ORIGINAL RESEARCH PAPER
Volume - 10 | Issue - 04 | April - 2021 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

STUDY ON FUNCTIONAL OUTCOME OF TIBIAL PLATEAU FRACTURES TREATED WITH LOCKING COMPRESSION PLATE

Anaesthesiology

Dr. M. Ganesh Kumar M.S (Ortho), Assistant Professor of Orthopaedics, Govt Theni Medical College, Theni, Tamilnadu.

Dr. M. Sivakumar* M.S(Ortho) D.Ortho, Senior Resident of Orthopaedics, Govt. Sivagangai Medical College, Sivagangai, Tamilnadu. *Corresponding Author

ABSTRACT

Proximal tibial fractures, one of the commonest intra articular fractures. Incidence of these fractures is increasing due to road traffic accidents. At the same time surgical treatment options for the same are also being modified continuously. Any fracture around the weight bearing joint like knee joint is of paramount importance as it would result in significant morbidity. Hence the treatment of proximal tibial fractures has become a challenge for the orthopaedic surgeons. **Methods:** During the study period 31 patients were treated with locking compression plate on lateral side through anterolateral approach for varying types of tibial plateau fractures. Out of 31, 28 patients were available at final follow up. The functional and radiological outcome assessed with Rasmussen scoring system. At the end of study stability of the knee joint assessed with standard stability tests. **Results:** Most of the patients were sustained injury following major road traffic accidents and most of them were males. At final follow up the functional outcome was excellent in 65 % of patients and good to fair in 35% of patients. No patient had poor functional outcome, though 10% of patients had poor radiological outcome. At the end of study 3 patients had posterior laxity, 2 patients had lateral meniscal injury and 4 patients had varus laxity. **Conclusion:** The functional outcome of tibial plateau fractures treated with single lateral locking compression plate was satisfactory in all our patients. All patients had acceptable clinical outcome though few patients had poor radiological outcome. We found 32% of patients with instability at the end of our study

KEYWORDS

Tibial fracture, functional outcome, complication, locking compression plate.

1.INTRODUCTION:

Fractures of the tibial plateau were originally described as the fender fracture, because they resulted primarily from low-energy pedestrian versus car bumper accidents .The majority of tibial plateau fractures reported in the recent literature have resulted from high energy motor vehicle accidents and falls from a height. Fractures of the tibial plateau are caused by direct axial compression, usually with a valgus or varus force and indirect shear forces. The direction, magnitude and location of the force, as well as the position of the knee at impact, determine the fracture pattern, location, and degree of displacemen[1]. Proximal tibial articular fractures caused by high energy mechanisms often associated with neurological, vascular injury, compartment syndrome, deep vein thrombosis, contusion or crush injury to the soft tissues, open wounds and injuries to the ligaments. Ligamentous injuries occur more frequently in minimally displaced, local compression, and split compression fractures.[2] More recent techniques such as double plating, fixed angle device, arthroscopically assisted reduction gained more popularity among orthopaedic surgeons. The external fixators associated with risk of knee stiffness and percutaneous screw fixation often associated with loss of reduction. Dual plating with single incision associated with high incidence of Wound Complications. There is increasing evidence that use of locking plate associated with good functional outcome in complex periarticular fractures and osteoporotic fractures. The development of locking implants has allowed the use of minimally invasive approaches often allowing unilateral plate. Laterally-based locking plates provide increased stability in the presence of metaphyseal or metadiaphyseal comminution, and may offer an alternative to an additional medial plate or external fixator for added support of the medial column when a non-locking plate is used for bicondylar fractures. This allows fixation through a single lateral incision, potentially avoiding wound dehiscence and infection associated with combined or extended approaches in which a medial buttress plate is used [3].Many authors have reported high incidence of ligament injuries associated with tibial plateau fractures and the initial severe ligament injury associated with poor outcome. The purpose of this study was to evaluate the functional outcome of closed tibial plateau fractures treated with lateral locking compression plate and to evaluate stability of the knee joint at the end of the study.

2.AIMS

To evaluate the functional outcome of tibial plateau fractures treated with open reduction and internal fixation with locking compression plate.

