were graded preoperatively using Schatzker classification. The functional outcome of the patients was assessed using knee society score (KSS). **Results:** Majority of the patients was males and in the age group of 30-50 years with right sided predominance. Schatzker type V and VI were the most common fracture patterns observed. Good results were obtained in 44% and excellent results in 38% of the patients. Fair results in 14% and Poor results were obtained in only 4% of the patients. Mean union time was about 4.6 months with 86% patients showing radiological union within 6 months. 4 patients showed delayed union with 3 showing non-union. Mean range of flexion was found to be 116 degrees, with 82% of the patients showing functional range of flexion (110 degrees or more). 4 patients showed an extension lag of 5 degrees while 1 other patient had an extension lag of 10 degrees. 4 % (2 patients) had knee stiffness. **Conclusion:** Locked compression plates in tibial plateau fractures has revolutionized the way these fractures are managed. It has the following advantages- Anatomic reduction of the articular surface is of utmost importance.

Keywords: tibial plateau, fractures, locking compression plate

Introduction

Fractures of proximal tibia have always been difficult to treat because of the subcutaneous location of its anteromedial surface. Severe bone and soft tissue injuries are not infrequent and there is high incidence of open fractures compared with other long bones.[1] The incidence of malunion, non-union and infections are relatively high in many reported series, causing significant long-term disability. Recently significant attention has been given to the condition of soft tissue envelope. Soft tissue friendly approaches and minimally invasive techniques have

improved the outcome. The fractures of proximal tibia are common intraarticular fractures. These injuries can be divided into two broad categories, high energy fractures and low energy fractures. Majority of these fractures are due to high speed velocity accidents or fall from height[2] where fractures results from direct axial compression, usually with a valgus (more common) or Varus moment and indirect shear forces.[3] Elderly patients with osteoporotic bone are likely to sustain depressed type fracture.[4] The goal of surgical treatment of proximal tibia fracture is to restore congruent articular surfaces of the tibial condyles so that eventually patient can achieve a functional and painless range of motion in the knee joint.[5] The various clinical studies established that bone beneath a rigid conventional plate are thin and atrophic making them prone for secondary displacement due to insufficient buttressing and secondary fractures after removal of plate, fracture site take longer period to unite due to interruption of vascular supply. This gave rise to a new concept of biological fixation using the plates, otherwise called minimally invasive plate osteosynthesis (MIPO). But this was difficult as conventional plates were to be accurately contoured to achieve good fixation, at the same time osteoporosis also posed the same problem of poor fixation with conventional plates.[6]

Materials and Methods

A prospective study was conducted in the Department of Orthopaedics, NMCH, Patna, Bihar, India, for the period of 1 year, after taking the approval of the protocol review committee and institutional ethics committee.

50 patients with tibial plateau fractures above 18 years of age were included in the study.

Inclusion criteria

- Age group adults (>18 years)
- radiologically diagnosed tibial plateau fractures
- Open fractures Gustillo Anderson type I and II

Exclusion criteria

- Age group (<18 years),
- compartment syndrome requiring fasciotomy,
- open fractures Gustillo Anderson type III,
- tibial plateau fractures needing neurovascular repair and refusal to provide informed consent

Pre-operative x-rays of knee with leg (antero-posterior and lateral view) and computed tomography (CT) was taken for assessing the fracture pattern. General work-up of the patient was done (complete blood count, liver function test, kidney function test, blood sugar level, prothrombin time) along with any specific investigations if advised by physician and anaesthetist.

All tibial plateau fractures were graded preoperatively using Schatzker classification.[7] The functional outcome of the patients were assessed using knee society score (KSS).[8]

Operative technique: Patient was placed in supine position with a bolster under the same side hip and knee. The procedure was carried out under spinal anaesthesia with or without epidural anaesthesia or general anaesthesia. Tourniquet was applied. The operating limb was thoroughly scrubbed with betadine scrub (7.5%) and painting done with betadine solution (5%) and kept for 3 minutes. Appropriate draping done for thigh and leg. Operative site cleaned with spirit.

