Original Research Article

Management of tibial plateu fractures in a tertiary care hospital

Rahul Salunkhe[**], Ashwin Deshmukh[*], Sanjay Deo[##], Sachin Sonawane[*], Saurabh Damdhere[#]

[**]Associate Professor, [*]Assistant Professor, [##]Professor, [#]Jr. Resident, Department Of Orthopaedics, Dr D.Y. Patil Medical College, Hospital And Research Center, Dr. D.Y.Patil Vidyapeeth, Pimpri—411018, Pune, Maharashtra, INDIA.
Email: drashwin_d@yahoo.com

Abstract

Background: Tibial plateau fractures remain challenging because of their number, variety and complexity. The indications for non-operative versus operative treatment vary widely in literature. Different surgeons have advocated different treatment protocols, some in support of conservative and some against. **Aim:** To compare the surgical management of tibial plateau fractures with percutaneous CC screw fixation (PCCS), ORIF with plating and CC screw (PF + CC screw) fixation and universal mini external fixator (UMEX). **Material and Methods:** A total of 30 cases with closed tibial plateau fractures were grouped as Group 1 (n=10): Percutaneous CC Screw Fixation, Group 2 (n=10): ORIF with CC Screw and Plate Fixation and Group 3 (n=10): CREF with External Fixator (UMEX). Their radiological and functional outcomes were compared. **Results:** The average time of radiological union for PCCS was 13 weeks, for PF+CC screw fixation was 16.2 weeks and for UMEX (n=10) was 15.6 weeks. Mean Rasmussen's functional score was 24.866.For the PCCS group, PF + CC screw and for the group UMEX group was 27.000, 23.800 and 23.800 respectively. Our observations showed that good functional results can be expected in patients with tibial plateau fractures, treated with PCCS. **Conclusion:** Near anatomical restoration of the articular surface of the tibial plateau fracture can be achieved with PCCS or with PF + CC screw fixation. All the three techniques used for the treatment of tibial plateau fracture have their own advantages and drawbacks as they are limited to the pattern of the fracture and its extent.

Key Words: Tibial plateau fracture, Percutaneous CC Screw Fixation, CC Screw and Plate Fixation, UMEX, radiological union, Rasmussen's functional score.

[*]**Address for Correspondence:**
Dr. Ashwin Deshmukh, A-501, Waterfront Society, Vithalrao Vandekar Road, Near Nittro Gym, Kalyani Nagar, Pune – 411006, Maharashtra, INDIA.
Email: drashwin_d@yahoo.com

Received Date: 10/05/2018 Revised Date: 13/06/2018 Accepted Date: 04/07/2018
DOI: https://doi.org/10.26611/1020711

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 07 July 2018

INTRODUCTION

Fractures of the proximal tibia, particularly those that extend into the knee joint are termed as tibial plateau or tibial condylar fractures. These fractures constitute about 1% of all fractures and 8% of the fractures in elderly.[1] The objectives of tibial plateau fracture treatment is precise reconstruction of the articular surfaces, stable fragment fixation allowing early mobilization and repair of all concomitant ligamentous and other soft tissue lesions. The indications for non-operative versus operative treatment of tibial fractures vary widely in literature.[2] Different surgeons have advocated different treatment protocols, some in support of conservative and some against. In the past two decades, with improvements in surgical techniques and implants, there has been a trend towards surgical management of these injuries. No proven uniform successful method of treatment exists. Nevertheless, tibial plateau fractures remain challenging because of their number, variety and complexity. As these are problem fractures we have undertaken a study on the management of tibial condylar fractures.

MATERIAL AND METHODS

This Prospective study included 30 cases with closed tibial plateau fractures admitted in Department of Orthopedics at Padmashree Dr. D. Y. Patil Medical College, Hospital and Research Centre, Pune over a period of two years. The study was approved by the local ethical committee and the patients gave their informed consent to participate.

How to site this article: Rahul Salunkhe, Ashwin Deshmukh, Sanjay Deo, Sachin Sonawane, Saurabh Damdhere. Management of tibial plateu fractures in a tertiary care hospital. *MedPulse International Journal of Orthopedics*. July 2018; 7(1): 01-05.
https://www.medpulse.in/Orthopedics/

Inclusion Criteria

- The patients with closed tibial plateau fractures.
- The patients of 18-55 years age group of both sexes.
- The patients with indications for operative intervention.
- Closed and open (compound) injuries.

