

Research Article

Fragment Specific Fixation for Tibial Plateau Fractures with particular reference to arthroscopic assisted surgery.



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Abstract

Background: Tibial plateau fractures treatment strategies have shifted away from relying only on the Schatzker or AO/OTA categorization, as the idea of the proximal tibia as a three-column structure. This is a prospective randomized study for evaluation of the results of management of tibial plateau fractures especially posterior column with reference to arthroscopic assisted surgery according to fragment specific fixation concept based on Luo three column classification (CT based). **Methods:** This is a prospective randomized study for evaluation of the results of management of tibial plateau fractures especially posterior column with reference to arthroscopic assisted surgery according to fragment specific fixation concept based on Luo three column classification (CT based). This study was conducted on (thirty) patients with tibial plateau fractures, 20 cases were treated by ORIF & 10 cases treated by ARIF. They were treated in Minia University hospital & El-Minia General Hospital during the period from June 2018 to May 2021. All patients were followed up for at least one year. **Results and conclusion:** We concluded that fragment specific fixation for tibial plateau fractures under guiding of three column classification showing excellent results for tibial plateau fracture mainly posterior column injuries using Lysholm scores for clinical evaluation and Rasmussen score for radiological evaluation. Moreover, arthroscopically assisted internal fixation (ARIF) had higher Lysholm score and Rasmussen scores when compared to others performed traditional ORIF.

Keywords: Tibial Plateau Fractures, Fragment Specific Fixation, arthroscopic assisted surgery

Introduction

Tibial plateau fractures are serious injuries with a wide variety of clinical manifestations and serious long-term consequences. Classifications of these difficult fractures, as well as fixation strategies and predicted results, have attracted a lot of attention in recent years^[1,2].

Complex comminuted fractures with extensive joint line destruction and cartilage lesions^[3] vary from non-displaced split fractures to mildly to severely displaced depression fractures.

Knee function, both short- and long-term, is jeopardized by tibial plateau fractures. Their surgical treatment presents unique difficulties. The goals of treatment for articular fractures are the same as those for any other kind of fracture: anatomic reduction, stable fixation that allows for early mobility, and as little surgical stress as possible^[4].

Injuries to the vasculature, nerves, ligaments, menisci, and neighboring compartments are all possible complications of a

tibial plateau fracture. Most tibial plateau fractures need orthopedic evaluation and surgery^[5], however non-operative treatment is a viable option for those with only mild fractures and no other injuries.

Treatment strategies have shifted away from relying only on the Schatzker or AO/OTA categorization, as the idea of the proximal tibia as a three-column structure and the extensive research of the posteromedial and posterolateral fragment morphology have done^[6].

Arthroscopy is helpful to aid the fracture reduction and to treat intra-articular soft-tissue injuries when open reduction and internal fixation (ORIF) is the best choice for these fractures. The reduction and fixation of posterolateral and posteromedial fragments is compromised by antelateral and anteromedial surgical techniques. This may be done by using posterolateral or posteromedial reduction and fixation techniques, which allow for more precise placement of plates and screws. In certain individuals over the age of three score, TKA (Total Knee Arthroplasty) might be the first line of defense against complicated patterns. These fractures often result in the development of osteoarthritis^[6].

Patients and Methods

This is a prospective randomized study for evaluation of the results of management of tibial plateau fractures especially posterior column with reference to arthroscopic assisted surgery according to fragment specific fixation concept based on Luo three column classification (CT based).

This study was conducted on (thirty) patients with tibial plateau fractures, 20 cases was treated by ORIF & 10 cases treated by ARIF.

In this study we used ARIF method in posterolateral column with or without

lateral column fractures as recommended in literature^[4]. Randomization was done in cases with posterolateral column fracture to be treated by ORIF or by ARIF by card selection.

They were treated in Minia University hospital & El-Minia General Hospital during the period from June 2018 to May 2021. All patients were followed up for at least one year.

Inclusion criteria

- All tibial plateau fractures in skeletally mature patients
- Age ranged from 20 to 60 years old.

Exclusion criteria

- Open fractures.
- Multiple injured patients.
- Previous knee surgery or knee injury.
- Pathological fractures, except porotic.
- Associated vascular injury.

