



A PROSPECTIVE STUDY: TO ASSESS THE OUTCOME OF THE PROXIMAL TIBIAL FRACTURE TREATED WITH OPEN REDUCTION INTERNAL FIXATION.

Orthopedics

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ABSTRACT

Introduction: Proximal tibia being involved in body weight transmission through knee joint and leg, it plays a vital role in knee function and stability. Fractures of proximal tibia have historically been difficult to treat because of its subcutaneous location of the anteriomedial surface of the tibia. Severe bone and soft tissue injuries are not infrequent and there is high incidence of open fracture compared with other long bones.

Materials and Methods: A prospective study was conducted from December 2014-December 2016 at Mahatma Gandhi University of Medical Sciences & Technology, Jaipur after obtaining the ethical clearance, to study functional output of tibial condylar fractures managed with locking plate. We studied of 30 cases of tibial condylar fractures.

Results: In our series Excellent results were achieved in 17 cases (56.67%), Good results in 9 cases (30%) and Fair in 4 cases (13.33%) (Modified Rasmussen's Knee Scoring System was used to assess the outcome).

Conclusion: Optimal timing of tibial plateau fractures surgery, proper assessment of fracture pattern using CT scan and choice of implant is very important in outcome of surgery. The advantage of lateral locking plate is that it can be used in medial column fracture with lateral column, thus prevent from dual incision.

KEYWORDS

Prox. Tibial, Fracture, ORIF.

Introduction:

Proximal tibia being involved in body weight transmission through knee joint and leg, it plays a vital role in knee function and stability. Fractures of proximal tibia have historically been difficult to treat because of its subcutaneous location of the anteriomedial surface of the tibia. Severe bone and soft tissue injuries are not infrequent and there is high incidence of open fracture compared with other long bones.

The aim of surgical treatment of proximal tibial fractures is to restore and preserve normal knee function, which can be accomplished by anatomical restoration of articular surfaces, maintaining mechanical axis, restoring ligamentous stability and preserving a functional pain free range of motion of knee.

The incidence of malunion, non-union and infections are relatively high in many reported series, causing significant long term disability. Recently more attention has been paid to the condition of soft tissue envelope. Soft tissue friendly approaches and minimally invasive techniques have improved the outcome. Treatment of these injuries using minimally invasive percutaneous plate osteosynthesis (MIPO) techniques minimize soft tissue injury and damage to vascular integrity of fracture fragments.

New implants and surgical techniques have provided new options for the treatment of tibial plateau fractures. These include techniques of fixed angle plate and screw designs (LCP). High-energy tibial plateau fractures present a spectrum of soft tissue and bony injuries that can produce permanent disabilities. Their treatment is challenged by fracture comminution, instability, displacement and extensive soft tissue injuries. New implants and surgical techniques have provided new options for the management of these fractures.

Material and Method:

A prospective study was conducted from December 2014-December 2016 at Mahatma Gandhi University of Medical Sciences & Technology, Jaipur after obtaining the ethical clearance, to study functional output of tibial condylar fractures managed with locking plate. We studied of 30 cases of tibial condylar fractures.

Inclusion Criteria of our study was:

- All Proximal Metaphyseal Fractures of Tibia
- Both Closed and Open fractures (Up to Gustilo Type II)
- Patient above Age of 18 years

Exclusion Criteria of our study was:

- Patient Less than 18 Yrs of Age

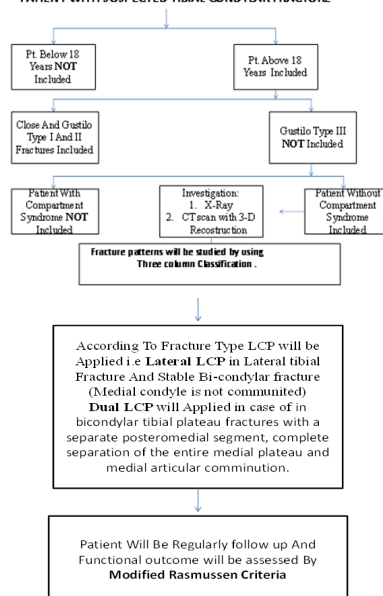
- Patients who are medically unfit for the surgery.
- Open fractures Gustilo Type III.

Once the patient was admitted, x-rays (AP and lateral) and CT scan were taken, posterior cast was given for support and analgesics and anti-inflammatory drugs were given. All the associated injuries were treated accordingly. Type of fracture was decided according to Three column classification¹ (Fig 1). Line of treatment was decided according to the type of fracture, degree of displacement and depression, and general condition of the patient.