Exclusion Criteria

- Paediatric age group and patients with age more than 55 years old.
- Patient's non willingness or inability to follow direction of restricting activity and controlled mobility in healing period.
- Fractures of the shaft of the tibia below the level of tibial plateau.
- Foreign body sensitivity.

Indications for Operative Intervention

- Inability to maintain fracture alignment with functional bracing. Non-compliance or intolerance to orthosis - multiple injuries, spinal cord injuries, multiple long bone fractures, injury requiring prolonged recumbence.
- Ipsilateral Femur Fractures (Floating Knee)
- Bilateral Tibia Fracture
- Segmental Fracture

Detailed history, clinical examination and investigations were done. After anaesthetic fitness the patients were posted for surgery as early as possible.

Groups

Group 1 (n=10): Percutaneous CC Screw Fixation,

Group 2 (n=10): ORIF with CC Screw and Plate Fixation and

Group 3 (n=10): CREF with External Fixator (UMEX)

Operative details: All operations were performed under pneumatic tourniquet. All the CC screw fixations and CREF with UMEX were done percutaneously following a closed reduction technique. For Open Reduction and Internal fixation with plating either anterolateral incision or anteromedial approach was used depending on the fracture. First, reconstruction of the articular surface was undertaken, followed by re-establishment of tibial alignment. Adequate buttressing of elevated articular segments with bone graft or bone graft substitute was used.

Implants used for fracture fixation

1. **Screws:** Cortical screws - 4.5 mm diameter of various lengths and Cancellous screws:- 16mm, 32mm partially threaded and fully threaded.
2. **Buttress plate:** T Plate, L Plate and Hockey Plates were used. T plate has a horizontal and vertical limb. It is thin plate and helps in preventing a thin cortex or defect in cancellous bone from collapsing. L plate is of 2 types left and right offset with a double bend to fit onto the plateau. Hockey stick plate is stout and stronger and majority of times used to buttress lateral plateau.
3. **External Fixator:** Universal mini external fixators were used for fractures with moderate to severe communition.

Post-operative Management: Drain was removed after 48 hours of surgery. Daily pin tracts dressings were done, dressings of surgical wounds were done on 2nd, 5th, 8th post-operative day. Above knee slab was discarded after suture removal on 12th day. The patients were discharged with the advice not to do heavy work and were followed up in OPD after 1week, 3 weeks, six weeks, and after that every month for at least 6 months.

Follow-up and Implant removal: After one month of follow up, If X-ray revealed fracture uniting, the active ranges of movements were advised. Weight bearing and strenuous activities were still withheld. After 2 months, if there was clinical and radiological union, then in cases of UMEX, the frame was removed and PTB (patella tendon bearing) cast was given for 2 weeks and weight bearing started. After 10 weeks, cast was removed and regular weight bearing was advised. Implant removal of the UMEX frame was done after 6 weeks or after radiological and clinical union was achieved. Other implants like PCCS or bone plates were removed if there was local discomfort over the implant with activity in a young patient, especially if 6.5 to 7.0 mm cannulated screws were used and in low energy lateral plateau fracture implants were removed at the end of one year whereas in Schatzker type V and VI implants removed at eighteen to twenty four months. After implant removal full weight bearing was restricted for yet another four to six weeks.

RESULTS

Majority of the fractures occurred in the age group of 21-40 years with maximum incidence being in the productive age group of 21-30.Male population was 60% and the female population was 40%.

Table 1: Age Incidence

Age group (years)	No. of patients (Percentage)	CC Screw	PF + CC Screw	UMEX
11 – 20	2 (6.66%)	2	0	0
21 – 30	11 (36.66%)	4	3	4
31 – 40	10 (33.33%)	4	3	3
41 – 50	3 (10%)	0	2	1
51 – 60	4 (13.33%)	0	2	2
Total	**30**	**10**	**10**	**10**

In our study, majority of the fractures were found to be of Type IV (30%), followed by the Type VI (23.33%) and Type V (20 %). Rest of the fracture types i.e. Type I, Type II and Type III were not that common and accounted for a total of 26.67% of all the 30 cases.

Table 2: Incidence of Type of fracture

Schatzker's Classification	Total	PCCS	PF + CC	UMEX
Type I	5 (16.66%)	5	0	0
Type II	2(6.66%)	2	0	0
Type III	1(3.33%)	1	0	0
Type IV	9(30%)	2	7	0
Type V	6(20%)	0	3	3
Type VI	7(23.33%)	0	0	7
Total	**30**	**10**	**10**	**10**

All the fractures treated at our institute in our study united well within the expected time. There was no case of delayed union or nonunion noted.15 patients operated showed no complications.4 out of 30 patients had pin tract infection, 9 out of 30 patients had joint stiffness and 2 patients had joint stiffness as well as pin tract infection.