Ethical consideration:

The hospital's Research/Ethics Committee approval and written informed consents from the patients and their approval to be included in the study were obtained.

All patients gave their written informed permission after being given information about the procedure's goals, risks, and potential problems. Patients who choose not to take part in the trial were nonetheless given all necessary medical attention. Participants had been given the opportunity to ask any study-related questions they had. It was made very clear what the next steps would be in the follow-up process.

Procedures:

The Rasmussen radiologic score was used to analyze the radiologist's findings. In accordance with the Rasmussen criteria [7], satisfying outcomes were judged to be either excellent or good, whereas unsatisfactory results were characterized as either fair or bad (supplementary file 1).

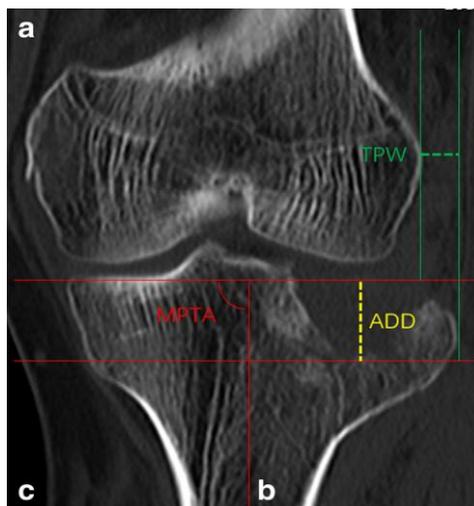


Figure (1): Radiological measurement of the TPW, ADD and MPTA.

Medial proximal tibial angle (MPTA), tibial plateau width (TPW), and articular depression depth (ADD)^[8]

- The TPW (green dashed line) was located between the widest point of the lateral tibial plateau and the tangent to the lateral femoral condyle..
- The angle of dislocation (yellow dashed line) was determined by calculating the angle between the tangential line to the articular surface and the tangential line to the lowest point of depression..
- The medial proximal tibial angle (MPTA) is the angle formed by the tibial anatomic axis and the proximal tibial joint line..

Lysholm knee score (supplementary file1). is a functional evaluation tool that takes into account eight factors (limp, locking, discomfort, stair climbing, usage of supports, instability, swelling, and squatting) when assessing a patient's knee. Scores range from 0 (not significant) to 100 (very significant) using:
 85-100 indicating an excellent outcome,
 70-84 indicating a good outcome
 60-69 indicating fair outcome,
 and less than 60 indicating a poor outcome ^[9].

I. Definitive treatment.

Protocol calls for checking for edema and blistering in all patients with high energy multicolumn tibial plateau fractures. Only until the skin and other soft tissues were in the best possible shape were patients brought in for surgery.

In every instance, a CT scan was performed to better describe the morphology and help in surgical planning (using Luo's categorization system). Decisions were made using a "three-column categori-

zation."

This fracture required open reduction and internal fixation to achieve anatomic reduction. Ten instances of lateral column depression and posterolateral column required arthroscopic aided reduction.

Open reduction and internal fixation (ORIF) Operative technique: (Figures in supplementary material 2)

Anesthesia:

Spinal or epidural anesthesia was used in all cases. All patients received intravenous third generation cephalosporin antibiotic before tourniquet application.

Tourniquet:

The tourniquet was used in all cases.

Positioning of the patient:

- According to the column affected:
 - Prone position used in 6 cases with posteromedial incision and posterior fixation only.
 - In 14 instances, the posterior approach to the tibial plateau was done in conjunction with anterolateral approach

and fixation, resulting in a floating posture of prone based on lateral decubitus..

○ After that, the leg is prepped and draped normally.