All displaced, depressed fractures were operated upon to achieve anatomical reduction, rigid internal fixation and early mobilization.

Whenever surgery was decided, patient was thoroughly investigated, affected knee and iliac crest was prepared. All patients were operated under spinal anaesthesia and tourniquet. In all patients, MIPO, Lateral joint arthrotomy, posteromedial approach was taken as per fracture personality. Once fracture site was exposed, depression and displacement was noted by elevating the meniscus.

PATIENT WITH SUSPECTED TIBIAL CONDYLAR FRACTURE



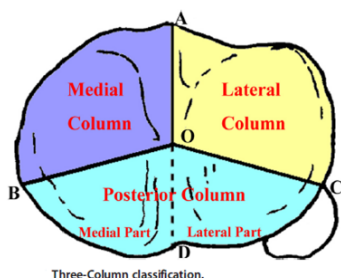
In **One-Column** fracture when wedge was small, it was fixed by periarticular plate while when wedge was large, buttress plate was used elevation of depression was carried out by introducing a spike through the window in the cortex. Subarticular space was filled by cancellous bone grafts.

In **Two-column** fracture, elevation of depression was carried out by introducing a spike through the window in the cortex. Subarticular space was filled by cancellous bone grafts. Elevated articular surface was supported by placing LCP, T-buttress or posteromedial plate was carried out according to fracture personality.

In **three-column** fracture, reduction, elevation, bone grafting followed by fixation by cancellous screws and buttress plate was done.

Check x-rays were taken in the operation table before closing the wound. Post-operative treatments consists of antibiotics, analgesics, quadriceps exercises.

Gentle knee bending exercise was started after 72 hours while vigorous knee bending exercise and crutch walking with non weight bearing was allowed after removal of stitches. Patient was discharged with the instruction of knee bending exercise, quadriceps exercise and non weight bearing. Range of movement was noted. Patient was first followed on 1 month then on third month and on 6 month post operative. The **Modified Rasmussen criteria**² (Fig 2) was used to assess the functional outcome at each follow-up and also check x-ray was done. All the data obtained were filled in the proforma. Non weight bearing continued for approximately 10-12 weeks, complete weight bearing was started after 12 weeks.



Three-Column classification.

Fig 1.

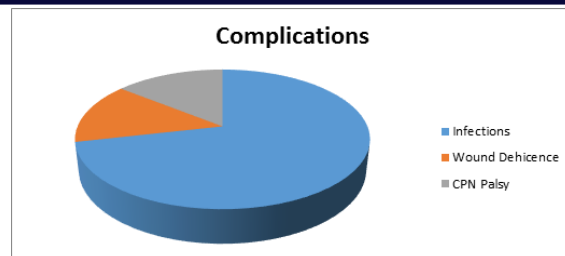
Modified Rasmussen criteria					
CRITERIA	POINTS	ACCEPTABLE EXCE.	GOOD	UNACCEPTABLE FAIR	POOR
Subjective Complaints		5	4	2	0
a) Pain					
• No pain	+6				
• occasional pain	+5				
• stabbing pain in certain position	+4				
• Pain after activity	+2				
• Night pain	+0				
b) Walking capacity		6	4	2	1
• Normal walking	+6				
• Walking for 1 hour	+4				
• Short walking >15 min	+2				
• Walking indoor only	+1				
• Wheel chair / bed ridden	+0				
c) Squatting		6	5	2	0
• Squatting without pain	+6				
• Squatting with mild pain	+5				
• Squatting with severe pain	+2				
• Squatting with heel off	+1				
• Unable to squat	+0				

Fig 2.

Results:

Common complications noted during hospitalization are superficial infection, Wound dehiscence and Common peroneal Nerve palsy. In all the 5 cases who had infection, with the course of routine antibiotics it was subsided. No case of deep seated infection or chronic osteomyelitis was noted. And 1 case who had Wound dehiscence was treated with shoelace wound closure and was stable in further follow-up. and 1 case who had Common peroneal Nerve palsy recovered fully in 3rd month follow-up.

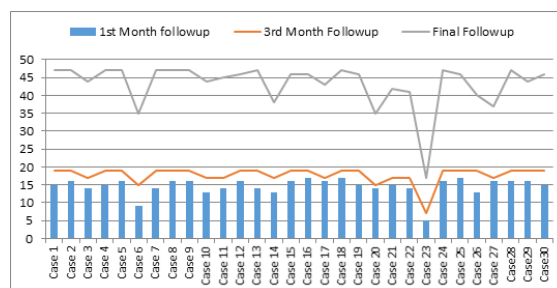
Mortality rate was nil.



