International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2019; 5(4): 204-208

www.orthopaper.com
Received: 24-08-2019
Accepted: 28-09-2019

Dr. Pulkit P Maniar
MS Ortho, Associate Professor, Department of Orthopaedics, Gmers Medical College, Gotri, Gujarat, India

Dr. Pratik Patel
D. Ortho, DNB Ortho, Department of Orthopaedics, Gmers Medical College, Gotri, Gujarat, India

Dr. Tejash patel
DNB Ortho, Department of Orthopaedics, Gmers Medical College, Gotri, Gujarat, India

Corresponding Author:
Dr. Pratik Patel
D. Ortho, DNB Ortho, Department of Orthopaedics, Gmers Medical College, Gotri, Gujarat, India

To study outcomes in patients with schatzker type V and VI tibial plateau fracture treated with single 4.5mm lateral locking compression plate

Dr. Pulkit P Maniar, Dr. Pratik Patel and Dr. Tejash patel

DOI: https://doi.org/10.22271/ortho.2019.v5.i4d.1675

Abstract
Background: Bicondylar tibial plateau fractures Schatzker type V and VI present a therapeutic challenge to the orthopaedic trauma surgeon both in terms of the osseous injury as well as the concomitant soft-tissue insult. Double Plating with single incision or dual incisions provides more insult to the compromised soft tissue. However, single locking plate combines the technical advantages of an angular stable plate with those of the modern biological plating technique.
Methods: The Study was held at the authors' institutions between January 2014 and December 2017, 20 patients with a mean age of 40.5 years (Range from 22-65 years) with Bicondylar tibial plateau fractures with or without metaphyseal extension. Patients were diagnosed clinically, checked with standard X-rays. Patients were treated by single lateral anatomically contoured 4.5mm locking compression plate. Functional assessment was done according to the Rasmussen Knee score and WOMAC score. Radiological evaluation was done according to the Modified Rasmussen Knee score. Patients were followed-up for an average of 6 months.
Results: Union was achieved in all patients with a mean knee range of motion of 2°-118° (range: 0°-10° for extension lag, range: 85°-135° for flexion). The mean Functional Rasmussen Knee score at 6 month follow up (24.55 ± 3.17 SD) ranged from (18.0-29.0) with significant P value (P value <0.001) and mean WOMAC score was (15.65±6.45) ranged from (7.0-30.0). The mean Modified Rasmussen Radiological Knee score at 6 month follow up (7.45 ± 1.57 SD) ranged from (3.0 - 9.0). Of the 20 patients, two patient had wound related problems, two patient had post-operative malalignment (varus), one patient suffered from hardware irritation and one patient had instabiity.
Conclusions: Surgical treatment of bicondylar tibial plateau fractures with the single lateral locking compression plate that was evaluated in our study can lead to a good functional and radiological outcome and considered an effective system for providing fracture stabilization provided that the correct surgical technique is used. Awareness of posteromedial fragment fixation through lateral locking plate with screws engaging the fragment and delay weight bearing is essential to prevent medial collapse.

Keywords: Bicondylar tibial plateau fracture, Schatzker type V and VI, 4.5mm locking compression

Introduction
The knee joint is one of the strongest and most important weight bearing joint in the human body. It allows the lower leg to move relative to the thigh while supporting the body's weight. Movements at the knee joint are essential to many everyday activities, including walking, running, sitting and standing. Hence, proper management of these fractures play a critical role in minimizing morbidity and disability resulting from post-traumatic arthritis.
Intra-articular fractures of the proximal end of tibia are serious complex injuries difficult to treat. Proximal tibial fractures account for 1.2% of all fractures in adults [1]. Such injuries result due to high energy trauma like road traffic accidents, sports injury or fall from height. Low energy tibial fractures have been associated with osteoporotic bone and poor bone quality. In most of the cases, the initial load is combined with angular forces, leading to comminution not only of the articular surfaces but of the metaphysis as well.
Surgical treatment for high energy displaced bicondylar fractures of the tibia plateau remains a challenge for most surgeons. According to the Schatzker classification, types V and VI are complex fractures often associated with soft tissue injury, a high risk of wound complications,