Incision taken either in a lazy S fashion on the anterolateral aspect or a straight incision posteromedially. Compression bony clamp was used in cases to bring the fracture fragments together to achieve the reduction. After confirming the reduction under image intensifying television (IITV) guidance,

fixation of the fracture was done with locking compression plate - either an anterolateral plate or posteromedial buttress plate depending on the fracture pattern. In case of Schatzker type II or III fracture, the depressed fragment was elevated with Steinmann pin/K-wire with or without bone grafting followed by plate fixation under image intensifying television (IITV) control Tourniquet deflated. Any obvious bleeder either cauterized or ligated to achieve haemostasis drain kept. The wound is closed in layers sterile dressing done. Additional support in case of gross comminution or unstable fixation is given by long knee brace or above knee slab for 3 weeks. Postoperatively standard anteroposterior and lateral x-rays of leg with knee taken. Drain removed after 24 hours.

IV antibiotics (injection ceftriaxone 1 gram 12 hourly and injection amikacin 500 milligrams 12 hourly) given for 5 days and then shifted to oral antibiotics (tablet ciprofloxacin 500 mg 12 hourly) for further 7 days. Check dressing done on 3rd and 7th day. Stitches removed on the 11th day. In case of stable fixation, knee range of motion started on the 4th post-operative day. Regular follow-up done at 1, 3, 6, 9 and 12 months and patient evaluated for fracture union, wound condition and range of motion at knee joint.

Statistical analysis was done on Microsoft excel sheet using statistical package for the social sciences (SPSS) 21.0 and It was done using Microsoft excel 2010 and Microsoft word 2010.

Results

Majority of the patients were males and in the age group of 30-50 years with right sided predominance. Schatzker type V and VI were the most common fracture patterns observed (Table 1).

Table 1: Demographic data of patients

Criteria	Number of patients (%)	
Age		
Below 30	10	20
30-40	15	30
40-50	17	34
50-60	6	12
60-70	1	2
70 or above	1	2
Sex		
Male	48	96
Female	2	4
Side of injury		
Right	31	62
Left	19	38
Mode of injury		
Road traffic accidents	40	80
Fall from height	8	16
Household injuries	2	4
Schatzker classification		
I	8	16
II	2	4
III	1	2
IV	4	8
V	14	28

VI	21	42
Type of plating		
Anterolateral	45	90
Posteromedial	3	6
Dual plating	2	4

Good results were obtained in 44% and excellent results in 38% of the patients. Fair results in 14% and Poor results were obtained in only 4% of the patients (Table 2).

Table 2: Knee society score grade

Grade	No. of cases	Percentage
Excellent	19	38
Good	22	44
Fair	7	14
Poor	2	4

Mean union time was about 4.6 months with 86% patients showing radiological union within 6 months. 4 patients showed delayed union with 3 showing non-union. Mean range of flexion was found to be 116 degrees, with 82% of the patients showing functional range of flexion (110 degrees or more). 4 patients showed an extension lag of 5 degrees while 1 other patient had an extension lag of 10 degrees (Table 3).

Table 3: Clinical outcome

CriteriaNumber of patients (%)		
Time for radiological union (months)		
<6	43	86
6-9	4	8
9-12	3	6
Flexion ROM (degrees)		
<90	3	6
90-105	6	12
≥110	41	82
Extension lag (degrees)		
<10	4	8
10-20	1	2
>20		

Overall complication rate was 22% out of which 8% (4 patients) had infection out of which 2 patient were controlled on antibiotics. 2 patient had to be given a wound wash while 3 patients have had to have their plate removed followed by external fixator application. 1 of these patients who was a chronic smoker and diabetic developed deep infection which was managed by removal of plate and repeat wound washes and debridements with proper blood sugar level control and antibiotics according to the culture and sensitivity report. The wound healed but the fracture went into non-union. Uncontrolled diabetes was found to be associated with high risk of infection in these patients. 4% (2 patient) had varus malunion but not too significant as to warranty corrective surgery. 4% (2 patients) showed articular depression radiologically but patient did not complain of any symptoms due to it. 4 % (2 patients) had knee stiffness. Nonunion was seen in 2% (1 patient) who was managed

with implant removal with external fixator with repeated debridements to manage the infection first followed by bone grafting and plate application secondarily. Delayed union in 2 % (1 patients) (Table 4).

