

Tibial Plateau Fractures Treated With Minimally Invasive Percutaneous Plate Osteosynthesis (Mippo) Technique Prospective Study

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Abstract:

Background: Tibial plateau fractures are articular and are a risk to the functional integrity of the knee joint. These fractures often have additional soft tissue injury, which affects the patient's recovery after the initial injury. The objective of treating intra-articular fractures is to create a stable joint that allows for early range of motion to nourish and preserve cartilage. The advantages of treating these fractures under MIPPO technique are decreased operative time, less blood loss, smaller incisions, short hospital stay and early rehabilitation.

Objective: This study was done to know the clinical outcomes of treating Tibial plateau fractures with the MIPPO technique

Materials and Methods: This study was done at tertiary care teaching hospital in the Department of Orthopaedics at Great Eastern Medical School, Srikakulam, Andhra Pradesh, India from December 2022 to December 2023. 30 patients were included as per the eligibility criteria. Age, gender, type of fracture, weight-bearing to tolerate mobilization and intraoperative reduction: good or acceptable were assessed.

Results: Most of the patients were aged 51-60 years. 60% of the patients were males. In 60% cases mode of injury is RTA. 40% cases were classified under type I according to Schatzker's classification. Clinical outcome is good in 56.6% of cases.

Conclusion: CRIF/ORIF with Percutaneous cannulated screws is the preferred treatment for Schatzker's types I and II, with results that are excellent. Bone grafting and ORIF with Buttress plates can be used to treat Schatzker's type III, with good to fair results. Buttress plating and ORIF were used to treat type IV fractures in Schatzker, with fair to good results. There were several good to fair results in high-velocity injuries of Schatzker types V and VI.

Key Words: Outcomes, MIPPO, Tibial plateau fractures, Intra articular

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I. INTRODUCTION

Knee has a medial and lateral tibial plateau, on which the menisci sit and articulate with the femoral condyles. Tibial plateau fractures are not common injuries resulting from high or low velocity, axial compressive forces. They account for 1% of all fractures.¹ Of isolated tibial plateau fractures occur to the lateral plateau, 25% are isolated medial tibial plateau fractures. These tibial plateau fractures are articular and are a risk to the functional integrity of the knee joint.² It is quite challenging to treat these fractures.

High-velocity injuries occur due to road traffic accidents. The impact is initially felt on the patella, tibia, and femur in varied proportions. The typical pedestrian injury, known as a "Bumper Fracture," occurs when a moving object strikes a stationary lower limb. As most vehicles have bumpers that are around knee height, these fractures are possible.

Tibial plateau fractures are mainly classified either using the Schatzker's, or the OTA/AO systems.³The Schatzker system classifies these fractures from type I to VI, while the OTA/AO system classifies these fractures either as class A, B or C depending on the severity and the degree of the injury of articular involvement.

Proximal tibia is involved in body weight transmission through the knee joint and leg, it plays a key role in knee joint function and stability. Fractures of the proximal tibia are generally classified into two broad

categories, high energy fractures and low energy fractures. The main reason for these fractures is due to its subcutaneous location of the anteromedial surface of the tibia.

Older patients with osteopenic bone are more likely to sustain depression-type fracture because their subchondral bone does not resist axial directed load.

The objective of treating intra-articular fractures is to create a stable joint that allows for early range of motion to nourish and preserve cartilage⁴. Surgical treatment is gold standard for management of such fractures. This was done by conservative measures like cast bracing, traction, immobilization to surgical intervention for better results. Though these conventional methods achieved satisfactory results, it was still associated with shortcomings like large incisions, more blood loss and infection, hardware complications besides having some functional and alignment problems. Adding to this there is osteoporosis and bone necrosis at bone plate and screw interface leading to infection, toggling of screw, loss of fixation, collapse, malunion and non-union.

Percutaneous fixation offers its best in isolated un-displaced fractures, split uni-condylar fractures and in elderly osteoporotic bone. The advantages are decreased operative time, less blood loss, smaller incision, short hospital stay and early rehabilitation.