difficulty in reduction, and further sufficient fixation for stabilization. However, the ideal fixation method is not yet clear, and treatment options include screws, an external fixator, hybrid external fixation [2, 3], limited internal fixation combined with a tensioned wire [4], classic dual buttress plates, a unilateral periarticular locking plate, and hybrid dual plates (Combination of locking plate and buttress plate). In highly unstable bicondylar fractures, open reduction and internal fixation (ORIF) with dual plating has been biomechanically proven as an effective method for stabilization after reduction of both fracture fragments and articular surfaces. However, fixation with dual plating requires extensive soft tissue dissection and thus increases the risks of wound complications. There are many articles using a unilateral periarticular locking plate in the treatment of bicondylar tibial plateau fractures with a lower risk of soft tissue damage and surgical site infection. They reported that both stabilization methods are equally effective [5-7].

With multitude of surgical procedures available, there still remains ambiguity regarding the ideal method for fixation for Schatzker type V and VI tibial plateau fractures. So we decided to take up this study to evaluate the functional and radiological outcome of single plating via single incisions for bicondylar tibial plateau fractures.

Material and Method

The study was a descriptive study of 20 cases who were aged above 18 years and were diagnosed having a Schatzker type V or VI close tibial plateau fractures at the authors' institutions from Jan 2014 to Dec 2017, including patients of both sexes from urban, semi-urban and rural population of all socioeconomic strata meeting inclusion and exclusion criteria. A clearance from ethical committee of institute was obtained. Written informed consent was also obtained from the patients or their family for participation in the study.

Inclusion criteria

1. Patients presenting with tibial plateau fracture Schatzker types V and VI.
2. Patients above 18 years.
3. Patients with closed fracture.

Exclusion criteria

1. Patients presenting with tibial plateau fracture Schatzker type I,II,III and IV.
2. Patients with age less than 18 years.
3. patients with pathological fractures.
4. Patients with poly-trauma.
5. Patients with open fractures.
6. Patients with late presentation (>6 weeks).

On admission thorough history and clinical examination was done. We assessed the neurovascular status and radiological assessments of the fractured limbs were performed. Further investigations were done depending on the general condition of the patient and the routine pre-operative protocol as per our hospital guidelines, radiological assessment in AP and lateral planes were done and preoperative 3D CT scans were done to evaluate the fracture pattern. As coronal plane fractures are easily missed in AP radiographs, so lateral plane X-rays and 3D CT scans helped us to evaluate the exact fracture pattern.

Surgical procedure steps

After spinal anaesthesia or general anaesthesia, patient were given supine position and tourniquet were applied in upper thigh. A small bag underneath the buttock to correct the normal external rotation of the lower limb was placed. Painting and draping was done. Limb was exsanguinated by either elevation or by applying a soft rubber bandage. Incision either anterolateral or anterior midline approach consider on the basis of fracture pattern.

Anterolateral approach

For this approach, a curvilinear longitudinal incision was made starting from the lateral femoral epicondyle and passing over the Gerdy's tubercle and running parallel to the shin one cm lateral to it. Tissue to expose the lateral aspect of the knee joint capsule. Below the joint line, the incision was deepened through subcutaneous tissue and the fascia overlying the tibialis anterior muscle incised. If the articular surface was depressed then a cortical window will be made over tibia and surface was elevated using punch and the void remaining after elevation was filled either by iliac crest bone graft or by allografts or reduction done by joy stick method or leverage method. Tibial condyle reduction hold with bone reduction clamp and K wires after this 4.5mm LCP was fixed to the lateral surface of tibia by k wire and then locking screws were applied to fix the fracture. Fracture reduction and plate placement was checked under the image intensifier.