Approach:

- (1) First, with the patient prone on a radiolucent table and the knee slightly flexed, a posteromedial incision was made. Banks and Laufman[11] were the first to describe it.
- (2) While the patient is lying face down, the transverse portion of a hockey-stick incision is made beginning at the lateral end of the flexion crease of the knee and continuing across the popliteal space. This is Fig. -A [11].
- (3) After 7-10 cm of incision along the medial side of the leg, reverse the direction of the cut.
- (4) Using the skin incision diagram as a guide, create an angular flap of skin and subcutaneous tissue and incise the deep fascia. -B [11]
- (5) Learn where the nerves and blood vessels of the skin are so you can keep them safe. Find the distance between the medial head of the gastrocnemius muscle and the tendon of the semitendinosus muscle.
- (6) The popliteus and flexor digitorum longus muscles should be on the floor of the interval figure, while the semitendinosus should be retracted proximally and medially and the gastrosoleus component should be retracted distally and laterally. - C [11].
- (7) Careful subperiosteal placement of a Hohmann retractor at the level of the lateral cortex of the proximal tibia was used to elevate the flexor digitorum longus muscle distally and laterally, and the popliteus muscle proximally and laterally. All dissection from medial to lateral should be performed beneath the popliteus muscle in the proximal part. During a surgical dissection, there is no "real" plane through which to see the neural tissue. The Hohmann retractor is then placed beneath the tibial lateral cortex in the subperiosteal plane.
- (8) Distally along the medial aspect of the calf, the incision may be prolonged if

required by continuing the dissection in the same intermuscular plane. It is important to note that the soleus muscle covers both the tibial nerve and the posterior tibial artery. With the use of a Langenbeck retractor, the hamstring insertion is retracted medially, and the popliteus and soleus origin are lifted off the posteromedial face of the proximal tibia, moving from the medial to lateral side of the leg as necessary to expose the fracture of the posterior column.

(9) By employing a periosteum elevator to access the "fracture window" at the fracture site, the articular surface was raised.

(10) Several subchondral Kirschner wires were used to temporarily repair the diminished articular surface.

(11) To improve exposure, flexing the knee may relax the posterior soft tissue; however, the articular surface in the posterior column can only be reduced and fixed with a buttress plate if the knee is extended.

➤ For posterior column fixation, a contoured 3.5-mm LC-DCP, 3.5-mm T-plate, or 4.5-mm T-plate was employed.

➤ The buttress plate was typically inserted transversely for the posteromedial fragment (parallel to the medial ridge of the tibia).

➤ In most cases, the posterolateral fragment was supported by an oblique posterior plate running from the proximal to the distal medial.

(12) The lateral column fracture was reduced and fixed using a standard anterolateral technique (figure):

Basic lateral utility incision: The incision is made 1–2 cm proximal to the joint line in the midportion of the fascia lata, following the midaxillary line. With a gentle slant toward the lateral edge of the anterior tibial crest, it is brought distally across Gerdy's tubercle. If more room is needed, the incision might be made either closer to the patient's body or farther away.

B. There is a cleavage in the fascia lata along the middle, right in the middle of Gerdy's tubercle. Just laterally of the anterior tibial crest, a continuous incision is made into the fascia of the anterior compartment.

C. The primary fracture line and capsular structures are shown when anterior and posterior fascia lata are retracted. The tibial meniscus ligament has been located.

D. An incision was made in the meniscotibial ligament below the level of the lateral meniscus. To make it easier to mend the torn meniscus on the outside edge of the knee, the ligament's connection on the tibia is left unharmed.

Meniscal retraction is aided by sutures linked to the proximal capsule and meniscus in position (E). Submeniscal arthrotomy is performed so that the joint may be seen without having to open it. Visible articular impaction runs parallel to the primary fracture line.

Lateral plates were used to raise the articular surface through the fracture window and secure it in place (L-plate or LISS-PT; Synthes).

With the use of fluoroscopy, we were able to verify the accuracy of the reduction, the placement of the plates, and the screw length. The opening between the subcutaneous tissue and the skin was closed. The lateral column fracture was reduced and fixed using a standard anterolateral technique

Arthroscopic assisted reduction and internal fixation (ARIF): (figures in supplementary material 3)

Anesthesia:

Spinal anesthesia was used in all cases. All patients received intravenous third generation cephalosporin antibiotic before tourniquet application.

Tourniquet:

The tourniquet was used in all cases.

Positioning of the patient:

Patients were positioned in the supine position on a flat, radiolucent table with a movable stress post at one side providing access to the medial compartment. The fluoroscope may be brought in from the other side of the table and oriented suitably in the figure of four position, allowing for adequate access to the lateral compartment with little or no assistance.