AIM AND OBJECTIVES

To study the outcome of Tibial Plateau Fractures treated with Minimally Invasive Percutaneous Osteosynthesis (MIPPO) Technique.

OBJECTIVES

1. To determine the pattern of tibial plateau fractures seen at Great Eastern Medical School and Hospitals.
2. To determine the different modalities of management of tibial plateau fractures.
3. To determine the patient functional status after tibial plateau fracture management.
4. To correlate the functional outcome to the pattern of injury.

II. METHODOLOGY

This is institutional based prospective study which comprises of 30 patients with tibial plateau fractures and were treated between December 2022 and DECEMBER 2023 with minimal invasive percutaneous plate osteosynthesis (MIPPO).

The Inclusion Criteria:

1. Patient with closed tibial plateau fracture.
2. Patients with age group > 20 years of both sexes.

The Exclusion criteria:

1. Open tibial plateau fractures.
2. Skeletally immature individuals
3. Tibial Plateau Fractures associated with knee dislocation
4. Patients with ipsilateral tibia and femur fracture

III. MANAGEMENT

Look for the general condition of the patient, if it is stable, take relevant X-rays

The type of fracture, the degree of displacement, and the degree of tibial plateau depression all had an impact on the treatment strategy. All types of fractures, as well as those with varying degrees of displacement and fracture instability, were treated surgically. T- buttress plates, L-buttress plates, 4.5 mm cortical screws, and 6.5 mm cannulated and non- cannulated cancellous screws made up the fixation devices.

Bone grafts were used in comminuted and depressed fractures. Bone graft was taken from femoral condyles or ipsilateral iliac crest.

Post operatively, patients were immobilized for three weeks with a compression bandage or an above-knee posterior slab. On the twelfth postoperative day, the sutures were taken out. Up to suture removal, broad-spectrum antibiotics were administered by intravenous infusion for five days and orally for seven days. The patients were advised to perform static quadriceps exercises for the first three weeks, then a passive range of motion exercises with a knee brace for protection, and non-weight bearing crutch walking for the remaining six weeks. After six weeks, it was advised to continue weight-bearing crutch walking and encourage in knee mobilization exercises. An immediate postoperative X-ray was taken, and later ones were taken during follow up visits at six weeks, three months, and six months.

IV. FOLLOW UP

- The first visit was performed at 2 weeks, and during this time look for the healing of the surgical scar and range of motion of knee joint

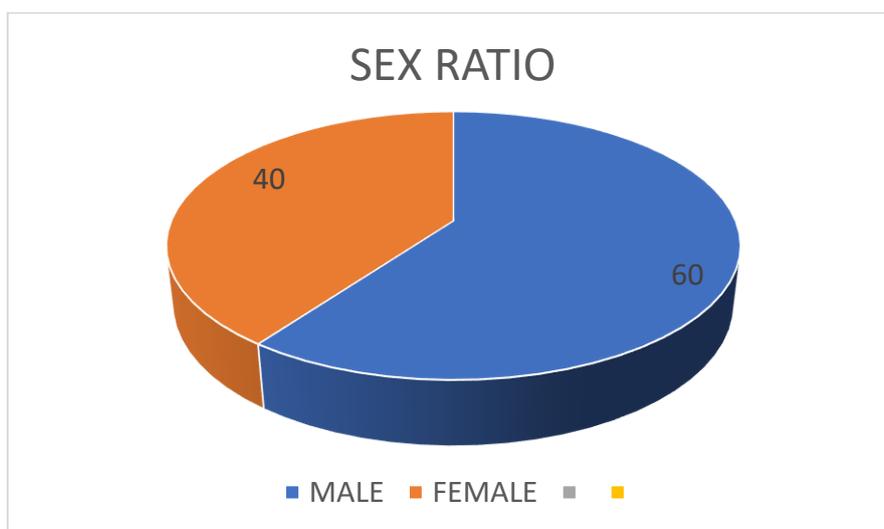
- At the second visit which was at 8 weeks an X-ray was obtained to check for any signs of fracture union and loss of reduction.
- At the third visit, which is after 3 months, xray was taken to look for fracture union