Anterior midline approach

A technique using an anterior midline incision with a medial parapatellar arthrotomy and a medial full-thickness skin flap for the open reduction and internal fixation for bicondylar tibia fracture. The approach is advocated as an alternative to a posteromedial approach when medial tibial plateau fractures reduction done. The anterior approach was simple and familiar for orthopaedic surgeons. It offers good visualization of both tibial condyles, simplifies reduction, and provides a functional scar if future procedures are necessary.

Patients were called for review at 2 weeks for stitch removal and evaluate for radiological and functional outcome and thereafter at 6 weeks, 3 month, 6 month interval thereafter till bony union and maximal functional recovery was achieved. At each follow up functional evaluation done with Rasmussen and WOMAC scoring system and Radiological evaluation done with Modified Rasmussen scoring system. Patients were assigned and grades were given in the form of excellent, good, fair and poor outcomes. The excellent and good were considered as acceptable functional outcome where as the fair and poor were considered as unacceptable outcomes.

Case 1

Pre op x-ray

Post op x-ray

Post op x-ray at 6 month

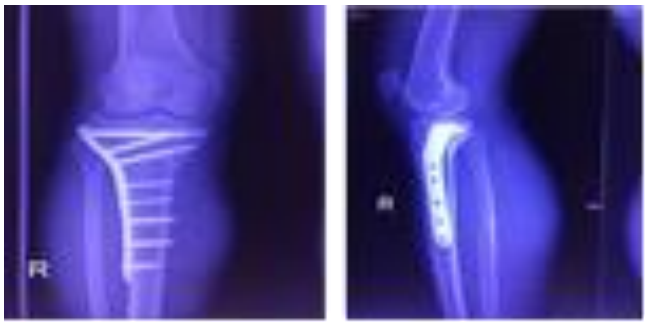

Fig 1

Functional outcome at 6 month

130 degree flexion

Full extension

Cross leg sitting

Squatting

Fig 2

Results and Observations

No patient was lost in the follow up 6 months. The observations of study were analysed using SPSS package. The numerical continuous data were expressed as mean and standard deviation of normally distributed data. The median was used for skewed distribution. Categorial or nominal data were expressed as frequency or percentage. Difference between proportion or assumption among categorial variables were done using the chi square or fisher exact test. P value less than 0.05 will be consider as statistically significant.

There were 20 patients with average age of 41.50 years. In our study the youngest patient was 22 years and the oldest patient was 63 years. Out of 20 cases. 17 were males and 3 were females. Road traffic accidents are clearly in excess of any other mode of injury in these fractures.

Out of 20 cases, Type VI fractures constituted 12 (60 %), being most common type of fracture, Type V- 8 (40%). The operations were done within 8 days following injury. 14 cases (70%) were operated within 3 days and 6 cases (30%) were operated within 3 to 8 days.