3. MATERIALS AND METHODS

Study Population: Patients with closed tibial plateau fractures treated with locking compression plate.

Study design: Retrospective Observational study.

97 patients were admitted with proximal tibia fractures .All patients were treated with various treatment modalities including conservative treatment with above knee slab, percutaneous cancellous screw fixation, external fixator, buttress plate fixation or locking compression plate.Among the 97 patients treated for tibial plateau fractures, 31 patients treated with locking compression plate were included in the study. Among the 31patients two patients were lost for follow up and one patient expired. Hence 28 patients were available for study. Clearance was obtained from hospital ethical committee.With the available medical records patients who underwent treatment for proximal tibia fractures with locking compression plate from the period of 2008 to 2011 were called and analysed for functional and radiological outcome and stability of the knee joint ligaments at follow up. The complications were documented.

Inclusion criteria:

1. Closed tibial plateau fractures.
2. Patients treated with locking compression plate.

Exclusion criteria:

1. Compound tibial plateau fractures.
2. Skeletally immature patients.
3. Fractures associated with distal femur and tibial shaft fractures
4. Closed fractures associated with extensive soft tissue damage.

Data Collection techniques:

Patient details were retrospectively collected by their corresponding hospital records. Patients were called for study using personalized letters, post cards and phone calls.

At the time of admission general condition of the patient was assessed with regards to hypovolemia, associated other systemic injuries and resuscitative measures taken accordingly. All patients received analgesics and tetanus toxoid in the emergency room. A thorough clinical examination was performed including detailed history taking related to age, sex, occupation, mode of injury, past and associated medical illness. The limb was immobilized with above knee plaster slab and limb elevation was given for all patients with pillow or Bohler Braun splint. Routine investigations were done for all patients. All patients were evaluated clinically and radiologically to find out associated skeletal and systemic injuries. X rays were obtained in two planes (anteroposterior and lateral view). Medial and lateral oblique

views were obtained in doubtful cases. Importance was given for other serious injuries like head injuries, chest injuries and abdominal injuries and treated accordingly. The fractures were classified according to Schatzker and AO classification system.Patients were operated as early as possible once general condition of the patient was stable and fit for anaesthesia. Adequate time was given for soft tissue healing and oedema to subside. Chest physiotherapy advised for all patients to improve the lung functions. All 28 patients were treated with locking compression plate on lateral side either through anterolateral approach or minimally invasive plate osteosynthesis (MIPPO) technique.

Surgical technique:

Under regional or general anaesthesia, patient was positioned supine, with sand bag under ipsilateral trochanter. Tourniquet was used in all patients. Knee joint was positioned in thirty to forty degree flexion to relax the gastronemius muscle. Through anterolateral approach, S shaped incision was centered over the Gerdy's tubercle. The deep fascia was elevated off the tibial tubercle to expose the lateral tibial plateau. The knee capsule was incised if needed and submeniscal arthrotomy done in difficult cases to allow better visualization of the articular surface.

AO distractor was used for fracture reduction in complex cases. Image intensifier was used for assessing the articular reduction. Depressed fracture fragments elevated either from medial or lateral side. Reduction clamps and K wires were used for provisional fracture fixation. Synthetic bone grafting was used for patients with depressed fractures. For fractures with coronal split and major medial component, additional screws were applied from anterior or medial side.

All fractures were fixed with locking compression plate on lateral side. Thorough wound irrigation was given with gentamicin mixed saline. Wound closed in layers with 12 size suction drain. Drain was not used when synthetic bone grafting done, to prevent loss of graft through suction. Compression dressing applied with pad and bandages. Prophylactic antibiotics continued for 48 hours post-surgery. Limb elevation with Bohler Braun splint was given till suture removal. Wound inspection was done on second, fourth and sixth post operative days. Drains were removed on second post-operative day or less than 50 ml volume over 24 hours.