V. RESULTS

SEX RATIO

Table 1: Sex ratio

	FREQUENCY	PERCENT
MALE	18	60
FEMALE	12	40



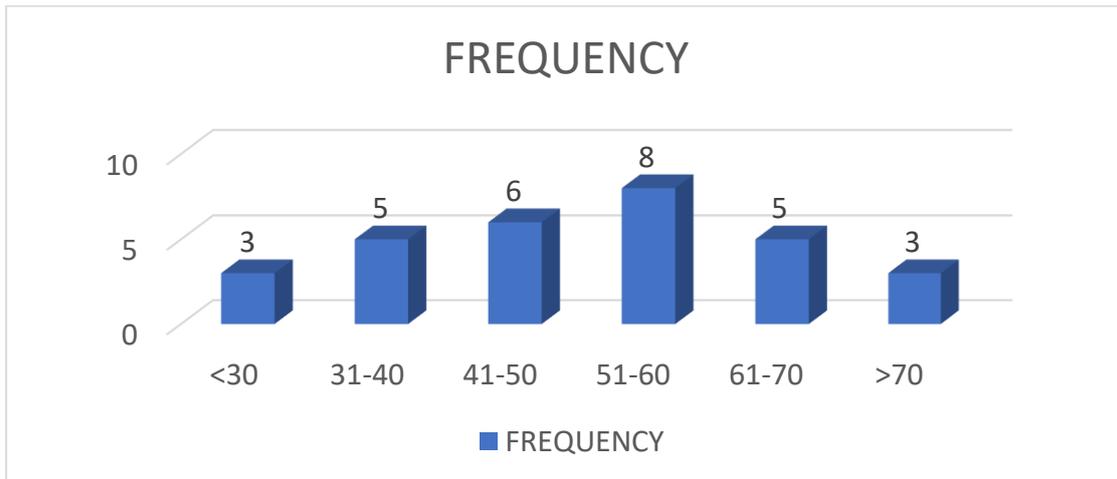
Graph 1: Sex ratio

In our study Males were 60% and females were 40%

AGE INCIDENCE

AGE.	FREQUENCY	PERCENTAGE
<30	3	10
31-40	5	16.6
41-50	6	20
51-60	8	26.6
61-70	5	16.6
>70	3	10

Table 2: Age incidence



Graph 2: Age incidence

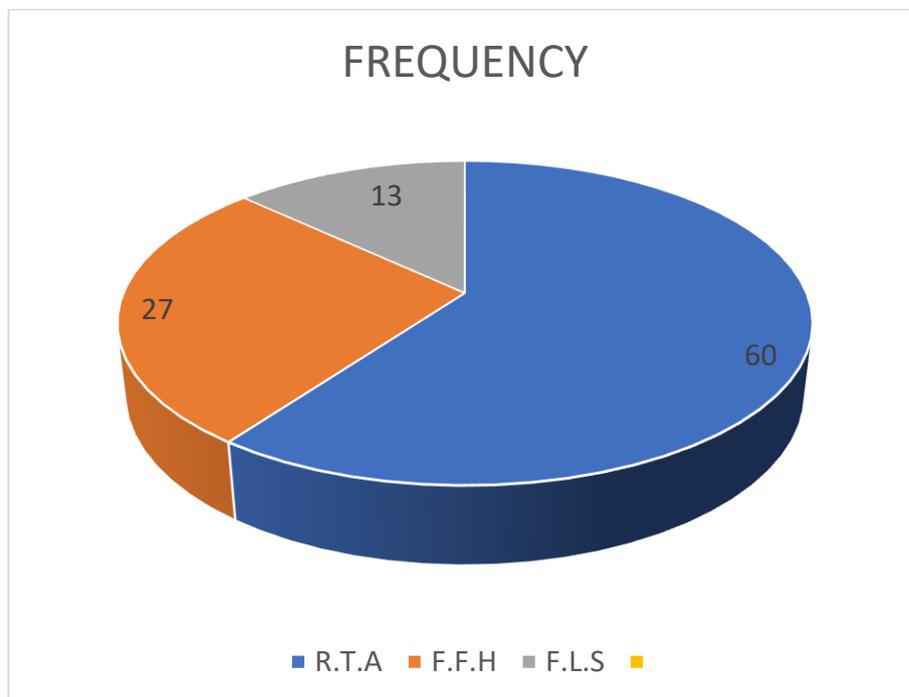
Around half our cases, patients were aged between 40-60 years. Least percentage of cases were noted in less than 30 years and greater than 70 years