A fracture was designated as healed when there was obliteration of the fracture line and evidence of bridging callus (Anderson *et al.* 1975) [15]. We have not found any cases of delayed union or non-union in our series. The range of radiological union varied between 14 weeks and 20 weeks and the average times for union in the study was 16.65 weeks.
Out of 20 cases, 1 patient (5%) had superficial infection, 1 patient (5%) had deep infection, 2 patients (10%) had varus deformity, 1 patient (5%) had implant prominence, 1 patient (5%) had instability.
We observed that mean flexion of the knee joint at the end of 6 months was 118 degrees with maximum of 135 degrees and minimum of 85 degrees. Distribution of extension lag over a period of time following surgery showing a decreasing trend signifying improvement. 65% patients had no extensor lag by 24 weeks. Pain is graded on a scale of 6 into 5 categories and 5 cases (25%) had no pain at 6 month and mean was 4.85(SD±0.99).
Nine patients (45 %) had ocassional ache, bad weather pain at the knee joint. Five patients (25%) had stabbing pain in certain position. One patient (5%) had afternoon pain, intense, constant pain around knee after activity and five patients (25%) had no pain at the knee joint. At the end of 24 weeks, 4 patient can normally walk, with relation to age (20%). 13 patients can walk outdoors at least 1 hr (65%). 3 patients can short walk > 15min (15%). Ninty percent of the cases were stable at 6 month follow-up. At 24 weeks mean was 5.90(SD±0.31). At the end of 24 weeks, 18 patients had normal stability in extension and 20 degree flexion. 2 patients had abnormal stability in 20 degree of flexion.
Functional evaluation was done at regular follow-up with Rasmussen Scoring. Mean Rasmussen function score at the end of 24 weeks was 24.55(SD±.017). According to Rasmussen functional grading criteria, there were 3 (15%) excellent results, 14 (70%) good results and 3 (15%) fair results at the end of 24weeks.
Radiological evaluation was done at the end of 6 month with Modified Rasmussen criteria Scoring. Mean Rasmussen radiological score at the end of 6 month 7.45(SD±1.57). According to modified Rasmussen radiological score at 24 weeks, there were 2 (10%) excellent results, 14 (70%) good results, 3 (15%) fair results and 1(5%) poor result.
Functional evaluation was done at the end of 24 weeks with WOMAC Scoring. Mean WOMAC score at the end of 24 weeks of pain was 2.6 ± 1.43, stiffness 0.95 ± 0.89, physical function 12.15 ± 4.65 and total was 15.65(SD±6.45).

Discussion

In this descriptive study, fixation done by 4.5mm lateral locking compression plate. This study was conducted to examine the short term results, particularly early functional results and complications and healing rate of tibial plateau fractures treated using the above mentioned modalities.
Our patient population was younger, with average of 41.5 years. The youngest patient was 22 years & oldest patient was 63 years. We had only two patients who had 60 or more years of age. Biggi F *et al.* [10] in their study presented 43 years as mean age of presentation.
In our study of 20 cases there was a male preponderance. There were 17 (85%) of male patients & rests were female, so male to female ratio in our study was 5.67:1. Redemaker MV *et al.* [9] had 1.24:1 and Biggi F *et al.* [10] had 2.05:1.
In our study 15 (75%) of patients sustained fractures following road Traffic Accidents. Next common mode of injury was fall from height. This result confirms that RTA is the most common mechanism of injury. Rademakers MV *et al.* [9] reported 39% of their patient had fracture following RTA and Biggi F *et al.* [10] reported 74.13% of fractures following RTA. We found that right side (60%) was more frequently involved as compared to the left side. Rasmussen PS *et al.* [8] reported 50.38% and James P S *et al.* [16] reported 48.7% right sided involvement. We have classified fractures using Schatzker classification which is a simple classification evident on plain radiograph AP clinically to plan the treatment. In our group of 20 cases, Type VI fractures constituted 12 (60%), being most common type of fracture, Type V-8 (40%). In the literature, Mukharjee GS *et al.* [12] reported in their study of 21 cases type VI fracture being commonest constituting 85.71% and Kumar SN *et al.* [14] in there study of 46 patients has reported more cases of Schatzker VI with 60.86% cases.
Out of 20 patients, 14 underwent surgery within 72 hrs of injury. In 6 patients surgery was delayed due to medical illness. The mean age of the fracture treated by lateral lock plate was 3.25 days (3.25±1.63SD). Hohl M [16] reported, open reduction & internal fixation is technically easier if performed on the day of fracture or after the initial swelling has subsided but within 14 days after fracture. The mean age of radiological union in case of lateral lock plate was 16.65 weeks which are comparable to the studies made by the other authors. Biggi F *et al.* [10] reported 15.6 weeks of radiological union rate.
Although standard techniques of open reduction and internal fixation have proven to be routinely successful in restoring osseous anatomy**,** the tenuous soft-tissue coverage and predilection for high-energy trauma of the proximal end of the tibia has led to a substantial rate of severe complications. Post op malalignment (varus) – 10%(2), Superficial infection – 5%(1), Deep infection – 5%(1), Implant irritation – 5%(1), Instability – 5%(1), Non union – 0, Implant failure – 0. Biggi F *et al.*(10) in 58 patients case series had Superficial infections – 5.2% (3), Deep infection – 1.7% (1), Pulmonary embolism – 1.7% (1), Deep-venous thrombosis – 1.7% (1), Significant postoperative stiffness – 5.2% (3). The high rate of varus malaligment seen in our study is comparable to the results obtained in various other studies that involved the treatment of these fractures by lateral plating alone. The possible explanation given for this is the lack of adequate fixation of the posteromedial fragment with the proximal screws given through the plate and the subsequent collapse of this fragment on weight bearing. Other possible reasons can be small or comminuted posteromedial fragment which cannot be adequately fixed.
In our study acceptable results, i.e. 85% excellent and good functional results according to Rasmussen functional criteria (24.55 ± 3.17), 80 % excellent to good radiological results according to modified Rasmussen radiological criteria (7.45 ± 1.57) and functional results according to WOMAC score is 15.65 ± 6.45 (Pain 2.6 ± 1.43, Stiffness 0.95 ± 0.98, Physical function 12.15 ± 4.65).
Excellent range of movement of the knee joint is obtained after early operative fixation and early mobilization, which is evident from our study. The average range of flexion of knee joint in our study was 118 degrees (range 85 - 135°), 65% patient with no extension lag, 30% patient with 5 degree extension lag, 5% patient with 10 degree extension lag and 95% patient with stable knee at the end of 6 month which is comparable with other studies. At 6 month follow up 70% patient with no pain or occasional, bad weather pain, 25% patient with stabbing pain in certain position, 5% patient with