Operative details:

1- Arthroscopic joint lavage & examination:

The standard anterolateral portal was used for viewing, and the anteromedial portal was used for manipulation. Fluid extravasation was not problematic because inflow was achieved by gravity or low-pressure pump (<40 mm Hg), also we used an accessory anterolateral portal as an outflow.

The surgical procedure was started with evacuation of hematoma and loose particles (figure). When intra-articular visibility is high enough, the shaver may be used to help clean out the joint cavity of any remaining blood clots or tiny bone pieces. After joint lavage, arthroscopic assessment is conducted to detect bone and cartilage abnormalities, in addition to meniscal and ligament injury.

Incision:

From above the patella, the iliotibial band was cut laterally down to the Gerdy's tubercle. This division of the fascia lata is bilateral and is located directly above Gerdy's tubercle. Just laterally of the anterior tibial crest, a continuous incision is made into the fascia of the anterior compartment. This technique involves retracting the fascia lata to reveal the fracture.

Fracture reduction and fixation:

For improved visibility of the lateral margin of the tibial plateau, a polydioxanone suture was threaded via a spinal needle to tether and retract the meniscus.

A tamp was then placed through the fracture site of the lateral tibial cortex, in cases of middle lateral column and/or posterolateral column depression or comminution we made a window through anterolateral cortex of proximal tibia to pass the tamp.

Then we check the proper position of the tamp under the depressed column fluoroscopy AP and LAT. Views before reduction of the fracture.

The arthroscope allows for direct visualisation of the tibial plateau reduction, and with the right amount of force exerted in the right direction, the tibial plateau may be brought as near to its anatomical position as feasible.

Internal dirt was cleaned out of the joint using a shaver. C-arm radiographs are then used to verify the decrease. K-wires are then discharged distally, parallel to the tibial plateau, to secure the reduction. Canonical screws are drilled into place over the K-wires and then manually tightened to provide fixation..

Then a lateral buttress plates was used for fixation of lateral cortex

Post-operative care and rehabilitation:

All patients of were placed in a posterior knee splint immediately postoperative. first generation cephalosporin antibiotic was continued to one week postoperative with proper analgesia. All patients stayed in the hospital from 2 to 3 days postoperative. The suction drain was removed in the second day postoperative with dressing of the wound. Standard anteroposterior and lateral radiographs were done then the patients were encouraged to start quadriceps muscle strengthening exercise and gradual graduated flexion - extension exercise

Follow-up:

Minimum 1 year postoperative follow up period for all cases:

During the first 2 weeks Patients were assessed clinically for stitches removal and evaluation of the wound. Passive flexion range of motion started the 1st. day postoperative up to 60° was performed then increased gradually, reaching full flexion within 6 to 8 weeks.

At 6 weeks, X-rays were taken to check on the fracture and the splint was taken off so that the patient could begin bearing some weight. Once radiographic proof of union was obtained, full weight bearing may

resume. In most cases, this would happen at around the 10-week mark. Until 6-9 months had passed, when adequate strength, range of motion, and proprioceptive abilities had restored, resumption to strenuous work or cutting or pivoting sports was discouraged..

Radiographs in antero-posterior and lateral views were examined at the next day of operation, four weeks, eight weeks and then after three months for assessment of fracture union.

Radiological evaluation at 3,6,12 months postoperative by plain X-ray

Clinical assessment of all patients by the Lysholm knee score and radiological assessment by the Rasmussen radiologic score were done at 3 months and recorded in the master sheet.

C. Administrative Design:

- It was submitted to the Research Ethics Committee for review.

Patients were only enrolled after giving their informed permission.

- No information was ever shared.

Participants were free to drop out of the trial at any time without any consequences to their care..

Results

Regarding sociodemographic characteristics, we found that most patients (83.3% of patients, 25 patients) were males, while 16.7% of patients (5 patients) were females. Their age ranged between 20 and 50 years old with a mean of 32.23 ± 7.81 years old.