MODE OF INJURY

MODE OF INJURY	FREQUENCY	PERCENT
R.T.A	18	60
F.F.H	8	27
F.L.S	4	13

Table 3: Mode of injury

R.T.A; road traffic accident
 F.F.H; fall from height
 F.L.S; fall from level surface



Graph 3: Mode of injury

Road traffic accident is the most common mode of injury in our cases , constituting about 60%

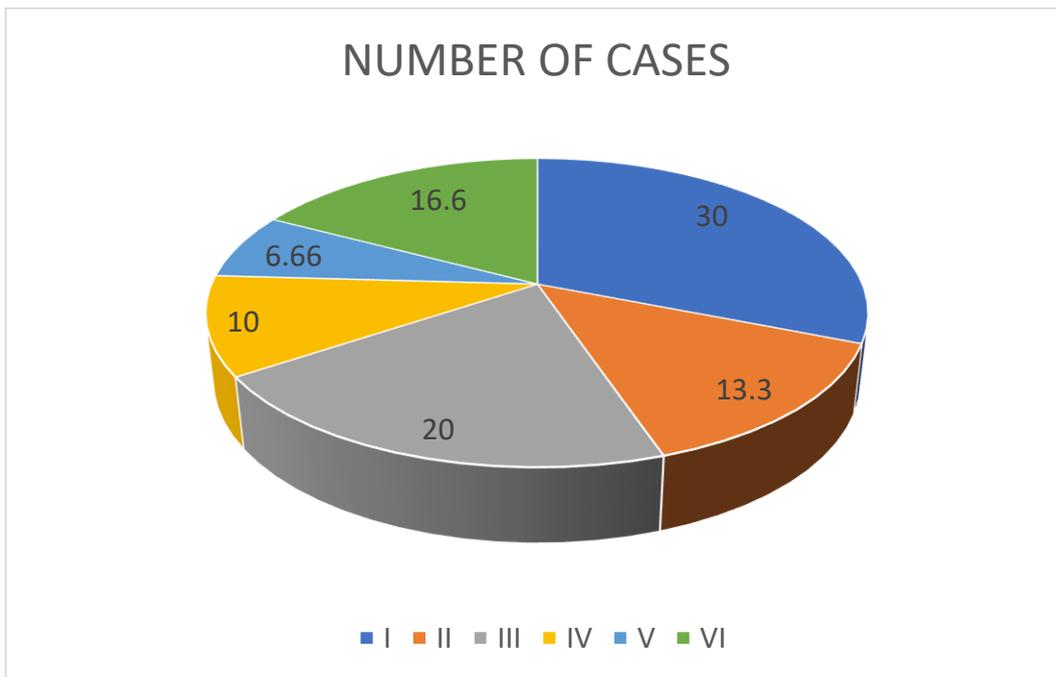
TYPE OF FRACTURE: SCHATZKER'S CLASSIFICATION

TYPE OF FRACTURE	NUMBER OF CASES	PERCENTAGE

I.Split	9	30
II.Split with depression	4	13.3
III.Pure depression	6	20
IV.Medial condyle fracture	3	10
V.Bicondylar fracture	2	6.66
VI.Metaphysio diaphyseal dissociation	5	16.6

Table 4: Classification of fracture

Majority of cases were of type I fracture and least number of cases were of type V