afternoon pain, intense, constant pain around knee after activity, 85% patient with normal walking capacity or walking outdoor atleast 1 hour. Ricci W M *et al.* [17] reported 61% excellent, 35% good, 4% fair results according to Rasmussen functional criteria and mean range of motion 120 degree (90-135 degree). Kumar SN *et al.* [14] reported 84.78% excellent, 13.04% good, 2.17% fair result according to Rasmussen functional criteria, 80.43% excellent, 19.56% good result according to modified Rasmussen radiological criteria and mean range of motion 116.76 degree (80-130 degree). Lee MH *et al.* [11] reported mean WOMAC score 36.5 (Pain 5.4 ± 2.31, Stiffness 4.8 ± 1.68, Physical activity 26.3 ± 5.74). Mardian S *et al.* [13] reported mean WOMAC score 54.3 (Pain 10.7 ± 11.2, Stiffness 19.8 ± 17.7, Physical activity 23.8 ± 21.9).

Conclusion

- Primary goal of treatment of Bicondylar tibial plateau fractures is to achieve a stable, painless motion of knee joint, and to maintain the articular congruity with ultimate goal of prevention of secondary osteoarthritis of knee.
- Presented data provide sufficient evidence that anatomic restoration of bicondylar tibial plateau fractures with 4.5mm lateral locking angular stable plate fixation result in decreased loss of reduction and declined incidence of posttraumatic osteoarthritis, thereby providing acceptable mid to long term outcome and hence to achieve optimal knee function and patient satisfaction.
- Soft tissue problems should be always kept in mind, and usage of a locking plate can reduce the discomfort of hardware impingement effectively. The single incision technique for TPF with a pre-contour locking plate reduces the soft tissue dissection, operation time and hospitalization period. To prevent skin flap necrosis dissection should be done sub periosteally in Internal Fixation.
- A trend of a higher postoperative malalignment (varus) rate over the posterior-medial compartment was noted, due to posteromedial fragment was not adequately fixed or early weight bearing of patients. If the medial buttress cannot be established by reduction of the lateral fracture, then open reduction of the medial side is necessary, and the medial fragment should also be buttressed with a plate.
- The difference in the improvement of Rasmussen functional score is statistically significant between 6th wk and 6th month. 85% of our patients had good to excellent results.