Table 4: Complications

Complication no.	No. of cases	Percentage
Infection	4	8
Knee stiffness	2	4
Varus malunion	2	4
Delayed union	1	2
Non-union	1	2
Articular depression	2	2

Discussion

The advent of locked compression plates has been a game changer in the management of tibial plateau fractures. Intra-articular fractures need proper anatomic reduction with rigid fixation for a painless bony union to occur.[9,10]

Mean union time was about 4.6 months with 86% patients showing radiological union within 6 months. 4 patients showed delayed union with 3 showing non-union.[11,12] 1 patients had infections post- operatively which could explain the delayed union. Since tibial plateau fractures are complex fractures, it is associated with a number of complications. In this study, 8% (4 patients) had infection out of which 2 patient were controlled on antibiotics. 2 patient had to be given a wound wash while 3 patients have had to have their plate removed followed by external fixator application.

We try to reduce the rate of infection by observing meticulous pre-operative hygiene - hand wash and proper preparation of surgical site just before surgery. According to fracture pattern, we used dual plating in 1 patients by separate incisions.[13] The commonest organisms in these infections were *Staphylococcus aureus*, methicillin resistant *Staphylococcus aureus, Pseudomonas aeruginosa* and *Klebsiella pneumococcus*. Wherever possible a minimally invasive surgery can be done to reduce soft tissue injury without compromising on the reduction of the articular surface.[14] Another factor which influenced infection rates was the operative time required and the experience of the surgeon performing the procedure.[15]

2 patient developed varus deformity but not too severe to require a second operation for its correction. No limb length inequality or rotational deformities were encountered.[16]

No case of hardware irritation requiring implant removal was seen nor was any nerve injury detected in any of the cases. 4% patients developed knee stiffness out of which 2% patient obtained a functional range of motion of the knee after physiotherapy while the other patient required manipulation under general anaesthesia to regain full motion at knee.[17-19]

We waited for an adequate amount of time after the patient was admitted with tibial plateau fracture for his edema to subside and blisters if any to heal as tibial plateau fractures are generally associated with bad local skin conditions such as edema, bruises, blisters and contused skin. Generally edema and local skin conditions improves by 7- 10 days after elevation, anti-edema medicines (trypsin, chymotrypsin and serratiopeptidase) and local magnesium sulphate dressing.

All the patients in this study were encouraged to start knee range of motion exercises on post-operative day 2 itself. However full weight bearing was not started immediately but initiated after about 3 weeks even in stable rigid fixations. In these 3 weeks, the patient was made to stand up supported and walk with the help of walker.[20,21] Patients who did not adhere to these essential post-operative rehabilitation protocols had a decreased range of knee flexion and 2 patients also developed knee stiffness.

This is a short term study to assess the functional outcome of tibial plateau fracture plating done in a small number of patients within the same demographic area. A larger sample group would be required to extrapolate the results and better understand the risk factors associated with infection rates, time required for union in different age groups and sex, appropriate time to wait before operating on a tibial plateau fracture and time after which full weight bearing can be done.

Conclusion

Locked compression plates in tibial plateau fractures have revolutionized the way these fractures are managed. It has the following advantages- Anatomic reduction of the articular surface is of utmost importance. Computed tomography of the fracture is very important to achieve the above mentioned point, as most of the times, X-rays do not reveal the actual fracture pattern and position of fragments. So segment specific fixation is possible after thorough review of computed tomography films. In case of depressed fractures, autogenous cancellous tricortical bone graft from iliac crest is found to be beneficial to fill the void after elevating the depressed fragment which prevents secondary collapse. Early active and active assisted physiotherapy is essential for successful outcome. With advent of newer locking plates, good quality fixation can be achieved and mobilization is possible from a very early stage post-operatively.