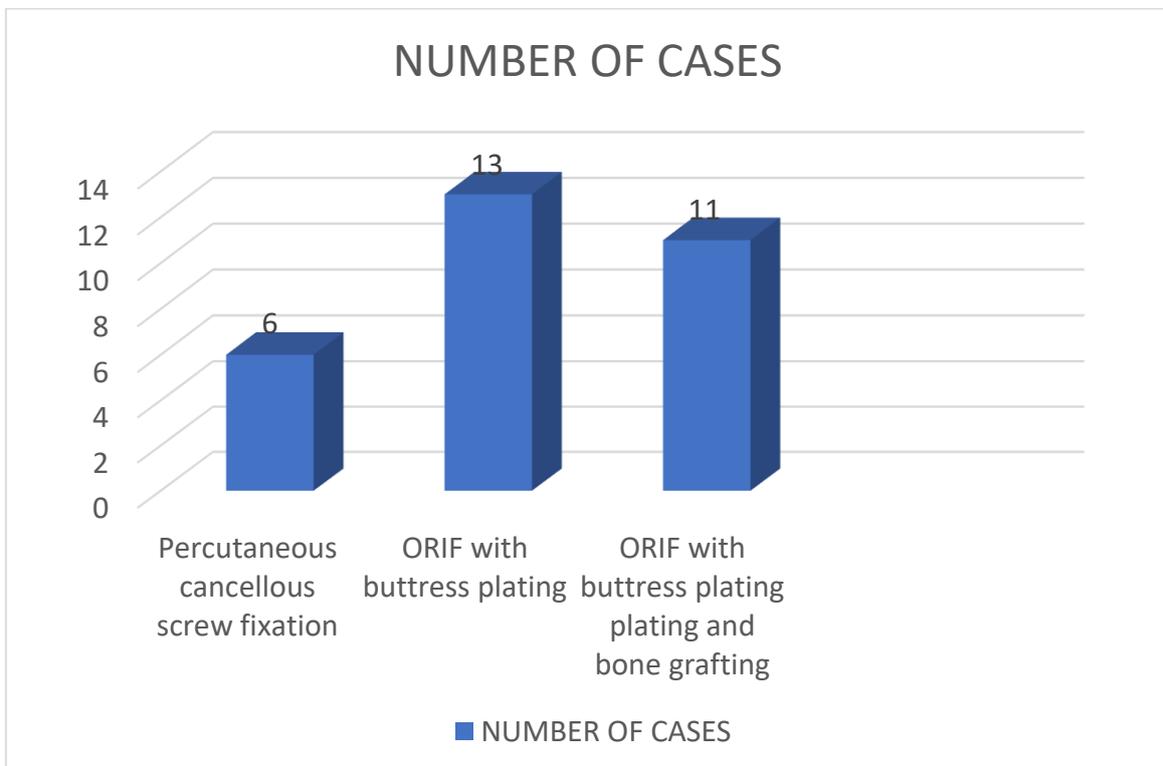


Graph 4: Classification of fracture

METHODS OF TREATMENT

METHOD OF TREATMENT	NUMBER OF CASES	PERCENTAGE
Percutaneous cancellous screw fixation	6	20
ORIF with buttress plating	13	43.3
ORIF with buttress plating and bone grafting	11	36.6