Table 3: Complications associated with the tibial plateau fractures

Complications	Total	PCCS	PF + CC	UMEX
None	15	0	0	0
Joint stiffness (JS)	9	1	7	1
Pin tract infection (PTI)	4	0	0	4
JS + PTI	2	0	0	2
Total	**30**	**1**	**7**	**7**

According to the Rasmussen`s functional score, in our series of total 30 patients none of the patients operated showed a poor result. Out of 10 patients treated with PCCS, 60% showed excellent results and 40% showed good results. None of the patients showed fair or poor results. All the patients treated with PF + CC screw fixation showed good results and in the group of patients treated with UMEX, 10% showed excellent result, 70% showed good result and 2% patients showed fair results.

Table 4: Functional results

Result	PCCS	PF + CC	UMEX	Total	Percentage
Excellent	6	0	1	7	23.33
Good	4	10	7	21	70
Fair	0	0	2	2	6.66
Poor	0	0	0	0	0

Healing of the fracture was assessed radiologically by the evidence of callus formation at the fracture site. The average radiological union time in our study of 30 case is 15 weeks. The average radiological union time for each modality used in our study is 14.2 weeks for PCCS, 16.2 for PF + CC screw fixation and 15.6 weeks for UMEX.

Table 5: Incidence of radiological union

Follow up	PCCS	PF + CC	UMEX
12 weeks	6 (60%)	0	1 (10%)
14 weeks	3 (30%)	2 (20%)	2 (20%)
16 weeks	1 (10%)	5 (50%)	5 (50%)
18 weeks	0	3 (30%)	2 (20%)
Total	**10**	**10**	**10**

DISCUSSION

Tibial plateau fractures are one of the most common fractures as a result of road traffic accident, fall from height, sports injury or assault. Keeping our aims high, we hereby present a prospective study comparing the surgical management of tibial plateau fractures with percutaneous CC screw fixation (PCCS), ORIF with plating and CC screw (PF + CC screw) fixation and universal mini external fixator (UMEX). Average age to be operated with PCCS was 28 years, whereas Sament R *et al*[3]showed an incidence of 19-60 years with average age of 36 years and Almisfer AK *et al*[4] showed a range of 23-55 years and an average of 34 years. The age incidence of patients to be operated with Plating + CC Screw was 22-55 years, with average age of 37.1, Lee JA *et al*[5]showed an age incidence of 18-82 years with an average of 42 years. Raza H *et al*[6] showed an incidence of 19-75 with an average of 40 years. The incidence of patients to be operated with UMEX was 25 - 52 years with an average age of 35.5 years. Seppo *et al*[7] reported an incidence of 20-60 years with an average of 39.8 years and Kataria *et al*[8] reported an average of 32 years. In our study, majority of our patients were male i.e. 18 out of 30 i.e. 60%. This can be attributed to our typical Indian setup where the male population largely works outdoors making them more prone to RTAs or FFHs and the female population confined to indoor household work. Mathur H *et al*[9] (74.1%) and Kataria *et al* (84.2%) also showed a higher male incidence in treatment of tibial plateau fractures in their study.[8] In our study patients treated with PCCS we found 50% patients with Type I fracture, 20% with Type II and Type IV each and 10% with Type III. Sament R *et al* in their study of treatment of tibial plateau fractures treated with PCCS fixation showed almost equal incidence of Type II and Type V fractures i.e. 39.28% and 35.71% respectively, and 16.07% and 8.92% with Type I and Type IV respectively.[3]Almisfer AK *et al* showed an incidence of 82.60% patients with Type I and 17.40% of Type II fractures.[4] In our study patients treated with PF +CC screw fixation were predominantly of the type IV (70%) and type V (30%). Raza H *et al* reported a large incidence of type III (26.83%) and of type II (21.95%) fractures. Type I, IV, V and VI accounted for 7.31%, 14.63%, 17.07% and 12.20% respectively out of the total 41 patients treated.[6] In our study, the patients treated with UMEX were 70% of type VI and 30% of type V, which correlated to the study by Zahid *et al* which showed patients treated with JESS to be of type V 57.14% and type VI 42.86% in their study of treatment of tibial plateau fractures with JESS, which is also a type of mini external fixator.[10] In our study of 30 cases, we observed joint stiffness in a total of 9(30%) patients and 2 patients