We found that only 5 patients (16.7% of patients) were current smokers. We also found that most patients (83.3% of patients, 25 patients) had no associated comorbidities. On the other hand, 6.7% of included patient (2 patients) had diabetes, similarly, 2 patients (6.7% of patients) were hypertensive. Only 1 patient (3.3% of patients) were cardiac.

All patients suffered from unilateral injury; two thirds of patients (20 patients) had right side injury while the remaining one third (10 patients) had left side affection. We also found that Rood traffic accidents (RTA) were the commonest form of

injuries among included patients. while fall downstairs (FDS) were the least commonly reported mechanism of injury that was

prevalent among only 4 patients (13.3% of patients) as shown in table1.

Table 1: Sociodemographic characteristics of included patients.

Variable			
Age (years)	Mean \pm SD Minimum – Maximum		32.23 \pm 7.81 20 – 50
Gender	Male	n (%)	25 (83.3)
	Female	n (%)	5 (16.7)
Special habits	Smoker	n (%)	5 (16.7)
	Non-smoker	n (%)	25 (83.3)
Comorbidities	No	n (%)	25 (83.3)
	Cardiac	n (%)	1 (3.3)
	Diabetic	n (%)	2 (6.7)
	Hypertensive	n (%)	2 (6.7)
Side affected	Right	n (%)	20 (66.7)
	Left	n (%)	10 (33.3)
Mechanism of injury	FDS	n (%)	4 (13.3)
	FFH	n (%)	6 (20)
	RTA	n (%)	20 (66.7)

Table 2: Classification of tibial plateau fracture among included patients

Tibial plateau fracture	N	%
Posteromedial (PM)	4	13.3
Posterolateral (PL)	4	13.3
Posteromedial + Posterolateral (PM + PL)	2	6.7
Anterolateral + Posterolateral (AL + PL)	6	20
Anterolateral + Posteromedial (AL + PM)	14	46.7

Table 3: operative details among included patients.

Variable			
Type of surgery			
Open reduction and internal fixation (ORIF)			20 (66.7)
Knee arthroscopy			10 (33.3)
Days before surgery	Mean \pm SD		4.67 \pm 3.6
	Minimum – Maximum		1 – 14
Time of surgery	Mean \pm SD		94.66 \pm 17.67
	Minimum – Maximum		60 – 120

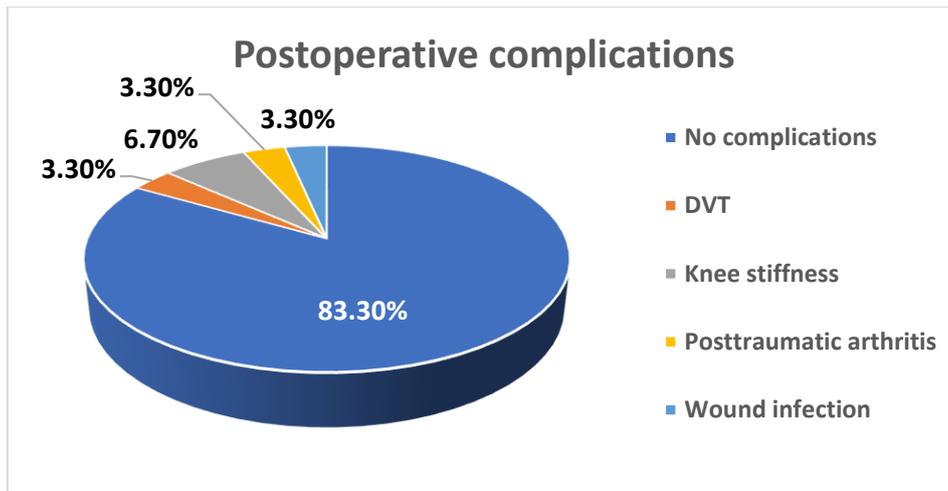


Figure 1: postoperative complications among included patients.

Follow up

Patients were followed up for a duration ranging between 12 and 16 months with a mean of 13.37 ± 1.59 months. We used 2 scores for following up those patients; Lysholm score for clinical evaluation and Rasmussen score for radiological evaluation.