Patients were discharged once the wound was dry, and has understood the necessary instructions and after discharge, patients were followed regularly to know the range of movement and residual disabilities using Modified Rasmussen criteria, at the end of 1st, IIIrd and VIth month.

1. Ten patients had quadriceps muscle wasting and had power of grade IV, this was found in patients who were not doing exercise. All cases recover in 6th month follow-up.
2. Flexion deformity (upto 10°) developed in 3 cases who are not doing physiotherapy properly. All cases recover in 6th month follow-up.

Functional outcome up Using Modified Rasmussen's Knee Scoring System at time of different follow-up :



In our series Excellent results were achieved in 26 cases (86.67%), Good results in 3 cases (10%) and Fair in 1 cases (3.33%)



Fig Showing: 3 column #on CT And Post op x-ray showing # treated with Lateral LCP and CC Screws



Picture 1-2 showing early post op. Mobilization And Picture 3-4 showing Good functional outcome at 6 month of follow-up

Discussion :

Optimal treatment of tibial plateau fractures has been an issue of

discussion for several decades. Extensive research has been performed analyzing functional and radiological results for non-operative, as well as surgical, treatment methods. Non-operative treatment is advised for minimally displaced closed fractures. Surgical treatment is advised for fractures with greater than 5 mm displacement or > 5mm condylar widening or greater than 5 degrees' instability with varus or valgus stress or depression of the joint equal to the depth of the cartilage that is or articular step > 3mm. During the last decade, studies analyzing surgically treated tibial plateau fractures have shown good results.

In Yi Zhu et.al.³ (Level II study) showed that mean kappa values for inter-observer reliability regarding Schatzker classification was 0.567 (range: 0.513–0.589), representing “moderate agreement”. The mean kappa values for inter-observer reliability regarding AO/ASIF classification systems was 0.623 (range: 0.510–0.710) representing “substantial agreement”. The mean kappa values for inter-observer reliability regarding Three-Column classification systems was 0.766 (range: 0.706–0.890), representing “substantial agreement”. He concluded that Three-Column classification, which is dependent on the understanding of the fractures using CT scans as well as the 3D reconstruction can identify the posterior column fracture or fragment. It showed “substantial agreement” in the assessment of inter-observer reliability, higher than the conventional Schatzker and AO/OTA classifications. They finally conclude that Three-Column classification provides a higher agreement among different surgeons and could be popularized and widely practiced in other clinical centers.

In our study we preferred Three Column Classification given by Luo et.al.¹ because it is simple, uncomplicated and its practical utility in preoperative planning. But we also find some flaws in this classification such as it consist of transverse cut in CT at the level of fibular head, so the fracture and depression above this level (11mm) that is between the articular surface and level of fibular head are missed. In our study the most common mode of injury was RTA (bike accident) that leads to high energy trauma that further leads to significant injury to soft tissue envelop surrounding proximal tibia causing significant swelling. Patient came late to us after trauma with swelling were managed with distal tibial skeleton traction and continuous monitoring for sign and symptoms of compartment syndrome. With this protocol we are able to manage all patients until subsidence of swelling before operation. We do not span any proximal tibial fracture came with swelling as it add extra procedure and financial burden to patient and move over with distal tibial skeleton traction results are satisfactory.

Stability of the knee after treatment of tibia plateau fractures as one of the most important predictors for future knee function. This underlines the main goal of treatment with ORIF, namely, to create a stable and painless knee joint.. The incidence of soft-tissue injuries in tibial plateau fractures is high. In a prospective cohort study performed by Gardner et al 103 patients with tibial plateau fractures were evaluated for soft-tissue (ligament and meniscus) injuries by MRI. They found that only 1% showed complete absence of soft-tissue injuries were present in up to 91% of all patients. Shepherd et al (Level II study) showed a high prevalence of soft-tissue injuries even in minimally displaced tibial plateau fractures. The treatment of these soft-tissue injuries has been a debate for several decades. It is important to create a stable knee, ensuring early exercise and restoration of knee function and minimizing the development of secondary osteoarthritis in the long term. Honkonen, in a (Level II study).²¹ article, described posttraumatic osteoarthritis to be present in 44% of 131 cases. Patients who underwent a meniscectomy showed a greater prevalence of posttraumatic osteoarthritis (74%) compared to patients whose meniscus was reattached (37%), which furthermore implies the need for repair of soft-tissue damage. Our study showed that after ORIF, good stability in an anteroposterior, as well as a mediolateral, direction is obtained in the majority of patients and no instability was present after fixation of fracture but the mobilization was delayed to three weeks in case of ligament injury M. V. Rademakers et.al (Level II study).⁴ concluded that the knee function is not likely to change significantly after 1 year. Given this fact, we believe that results at 1 year are a good prognostic indicator for future knee function. In this study, we analyzed the Functional outcome using modified Rasmussen criteria of surgically treated (ORIF) tibial plateau fractures and predictor factors influencing these results. Our results show that surgical treatment (ORIF) leads to excellent functional results. Continual monitoring of these patients made it possible to assess the progression of the knee function closely. Most patients have resumed

their daily activities as before trauma and have regained almost full flexion and extension of the knee joint 6 month after treatment.