Post operative protocol:

Gentle knee range of motion exercises and non-weight bearing walking with walker started on first post operative day. Quadriceps strengthening exercises were started once the pain was subsided. Chest physiotherapy was given to all patients to improve lung function. Suture removal done on tenth day.Patients were discharged on tenth post-operative day after taking post-operative check X ray and advised to review after one month unless there was any wound related complications. During the immediate post operative period, patients were advised to attend physiotherapy regularly for knee mobilization and muscle strengthening around knee joint. Patients were followed upto 8 months, clinical findings and radiological findings were recorded. Partial weight bearing started after the evidence radiological union. Patients were called for final follow up at the end of the study At final follow up, the functional and radiological outcome assessed with Rasmussen scoring system. Stability of the collateral ligaments was assessed with valgus and varus stress tests. Cruciate ligaments were assessed with anterior and posterior drawer tests. Injury to meniscal cartilage assessed by Mc Murray test. For assessing the progression of osteoarthritis, the final follow up X ray compared with the six months post-operative X ray.

4. RESULTS

Mean age of the patients in our study was 50 years and most of the patients were belongs to the age group of 41 to 50 years. Majority of the case load in our study were contributed by male patients (89 %). The major cause for tibial plateau fracture in our study was road traffic accidents (86 %) which includes both high and low velocity injury. In our study Schatzker type VI was the most common pattern (40 %). Followed by Schatzker type IV which forms 21 % of total case load. Right side involved in 75 % of patients and left side involved in 25 % of our patients. Most of the patients in our study were operated by open reduction and internal fixation because of high incidence of complex tibial plateau fractures.At final follow up the functional outcome in our patients were assessed with Rasmussen functional scoring system. Following variables were evaluated in each patient, pain, walking capacity, loss of knee extension, range of motion, and stability of the knee.At final follow up 65% of patients achieved excellent results and 21% of Patients achieved good results. No patient had poor outcome.

TABLE 1: RASMUSSEN FUNCTIONAL SCORING IN EACH FRACTURE

SCHATZKER TYPE	RASMUSSENS FUNCTIONAL SCORING (N=28)			
	EXCELLENT	GOOD	FAIR	POOR
VI	5	4	2	0
V	2	1	0	0
IV	4	0	2	0
III	3	0	0	0
II	4	1	0	0

RASMUSSENRADIOLOGICAL SCORING: The radiological outcome in our patients was studied with Rasmussen radiological outcome. The following variables were studied. Articular depression, condylar widening, varus and valgus angulation at fracture site, and osteoarthritis. At final follow up 15% of patient had excellent results, 43% of patient had good results and 10% had poor results. At final follow up all patients had satisfactory functional outcome and 10% of patient had poor radiological outcome.At final follow up 55% of patients with Schatzker type VI, 66% of patients with Schatzker type V and type IV achieved excellent results. No patient had poor outcome.At final follow up 80% of patients with Schatzker type II achieved excellent results. 75% of patients achieved good to fair outcome. 10% of total patients and 10% of patients with Schatzker type VI had poor radiological outcome. According to our study 9 patients out of 28 (32 %) had evidence of ligament injury at final follow up.

TABLE 2: RADIOLOGICAL SCORING IN EACH TYPE OF FRACTURE

SCHATZKER TYPE	RASMUSSENS RADIOLOGICAL SCORING (N=28)			
	EXCELLENT	GOOD	FAIR	POOR
VI	0	2	6	3
V	0	3	0	0
IV	0	4	2	0
III	0	2	1	0
II	4	1	0	0

Four patients had varus laxity among 4, 2 of them were Schatzker type VI and other two of them were Schatzker type II injury. Three patients had posterior laxity, among 3 two of them had Schatzker type VI and one patient had Schatzker type V injury. In our study 2 patients had lateral meniscal injury and both of them had Schatzker type II injury. According to our study varus laxity was the most common instability pattern followed by posterior laxity and injury to lateral meniscus. Schatzker type VI (4 patients) and Schatzker type II (4 cases) were the commonest fracture pattern, associated with ligament injury.Implant infection (7%), common peroneal nerve palsy (3.5%), tourniquet palsy (3.5%), symptomatic implant (11%), osteo arthritis (11%), opposite side mechanical knee pain (43%), quadriceps wasting, and extensor lag were the complications we found during the course of study