Discussion

Tibial plateau fractures (TPFs) are a kind of intra-articular fracture that often affects young, physically active people as a consequence of a high-energy trauma, or older patients with osteoporosis as a result of a low-energy injury. Restoring the mechanical axis of the lower limb and anatomically reducing the articular surface are essential steps in treating these fractures; however, reducing the risk of sequelae and regaining function are equally crucial.⁽¹²⁾

Medial or lateral posterior tibial plateau fractures (PTPF) are prevalent and make up 28.8 percent of all bicondylar tibial plateau fractures. Evaluation by computed tomography (CT) shows that roughly one-third of bicondylar plateau fractures include a posteromedial fragment⁽¹³⁾.

Two- and three-dimensional computed tomography scans of the tibial plateau have been shown to improve surgical planning and give more information on fracture patterns, articular surface state, and soft-tissue injuries than radiography alone. Compared to the Schatzker and AO-OTA classification systems, the three-column classification system published in 2010 by

Luo et al.,⁽¹⁴⁾ makes better use of the additional information provided by CT, improves understanding of injury patterns, optimises treatment approach, and has shown to have higher interobserver reliability.⁽¹⁵⁾

The situations were handled in our research using a fragment-specific fixation idea based on the Luo three-column categorization system (CT based). Treatment of tibial plateau fractures based on multiplanar CT scans and a column-specific strategy. Thirty patients with tibial plateau fractures participated in the trial, 20 of whom had ORIF and 10 who underwent ARIF.

The most active and productive age group (32.23 7.81 years) was shown to be at increased risk for high-energy tibial plateau fractures. The vast majority of our patients were male (83.3%), perhaps because men are more likely to be involved in automobile accidents as a result of their profession. In this research, we presented data on adverse events (66.6 percent right sided and 33.4 percent left sided).

Reducing and fixing posterior column fractures, particularly in the posteromedial fragment, might be challenging with conservative treatment, external fixators,

and the usual anterolateral plate osteosynthesis. It is crucial to get a clear picture of the damage, decrease the fracture, restore joint alignment, and secure the bones with a firm cast.. In the present study we used different techniques regarding to injury; as majority of our patients injury was (Anterolateral and Posteromedial) among 46.7%, followed by (Anterolateral + Posterolateral)in 40% , then Posteromedial (PM) in 13.3% and Posterolateral (PL) in 13.3% , we used in patients treated by ORIF ; posteromedial approach and A conventional anterolateral approach was used to reduce and fix the fracture in the lateral column. They were subjected for operative procedures for a duration ranging between 60 and 120 minutes with a mean of 94.66 ± 17.67 minutes

Our results were comparable with Selvaraj et al.⁽¹⁷⁾ Study In the prone position, they employed a combined postero-medial and antero-lateral approach, while in the supine position, they used an antero-lateral approach to fixate the lateral column. The average surgical procedure with this method took 106 minutes (Range 90 to 125 min).

For outcome we followed up for 13.37 ± 1.59 months by using Lysholm scores for clinical evaluation and Rasmussen score for radiological evaluation and found that 80% of patients had excellent Lysholm scores on follow up and while 86.7% of patients had excellent Rasmussen scores

In line with Selvaraj et al., (2020)⁽¹⁷⁾ study that was conducted purposes of evaluating the efficacy of the column-specific method to internal fixation of fractures of the tibial plateau when there are two or more fracture columns in the fracture site. Because of the improved comprehension of the fracture pattern afforded by the 3D CT scan, the three column categorization, and the column specific fixation approach, these patients had good radiological and functional outcomes.

In the other study by Thanappan et al., (2019)⁽¹⁹⁾ aimed to A follow-up study of 10 patients with displaced complicated tibial plateau fractures indicated 90% had acceptable or outstanding functional outcomes after column-specific repair. All the fractures in their research also healed in around three to four months. Forty percent of patients had an outstanding result, fifty percent had a good outcome, and ten percent had an acceptable radiological prognosis but an unfavourable clinical outcome.