References

1. Court Brown CM, Caeser B. Epidemiology of adult fractures: a review. Injury. 2006; 37:691-697.
2. Ali AM, Yang L, Hashmi M, Saleh M. Bicondylar tibial plateau fractures managed with the Shefield Hybrid Fixator. Biomechanical study and operative technique. Injury. 2001; 32:86-91.
3. Cole P, Levy B, Schatzker J, Watson JT. Tibial plateau fractures. In Skeletal Trauma: Basic Science Management and Reconstruction. Edited by Browner B, Levine A, Jupiter J, Trafton P, Krettek C. Philadelphia: Saunders Elsevier, 2009, 2201-2287.
4. Canadian Orthopaedic Trauma Society: Open reduction and internal fixation compared with circular fixator application for bicondylar tibial plateau fractures. Results of a multicenter, prospective, randomized clinical trial. J Bone Joint Surg Am. 2006; 88:2613-2623.
5. Gosling T, Schandelmaier P, Marti A, Hufner T, Partenheimer A, Krettek C. Less invasive stabilization of complex tibial plateau fractures: a biomechanical evaluation of a unilateral locked screw plate and double plating. J Orthop Trauma. 2004; 18:546-551.
6. Higgins TF, Klatt J, Bachus KN. Biomechanical analysis of bicondylar tibial plateau fixation: how does lateral locking plate fixation compare to dual plate fixation. J Orthop Trauma. 2007; 21:301-306.
7. Jiang R, Luo CF, Wang MC, Yang TY, Zeng BF. A comparative study of Less Invasive Stabilization System (LISS) fixation and two-incision double plating for the treatment of bicondylar tibial plateau fractures. Knee. 2008; 15:139-443.
8. Rasmussen PS. Tibial condylar fractures: impairement of knee stability as an indication for surgical treatment. J Bone and Joint Surg Am. 1973; 55:1331-1350.
9. Rademakers MV, Kerkhoffs GM, Sierevelt IN, Raaymakers EL, Marti RK. Operative treatment of 109 tibial plateau fractures: 5-27 year follow-up results. J Orthop trauma. 2007; 21:5-10.
10. Biggi F, DiFabio S, D'Antimo C, Trevisani S. Tibial plateau fractures: Internal fixation with locking plates and the MIPO technique. Injury. 2010; 41:1178-1182.
11. Lee MH, Hsu CJ, Lin KC, Renn JH. Comparison of outcome of unilateral locking plate and dual plating in the treatment of bicondylar tibial plateau fractures. J Orthop Surg Res. 2014; 9:62.
12. Mukharjee GS, Vindhya K, Murthy DK. Management of bicondylar tibial plateau fractures with lateral locking plate: Journal of evolution of medical and dental science. 2014; 3:7635-7643.
13. Mardian S, Landmann F, Wichlas F, Haas NP, Schaser KD, Schwabe P. Angular-stable locking plate fixation of tibial plateau fractures-clinical and
14. Kumar SN, Gupta A, Gill SPS, Kumar DN, Singh JS, Singh PK. Results of Single Lateral Locked Plate in Complex Schatzker Type V and VI Tibial Plateau Fractures Using Minimally Invasive Fixation Technique. IOSR Journal of Dental and Medical Sciences. 2016; 15:59-64.
15. Marsh JL. Tibial Plateau Fractures. In: Bucholz R.W, editor. Rockwood & Green's Fractures in Adults. 7th ed. Philadelphia: Lippincott Williams & Wilkins, 2010; 2:1783.
16. Hohl M. Tibial condyle fractures. J Bone Joint Surg Am. 1967; 49:1455-1467.
17. Ricci WM, Rudzki JR, Borrelli J. Treatment of Complex Proximal Tibia Fractures With the Less Invasive Skeletal Stabilization System. J Orthop Trauma. 2004; 18:521-527.