Graph 5; Methods of Treatment

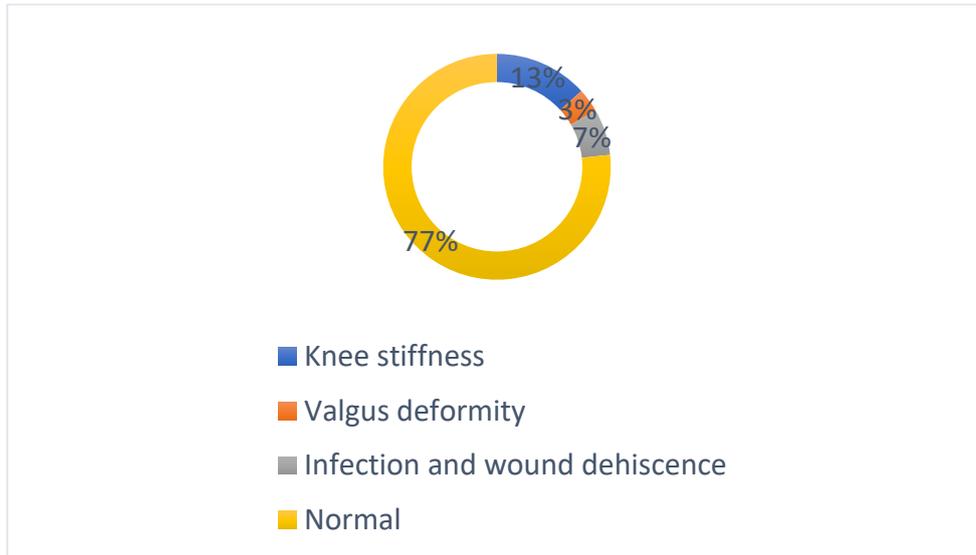


Out of 30 cases, Percutaneous cancellous screw fixation is done for 6 cases, ORIF with plating done for 13 cases, bone grafting and plating done for 11 cases

FREQUENCY OF COMPLICATIONS

Complications	No. of cases	Percentage
Knee stiffness	4	13.3
Valgus deformity	1	3.4
Infection and wound dehiscence	2	6.6

Table 6: Frequency of Complications



Graph 6; Frequency of complications

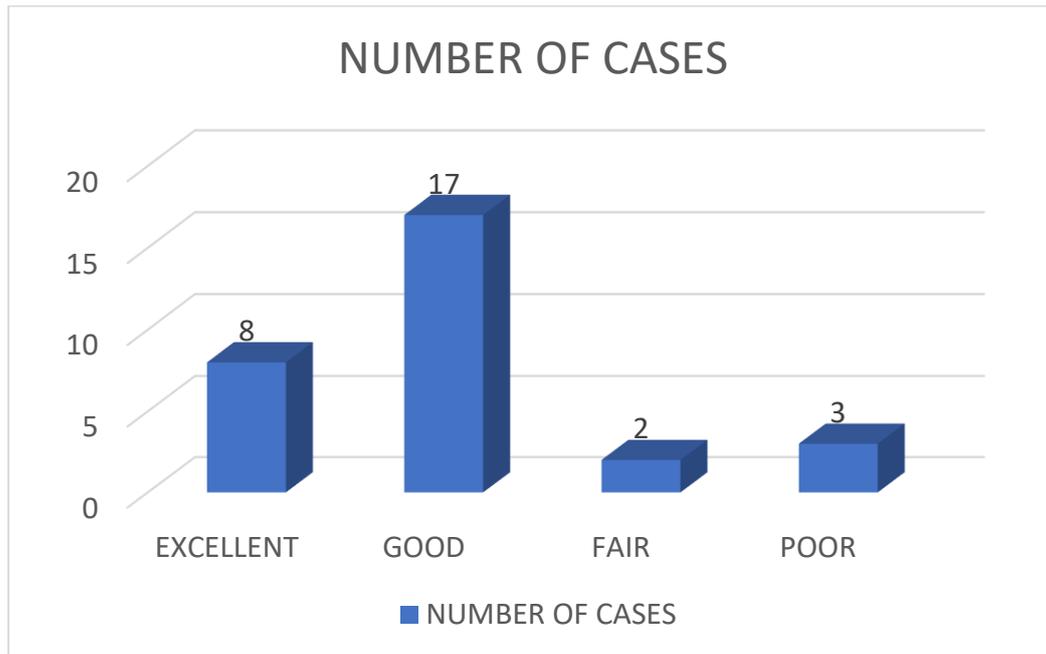
Knee stiffness noted in 4 cases, Physio therapy has been advised and Knee ROM has been encouraged. Infection is noted in 2 cases , which has been subsided later after 2 weeks of IV antibiotics