On opposite side van den Berg et al.,⁽¹⁶⁾ study aimed to Find out whether posterior fixation of tibial plateau fractures, including posterior column fractures, is beneficial. Specifically, they looked at all cases of operatively treated tibial plateau fractures with a PCF at their facility between 2009 and 2016, evaluating whether or not the surgical care followed the three column principles with proper fixation of the PCF in each case. Surprisingly, they were unable to find any evidence that TCC improved functional outcomes. Despite the TCC's widespread adoption by 2014, well over a third of patients were not treated in accordance with the TCC and showed no statistically significant changes on KOOS subscales. Patients treated with posterior plating did not have higher result ratings regardless of whether they were treated according to the TCC.

Moreover by Comparing to other studies using plating as Biggi et al., (2010)⁽²¹⁾ where fractures were classified according the OTA/AO classification. Following the MIPO (Minimally Invasive Percutaneous Osteosynthesis) principles, internal fixation with locking plates achieves excellent fracture reduction and good outcomes for the mid-term clinical outcome.

Conserva et al.. (2015)⁽²²⁾ study was to compare the results of complex tibial plateau fractures treated by an open reduction and internal fixation (ORIF) versus hybrid external fixation (EF) (without using three column classification)

in term of clinical and functional outcomes. the mean Rasmussen score was 24.9 (good) in the patients treated with ORIF and 25 (good) in those who received EF, and Yao et al., (2014) ⁽²³⁾ study was to assess bicondylar tibial plateau fractures treated with dual buttress plate fixation: long-term results and analysis of risk variables Thirty-four individuals had a perfect Rasmussen anatomic score, whereas 23 had a good one, and 17 had a mediocre one. By Rasmussen functional score, 56 (81.2%) patients had excellent or good outcomes, and by HSS score, 57 (82.6%) patients did as well..

In complicated tibial plateau fractures, a stable articular and metaphyseal fixation is essential for fracture healing, and anatomical reduction of the articular section of the fracture is required to avoid subsequent arthritis⁽²⁴⁾. Tibial plateau fractures were previously categorised using just two-dimensional imaging. Tibial plateau fractures, and the postero-medial corner in particular, often go untreated because surgeons are misled into focusing only on the medial and lateral columns instead of the posterior column ⁽²⁵⁾.

Selvaraj et al.,⁽¹⁷⁾ report the idea of column-specific fixation for complicated tibial plateau fractures, which is predicated on a thorough comprehension of the fractures as shown by CT images. This innovative method is a secure and efficient way to treat Schatzker V and VI tibial plateau fractures. These fractures are categorised in both the Schatzker and AO/Orthopedic Trauma Association systems based on the radiographic findings from the anterior and posterior views and the lateral view, respectively. Forty-three percent (18/42) of tibial plateau fractures in a group of 42 patients who had independent evaluations using plain radiographs and three-dimensional CT were under evaluated by simple radiographs⁽²⁶⁾.

Better fracture visualisation and reduction and fixation are achieved with a posterior approach, whether the patient is prone or supine; this method also has the benefit of causing less soft tissue harm than anterolateral incisions, and it may be

utilised to treat a torn posterior cruciate ligament. Rigid fracture fixation has benefits including early mobilisation, reduced soft tissue complications, better range of motion, and early mobilisation compared to other modes of fixation. These benefits are achieved through the accurate reduction of articular surfaces during posterior column fixation using an antiglide plate and medial and lateral column fixation using screws or lateral locking plates ⁽²⁰⁾.

Anteroposterior fracture configuration, depression, or sagittal malalignment or depression were often found fracture patterns in lateral tibial plateau fractures. If we strictly apply the three-column categorization system to this kind of fracture, we find that it is a combination of a lateral and posterior column fracture. This lateral split fracture pattern is common, occurring in as many as 75% of all tibial plateau fractures, as revealed by Molenaars et al., (2015), who employ CT mapping to define tibial plateau fractures⁽²⁷⁾. A lateral split (depressed) fracture should be adequately treated through a single lateral approach, but effective treatment strategy for this kind of fracture might be further contested (i.e., fracture morphology, degree of articular depression). Shear fractures of the posterior wall need further posterior fixation with appropriate buttressing in accordance with the three-column categorization, but transverse fractures of the posterior wall do not ^(28, 29).

In deciding whether or not to treat a fracture in the posterior column, the morphology of the fracture is crucial. Incorporating trauma mechanism-based fracture morphology might be a crucial missing piece in the three-column categorization and a roadmap for future surgical decision-making for posterior column fixation ⁽³⁰⁾.