References

1. Kenneth A. Egol and Kenneth J Koval, In: Fractures of proximal tibia: chapter 50, Rockwood and Green's "Fractures in Adults", Vol. 2, 6th edition, Lippincott Williams and Wilkins 2006.
2. Schulak DJ, Gunn DR. Fracture of the tibial plateaus. Clin Orthop 1975;109:166-177.
3. Koval KJ, Hulfut DL. Tibial plateau fracture : evaluation and treatment. J Am Acad Orthop Surg 1995;3:86-94.
4. Biyani A, Reddy NS, Chaudhary et al. The results of surgical management of displaced tibial plateau fracture in the elderly. Injury 1995;26:291-297.
5. Wagner M. General principles for the clinical use of the LCP. Injury 2003;34: B31-42.
6. Sommer C, Gautier E, Muller M. For clinical application of the LCP. Injury 2003; 34:B43-54
7. Zeltser DW, Leopold SS. Classifications in brief: Schatzker classification of tibial plateau fractures. Clin Orthop Relat Res. 2013;471(2):371-4
8. Insall JN, Dorr LD, Scott RD, Norman WS. Rationale, of The Knee Society Clinical Rating System, Clin Orthop Rel Res. 1989;248:13-4.
9. Jian Z, Ao R, Zhou J, Jiang X, Zhang D, Yu B. A new anatomic locking plate for the treatment of posterolateral tibial plateau fractures. BMC Musculoskelet Disord. 2018;19(319).
10. Jain RK, Shukla R, Baxi M, Agarwal U, Yadav S. Evaluation of functional outcome of tibial plateau fractures managed by different surgical modalities. Int J Orthop Res. 2016;2(1)
11. Van Nielen DL, Smith CS, Helfet DL, Kloen P. Early Revision Surgery for Tibial Plateau Non-union and Mal-union. HSS J. 2017;13(1):81-9.
12. Chan DB, Jeffcoat DM, Lorich DG, Helfet DL. Nonunions around the knee joint. Int Orthop. 2010;34(2):271-81.
13. Barei DP, Nork SE, Mills WJ, Henley MB, Benirschke SK. Complications

associated with internal fixation of high-energy bicondylar tibial plateau fractures utilizing a two-incision technique. J Orthop Trauma. 2004;18(10):649-57.
14. Raza H, Hashmi P, Abbas K, Hafeez K. Minimally invasive plate osteosynthesis for tibial plateau fractures. J Orthop Surg (Hong Kong). 2012;20(1):42-7.
15. Colman M, Wright A, Gruen G, Siska P, Pape HC, Tarkin I. Prolonged operative time increases infection rate in tibial plateau fractures. Injury. Elsevier. 2013;44(2):249-52.
16. Khatria K, Sharma V, Goyal D, Farooque K. Complications in the management of closed high- energy proximal tibial plateau fractures. Chinese J Traumatol. 2016;19(6):342-7.
17. Ali AM, El-Shafie M, Willett KM. Failure of fixation of tibial plateau fractures. J Orthop Trauma. 2002;16(5):323-9.
18. Hussain SN, Subbukannu B. Study on complications of tibial plateau fractures. Int J Orthop Sci. 2016;2(2):64-6.
19. Kugelman DN, Qatu AM, Strauss EJ, Konda SR, Egol KA. Knee Stiffness After Tibial Plateau Fractures: Predictors and Outcomes (OTA-41). J Orthop Trauma. 2018;32(11):421-7.
20. Reahl GB, Marinos D, O'Hara NN. Risk Factors for Knee Stiffness Surgery After Tibial Plateau Fracture Fixation. J Orthop Trauma. 2018;32(9):339-43.
21. Swarup A, Rastogi A, Singh S, Swarn K. Functional outcome of surgical management of tibial plateau fractures in adults. Int J Res Med Sci. 2016;4(3)