TABLE 3: COMPLICATIONS

COMPLICATIONS	NO OF PATIENTS (N=28)	PERCENTAGE %
COMMON PERONEAL NERVE PALSY	1	3.5
TOURNIQUET PALSY	1	3.5
INFECTION	2	7
SYMPTOMATIC IMPLANT	3	11
ARTHRITIS	3	11
EXTENSOR LAG	3	11
OPPOSITE SIDE KNEE PAIN	12	43

5.DISCUSSION & CONCLUSION:

According to our study 65 % patients had excellent results and 21 % had good results and 14 % had fair results. No patient had poor result. The mean Rasmussen functional score was 26.50 out of 30. 45% (5 cases out of 11) of patients with Schatzker type VI and 66% (two cases out of three) of patients with Schatzker type V, achieved excellent functional outcome. The mean range of motion was 126.40˚. Mathur et al[4] in their study of 27 closed tibial plateau fractures reported 37

% excellent and 52 % good results with Rasmussen functional scoring system. The mean Rasmussen functional score was 25.06. Sament et al[5] in their study of 56 tibial plateau fractures, reported satisfactory functional outcome in 89% of type I , 86% of type II , 100% of type IV and 80% of type V fractures. The mean Rasmussen functional score was 25.70. They found the mean Rasmussen score was significantly lower in patients with associated ligament injury. In our study 23 patients were treated with open reduction and internal fixation (82 %) and 5 patients (18%) were treated with minimally invasive plate Osteosynthesis. The high incidence of open reduction in our study was justifiable because of higher incidence comminuted tibial plateau fracture with articular depression which was difficult to reduce with minimally invasive technique and often needs bone grafting to support articular fragments. According to our study 15 % had excellent results, 43 % had good results, 32 % had fair results and 10 % had poor results. The poor results were found in Schatzker type VI injury (3 cases), among the three patients, one patient had posterior laxity and common peroneal nerve palsy, and another patient had implant infection in early post operative period and varus laxity at final follow up. Third patient with poor radiological outcome had 5 mm articular depression, 6 mm condylar widening and 6˚ varus angulation at fracture site. The poor radiological outcome in our study can be explained by associated ligament injury and inadequate fracture reduction in those patients.Delamarter et al[6] in their study of 39 tibial plateau fractures, found better outcome in patients without ligament injury, and those were treated for ligament injury during fracture fixation. They concluded initial severe ligament injury associated with poor prognosis. According to our study 9 patients out of 28 (32 %) had evidence of ligament injury at final follow up. Four patients had varus laxity. Among them, 2 of them were Schatzker type VI and other two of them were Schatzker type II injury. Three patients had posterior laxity. Among whom two of them had Schatzker type VI and one patient had Schatzker type V injury. In our study 2 patients had lateral meniscal injury and both of them had Schatzker type II injury According to our study varus laxity was the most common instability pattern followed by posterior laxity and injury to lateral meniscus. Schatzker type VI (4 patients) and Schatzker type II (4 cases) were the commonest fracture pattern, associated with ligament injury. Bennet et al[7] a study of 30 tibial plateau fractures, found 20% incidence to medial collateral ligament injury, 20 % incidence of meniscal injury and 10 % incidence of anterior cruciate ligament injury. According to their study Schatzker type IV and VI associated with most of the ligament injuries. Schatzker type IV was the most common injury pattern in their study.In our study we found 78 % of patients with articular depression averaging 4 mm. Those patients with poor radiological outcome had articular depression more than 6 mm. Rasmussen et al [8] reported average 5 mm articular depression in their study.Two patients (7%) had implant infection in early post operative period treated by debridement and intravenous antibiotics. Both of them had Schatzker type VI injury and one patient was under treatment for diabetes. The average range of motion in these patients was 110˚. High degree of soft tissue injury with complex tibial plateau fractures and associated diabetes mellitus could be considered as predisposing factors for infection in these patients.One patient (Schatzker type VI) developed common peroneal nerve palsy following surgery which was treated conservatively and recovered fully after a period of 7 months. All patients were operated from lateral side. The nerve damage in our patient can be attributed to more dissection on lateral side for achieving satisfactory reduction.Three patients (11%) had palpable and symptomatic implant and it was removed. David et al [9] in a prospective study of 40 patients with complex tibial plateau fractures treated with double buttress plate fixation reported 24% implant related complications. In these patients additional screws were applied from medial or anterior side to achieve acceptable articular reduction.In our study one patient (3.5 %) had tourniquet palsy due to prolonged operative time. Post operatively he had weakness of all groups of leg muscles and he recovered fully over the period of six months. Rasmussen et al [8]in their study reported one case of tourniquet induced myonecrosis and crush syndrome during the course of study. Out of 28 patients, 12 patients (43 %) had opposite side knee pain when climbing steps or walking. Our patients were kept under non weight bearing till radiological evidence of union (average 15 weeks). Many patients avoided full weight bearing on operated side for prolonged duration even after radiological evidence of bony union to protect the fixation. This altered gait pattern increased the load on normal side and predisposed them for mechanical knee pain in uninjured side. The abnormal biomechanics can be explained to opposite side knee pain in our patients but this finding needs further evaluation.Out of 28 patients, 3 patients (11 %) had radiological evidence of arthritis (grade II) at final follow up. All three patients had Schatzker type VI injury. Out of these three patients, two patients had significant posterior laxity, and one patient had varus laxity. The poor radiological outcome and osteoarthritis in these patients can be explained by associated instability. Though 10% of patients in our study had poor radiological outcome, all patients had acceptable clinical outcome. The functional outcome of tibial plateau fractures treated with single lateral locking compression plate was satisfactory in all our patients. All patients had acceptable clinical outcome though few patients had poor radiological outcome. We found 32% of patients with instability at the end of our study. The most common being varus laxity followed by posterior laxity and injury to lateral meniscus. According to our study Schatzker type VI and type II were the common injury pattern associated with instability at final follow up.Implant infection (7%), common peroneal nerve palsy (3.5%), tourniquet palsy (3.5%), symptomatic implant (11%), osteo arthritis (11%), opposite side mechanical knee pain (43%), quadriceps wasting, and extensor lag were the post operative complications we found during the course of study.The poor radiological outcome was seen in patients with clinical evidence of instability, hence considering the treatment of associated ligament injuries during fracture fixation may improve the outcome.The single lateral plate construct gave satisfactory results in all our patients, hence this can be considered as a reliable method of fixation in the treatment of tibial plateau fractures. Our mean duration of follow up was 29 months, hence long term studies are required to confirm the reliability of single lateral construct in the treatment of tibial plateau fractures.