There are various surgical approaches for proximal tibia some of the popular approaches for proximal tibia explained by AO are 1. Straight mid line approach in case of severely comminuted proximal tibia fracture the advantage of this incision is that it help in good visualization of both condyle and incision line will in line of incision for future joint replacement. 2. Anterolateral approach this is the most commonly used approach for treatment of lateral split, lateral split depression, non comminuted bicondylar, this approaches with joint arthrotomy and miniscal elevation is helpful in elevation of depressed condyle under direct vision. 3 Posteromedial this approach is for fixation of large posterior-medial fragment or medial condyle it is difficult approach then anteriolateral approach. 4. Combined approach that is anteriolateral and posteromedial for complex proximal tibial fractures. 5. MIPO approach for proximal tibia required less tissue dissection leading to less complications and better outcome.

Some popular approaches for posterior column fracture are : 1 Fibular neck osteotomy approach by Solomon et.al.² and no osteotomy approach by Frosch et.al.⁶ 2.Bhattacharya et.al (Level II study).⁷ described the posterior shearing tibial plateau fracture patterns and early results of treatment via a posterior approach. But his popliteal approach was posteromedial indeed and required a large skin flap with extensive medial dissection and the tendotomy of the medial head of the gastrocnemius. posterior L approach by Luo et.l (Level III study).¹ had a difficulty due to the blocking of medial gastrocnemius muscle, there is difficulty dealing with the posterolateral condylar fracture. Sometimes, it is required to cut the medial gastrocnemius muscle, which restricts early functional exercise.

Positioning of patient is very important while operating proximal tibia as it help in reduction and easy exposure of fracture site. For only posterior approach the patient was positioned prone with bump under thigh to ease the extension and flexion for reduction manoeuvre. Similarly, while operating with dual incision a bump is placed under contra-lateral hip and was removed after completion of medial side procedure addition to this a bump is placed under affected distal thigh for reduction manoeuvre.

In our study, we used Anterio-lateral approach, Posterio-medial approach, Dual incision, MIPO, Anterior midline approach according to fracture type and personality.

Wound infections remain a serious problem in the treatment of tibia plateau fractures, with infection rates ranging from 3% to 32%. (Level II study) of Benirschke SK et. al, Biyani et.al, Gerich T, et.al, Lachiewicz PF et.al Barei et al (Level II study)⁸⁻¹² performed a study analyzing the complications after ORIF with a 2-incision technique in patients with high-energy tibial plateau fractures. In 8.4% of 83 patients, a deep wound infection developed that required an average of 3.3 additional procedures to clinical resolution. They state that with proper timing of the internal fixation and precise tissue handling, high-energy tibial plateau fractures can be safely treated by dual plating. In our study, it became apparent that when dual incision and amount of metal used were minimized, complications were not frequent that is only five patients (16.66%) had superficial wound infections. As stated by Feng et.al.¹² and Martin C.Jordan et.al.¹³ the use of Lateral locking plate in Bi-condylar fracture and Less invasive surgery of tibial plateau fractures and biomechanically stable and overcome this problem of infections and appears to show satisfactory early results, with infection rates between 3.7% and 13.3%. (Level II study) of Cole PA et.al, Stannard JP et.al. Future analysis has to prove that the long-term results with less invasive surgery are equal to those obtained with formal ORIF.

SUMMARY AND CONCLUSION:

1. Proximal tibia is one of the most critical load bearing are in the human body.

2. Goal of management.

- Restore joint congruity
- Preserved normal mechanical axis
- Stable joint restore knee motion

3. Vehicle accidents are the common modes of injury

4. Two column fracture are more common than three and one column.

5. Incidence of ligament injury is 13%.
6. Incidence of post-operative infection is 6.66%.
7. Excellent results were obtained in 86% of surgically treated patients.
8. Overall surgical treatment is useful in fractures of tibial plateau particularly depressed and displaced. It is associated with very few complications provided it is carried out properly.
9. The advantage of lateral locking plate is that it can be used in medial column fracture with lateral column, thus prevent from dual incision.
10. The advantage of lateral locking plate is that it can be used in medial column fracture with lateral column, thus prevent from dual incision.

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