CLINICAL AND RADIOLOGICAL RESULTS

CLINICAL RESULTS

CLINICAL RESULTS	NUMBER OF CASES	PERCENTAGE
Excellent	8	26.6
Good	17	56.6
Fair	2	6.6
Poor	3	10

Table7; Clinical results



Graph 7; Clinical results

RADIOLOGICAL RESULTS

RADIOLOGICAL RESULTS	NO.OF CASES	PERCENTAGE
Excellent	8	26.6
Good	14	46.6
Fair	7	23.3
Poor	1	3.33

Table 8; Radiological results

Clinical and Radiological assessment has been done based on Modified Rasmussen criteria for Clinical and Radiological scoring. Out of 30 cases, 8 cases gave excellent results and 17 cases gave good results, based on Clinical assessment



PRE-OPERATIVE X-RAY



IMMEDIATE POST-OPERATIVE X-RAY

3 MONTHS FOLLOW UP



INTRA OPERATIVE IMAGES

VI. DISCUSSION

In our institute we operated 30 individuals with similar fractures for this study. Age of the patient, sex distribution, mode of injury, type of fracture, method of fracture fixation, associated complications, and functional outcomes were taken into consideration while analyzing the data.

Mean age in various studies, In Jain RK⁵ study the mean age is 38.9 years and in Stevens⁶ study the mean age is 40 years. In the study conducted by Myatt⁹ the mean age is 43.6 years. Our study result is in consistent with the results of other studies that there is increase in incidence of these fractures in age between 20 to 60 years

Gender distribution in various studies when analysed, In our study majority were males (60%) this is consistent with the results of other studies, Jain RK study has 79% males and Unnikrishnan⁷ has 76% males. This stays true with the fact that in India males are likely to engage in outdoor activities

Road traffic accidents stand out as most common mode of injury in Tibial plateau fractures with 60% in our study. In the study conducted by Rademakers¹⁰ RTA is more of injury in 55% cases and 86% in the study conducted by Manidakis¹¹

DISTRIBUTION OF PATIENTS, ACCORDING TO SCHATZKER TYPE.

TYPE	EBRAHEIM ⁸	MYTATT ⁹	JAIN RK	OUR STUDY
I	27%	7.5%	29.3%	30
II	30.76%	30%	27.59%	13.3
III	9.4%	2.5%	13.79%	20
IV	5.12%	20%	6.9%	10
V	18.8%	27.5%	8.62%	6.66

VI	12.8%	12.5%	13.79%	16.6
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On analysing complication rates in various studies, Infection rates ranges from 3% to 30%. So this becomes the potential problem in management of Tibial plateau fractures. It is 19% in study conducted by Jain RK and 23.3% in our study. Infection is settled down with help of IV antibiotics..

In our study, functional outcome is satisfactory in 83.2% cases (Excellent in 26.6% and Good in 56.6%). In Study conducted by Lachhiewicz ¹² it is 93%. And satisfactory results of 84% in studies conducted by Jain RK and Rademkaers .

VII. CONCLUSION

30 patients with tibial plateau fractures were treated surgically and monitored for six months. All of our patients underwent surgical treatment; 6 underwent closed reduction and internal fixation with percutaneous cannulated cancellous screws, 13 underwent ORIF with Buttress plate and Bone grafting, and the remaining 11 underwent ORIF with Buttress plating. 6 months follow up was done. Based on modified Rasmussen clinical and radiographic criteria, the function of the knee was evaluated.

In this study we found that the preferred method of care for displaced fractures of Schatzker types I and II was closed reduction and internal fixation with percutaneous cannulated screws. When treated surgically with ORIF, buttress plates, and bone grafting, Schatzker's type II fractures have good outcomes. By using Buttress plates and bone grafts, ORIF was used to treat Schatzker's types IV and V. This allowed for early mobilization, stable fixation, and precise anatomical repair of the tibial articular surface and yields good results.