6.REFERENCES:

1. Kenneth A Egol, Kenneth J Koval. Fractures of the tibial plateau. Chapman's orthopedic surgery, third Edition. Lippincott Williams and Wilkins 2001; 23:738 – 739.
2. Paige Whittle A, Canale, Beaty. Fractures of the lower extremity. Campbell's Operative orthopaedics, 11th Edition ,volume III. Mosby Elsevier 2007;51:3146-47.
3. Musahl V, Tarkin I, Kobbe P. New trends and techniques in open reduction and internal fixation of fractures of the tibial plateau. J Bone Joint Surg Br 2009; 91-B: 426-433.
4. Hitin Mathur, Shankar Acharya, Nijhawan. Operative results of closed tibial plateau fractures. Indian Journal Orthopaedics 2005; 39-2:108-112.
5. Sament, JC Mayanger, Sujit Kumar Tripathy. Closed reduction and percutaneous screw fixation for tibial plateau fractures. Journal of Orthopaedic Surgery 2012; 20(1):37-41.
6. Delamarter RB, Hohl M, Hopp E Jr. Ligament injuries associated with tibial plateau fractures. Clin Orthop 1990;(250):226 -233.
7. Schatzker J, McBroom R, Bruce D. The tibial plateau fracture: the Toronto experience. Clin Orthop 1979; 138:94-104.
8. Rasmussen P, Gothenburg. Tibial condylar fractures. Impairment of knee joint stability as an indication for surgical treatment. J Bone Joint Surg Am 1973; 55:1331-1350.
9. David P. Barei, Sean E. Nork, William J. Mills. Functional outcomes of severe bicondylar tibial plateau Fractures treated with dual incisions and medial and lateral Plates. J Bone Joint Surg Am 2006; 88A; 8:1713-1721.