Regarding complication in the present study, we reported no complications among majority of patients (83.3%; 25 patients). However, we found that knee stiffness was found in two patients (6.7%). we also found that DVT, posttraumatic arthritis and post-

operative wound infections were prevalent among one patient for each (3.3%)

In accordance with Selvaraj et al., (2020)⁽¹⁷⁾ reported hardware incompatibility and infection risk (three cases between 123 cases) the biggest drawbacks of this method are the profound infection that has formed.

Thanappan et al., (2019)⁽²⁰⁾ mentioned that In the course of the research, no participants had varus collapse. We found no evidence of delayed union or non-union, varus valgus deformity, implant fracture, or neurovascular damage.

Wang et al., (2016)⁽²⁹⁾ reported that Nonoperative treatment was successful in twelve patients with superficial infections, one with minimal skin necrosis, and two with wound dehiscence. Two patients had intraoperative vascular injuries. None of the fractures that were fixed showed signs of failure to heal. Pain and knee dysfunction were the results of other problems, such as fixation failure, and revision surgery was often necessary. Treatment of fractures in their investigation resulted in no instances of implant failure or reduction loss.

Compared to other research, the number of complications experienced after surgery was minimal in this one^(31,32) Traditional fixation structures, often using bilateral dual plating procedures, are widely employed by surgeons when treating difficult TPF^(32, 33). However, a high infection rate, anything from 8.6 percent to 22.3 percent, has been linked to this method^(34, 35), so it's not without its detractors^(34, 36).

The suggested treatment technique based on column specific fixation has shown positive results when using surgical procedures aimed towards the posterior column^{(37) (33) (38)}, such as the reversed L-shaped approach alone or in conjunction with other approaches⁽³⁷⁾

In *the current study* among 10 patients treated by arthroscopy (8 patients, 80%) had no associated intraarticular pathology. On the other hand, only 1 patient (10%)

developed anterior horn separation that was treated by partial meniscectomy. While only 1 patient (10% of patients) developed complex tear that was treated by total repair

On following up those patients, we found that patients subjected to arthroscopy had higher Lysholm score when compared to others performed traditional ORIF (88.4 ± 3.03 vs 85.7 ± 6.42) respectively. However, this was statistically insignificant ($p=0.221$) Also, we found that patients subjected to Arthroscopy had better Rasmussen scores compared to others subjected to traditional ORIF (18 ± 0.01 vs 17.2 ± 1.98) respectively

In harmony with our findings Elabjer et al., (2017)⁽³⁹⁾, study of 75 patients Schatzker type I–III with tibial plateau fractures. Where Cases were divided into 2 categories: one category was managed with ARIF (40 cases) and the other category with ORIF (35 cases). The average clinical and radiological Rasmussen scores show no statistically significant difference between the two groups. However, (ARIF) seems to offer a more accurate evaluation and management of associated intraarticular lesions.

Verona et al., (2019)⁽⁴⁰⁾ stud aimed to Analyze whether tibial lateral plateau fractures heal better with the arthroscopically aided reduction and internal fixation (ARIF) approach compared to the conventional open reduction and internal fixation (ORIF) method. Forty people who had broken their tibial plateau were included. Both the ARIF and ORIF groups had satisfactory to exceptional outcomes according to the Rasmussen radiological evaluation. Despite this, they found no evidence that the two surgical methods were significantly different.

The primary benefit of ARIF is that it permits direct visualisation of the articular surface during reduction with a less intrusive process than ORIF and facilitates detection and treatment of concomitant intra-articular lesions, which occur in 30%-

71% of patients with tibial plateau fractures⁽⁴¹⁾.

Conclusion

Fragment Specific Fixation for Tibial Plateau Fractures under guiding of three column classification showing excellent results for tibial plateau fracture mainly posterior column injuries using Lysholm scores for clinical evaluation and Rasmussen score for radiological evaluation. Moreover, arthroscopically assisted internal fixation (ARIF) had higher Lysholm score and Rasmussen scores when compared to others performed traditional ORIF.

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