In patients who underwent surgery, there were very minimal problems. In patients who suffered high-velocity injuries, osteoarthritis was less common after articular surface repair. To determine the exact incidence of posttraumatic osteoarthritis and other late sequelae, it would be desirable to follow up for a longer period of time.

REFERENCES

- [1]. Albuquerque PR, Hara R, Prado J, Schiavo L, Giordano V, Pecegueiro Do Amaral N. Epidemiological Study On Tibial Plateau Fractures At A Level I Trauma Centre. *Acta Ortopedica Brasileira*. 2013;21(2):109-15.
- [2]. Prat-Fabregat S, Camacho-Carrasco P. 2016. Treatment Strategy For Tibial Plateau Fractures: Anupdate. *Effort Open Review*. 1:225-232.
- [3]. Müller ME, Nazarian S, Koch P, Schatzker J. 2012. *The Comprehensive Classification Of Fractures Of Long Bones*. Berlin, Heidelberg: Springer Science & Business Media. 60 – 61.
- [4]. Ambulgekarl RK, Kothari P, Berlia R. 2016. A Study Of Outcome Of Tibial Plateau Fracture With Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) Technique. *In- Dian Journal Of Orthopaedics Surgery*. 2(3):236-239.
- [5]. Jain RK, Shukla R, Baxi M, Agrawal U, Yadav S. Evaluation Of Functional Outcome Of Tibial Plateau Fractures Managed By Different Surgical Modalities. *Int J Res Orthop* 2016;2:5-12
- [6]. Stevens DG, Beharry R, Mckee MD, Waddell JP, Schemitsch EH. The Long-Term Functional Outcome Of Operatively Treated Tibial Plateau Fractures. *J Orthopaed Trauma*. 2001;15(5):312-20.
- [7]. Unnikrishnan J, Jacob PJ, Francis J. Functional Outcome Of Tibial Condyle Fractures Following Open Reduction And Internal Fixation With Plate And Screws. *Kerala J Orthopaed*. 2013;26(2):98-106.
- [8]. Ebraheim NA, Sabry FF, Haman SP. Open Reduction And Internal Fixation Of 117 Tibial Plateau Fractures. *Orthopedic* 2004; 27(12): 1281-7.
- [9]. Myatt RW, Miles J, Matharu GJ, Cockshott S, Kendrew J. The Financial Cost Of Managing Tibial Plateau Fractures At A Major Trauma Centre. *Trauma*. 2014;17(1):33-8.
- [10]. Rademakers MV, Kerkhoffs GM, Sierevelt IN, Raaymakers EL, Marti RK. Operative Treatment Of 109 Tibial Plateau Fractures: Five-To 27-Year Follow-Up Results. *J Orthop Trauma*. 2007;21:5-10.
- [11]. Manidakis N, Dosani A, Dimitriou R, Stengel D, Matthews S, Giannoudis P. Tibial Plateau Fractures: Functional Outcome And Incidence Of Osteoarthritis In 125 Cases. *Int Orthop*. 2010;34(4):565-70.
- [12]. Hu CJ, Chang WN, Wong CY. Surgical Treatment Of Tibial Plateau In Elderly Patient. *J Orthop* 2001; 15(5):312-20
- [13]. Gupta RK, Dev B, Singh H. 2013. Displaced Tibial Plateau Fractures: Is There A Role Of Conservative Treatment In The Present Scenario. 15: 28-32.
- [14]. Aseri MK, Singh V, Sharma PK. Functional Outcome Of Proximal Tibial Fracture Treated Surgically Using Locking Compression Plate. *Int J Res Orthop* 2018;4:400-5.
- [15]. Dr. Sardar Jaideep Singh And Dr. Bala Chandranna .A Study Of Surgical Management Of Proximal Tibial Fractures Treated With Locking Compression Plate. 2020; *Int. J. Adv. Res.* 8(05), 198-202.
- [16]. Myatt RW, Miles J, Matharu GJ, Cockshott S, Kendrew J. The Financial Cost Of Managing Tibial Plateau Fractures At A Major Trauma Centre. *Trauma*. 2014;17(1):33-8.