(6.66%) reported with both joint stiffness and pin tract infection. 4(40%)had pin tract infection. One patient had pin tract infection along with stiffness of the fractures treated with UMEX and out of total 30 patients of tibial plateau fractures. Mikulak SA *et al*[11]had an incidence of 33% pin tract infection in their study on proximal tibia fractures treated with small wire external fixators. Mankar SH *et al*[12]studied 78 tibial plateau fractures treated with closed reduction and external fixator and got pin tract infections in only 9% of the patients. Knee stiffness is perhaps the most common complication seen after the surgery for tibial plateau fractures. In our study the average range of motion of the patients undergoing PF + CC is 98 degrees after the mean follow up after 3 months (12 weeks).In the study done by Cole *et al*[13]for tibial plateau fractures managed with less invasive stabilization system in 77 cases observed average range of motion was 1 degrees to 122 degrees. Raza H *et al* achieved a knee range of motion of an average of 118 degrees in his study treating 41 tibial plateau fractures with MIPO (Minimally Invasive Plate Osteosynthesis).[6] According to the Rasmussen's functional score, in our series of total 30 patients none of the patients operated showed a poor result. Sament R *et al* in their study of treatment of tibial plateau fractures PCCS got excellent results in 37% patients, good results in 52% and unacceptable results in 11% patients.[3]AlmisferAK *et al* in their study of closed reduction and percutaneous fixation of non-osteoporotic tibial plateau fractures got 70% excellent results and 30% good results.[4]Raza H *et al* in their study of treatment of tibial plateau fractures with MIPO got 44% excellent, 46% good and 10% unacceptable results.[6]Mathur H *et al* got excellent results in 37%, good in 52 and unacceptable in 11% of the fractures of the tibial plateau treated operatively using methods and principles advocated by AO/ASIF.[9]MankarSH *et al* showed excellent results in 62.8%, good results in 33.30% and poor results in 1.33% of the total patients treated with external fixators.[12] Healing of the fracture was assessed radiologically by the evidence of callus formation at the fracture site. The average radiological union time in our study of 30 case is 15 weeks. The average radiological union time for each modality used in our study is 14.2 weeks for PCCS, 16.2 for PF + CC screw fixation and 15.6 weeks for UMEX. Sament R *et al* studied fracture fixation for tibial plateau fractures with percutaneous screw fixation and the mean radiological union time was 12 weeks.[3]Lee JA *et al* studied treatment of tibialplateau fractures with less invasive stabilization system and the mean age for radiological union was 18 weeks.[5]ArifinHM *et al*[14]treated 33 patients with modified hybrid fixator for high energy Schatzker type V and VI tibial plateau fractures. The mean time for radiological union was 14 weeks. Mankar SH *et al* studied treatment of tibial plateau fractures with external fixators in which the mean radiological union time was 13.69 weeks.[12]

CONCLUSION

In the group of PF + CC screw fixation all the patient showed good results and the group treated with UMEX showed 1 excellent results, 7 good results and 2 showed fair results. So, we therefore observed that near anatomical restoration of the articular surface of the tibial plateau fracture can be achieved with PCCS or with PF + CC screw fixation. In the group of UMEX, the articular surface can be either restored by joystick manipulation of the fragment and the metaphyseal extension can also be supplemented with plate fixation along with the UMEX. All the three techniques used for the treatment of tibial plateau fracture have their own advantages and drawbacks as they are limited to the pattern of the fracture and its extent.

REFERENCES

1. Jacofsky DJ, Haidukerwych GJ. Insalland Scott Surgery of the knee. Philadelphia: Churchill Livingstone; 2006. Tibia plateau fractures. In: Scott WN; pp. 1133–46.
2. Gicquel P, Giacomelli MC, Basic B, Karger C, Clavert JM. Problems of operative and non-operative treatment and healing in tibial fractures. Injury. 2005 Feb; 36 Suppl 1:A44-50.
3. Sament R, Mayanger JC, Tripathy SK, Sen RK. Closed reduction and percutaneous screw fixation for tibial plateau fractures. J Orthop Surg. 2012; 20(1):37-41.
4. Almisfer AK,Almukaimi AZ, Hussain T. Closed Reduction and Percutaneous Fixation of Non-Osteoporotic Tibial Plateau Fractures. Kuwait Medical Journal 2004; 36(1):15-18.
5. Lee JA, Papadakis SA, Moon C, Zalavras CG. Tibial plateau fractures treated with the less invasive stabilisation system. IntOrthop. 2007; 31(3):415–418.
6. Raza H, Hashmi P, Abbas K, Hafeez K. Minimally invasive plate osteosynthesis for tibial plateau fractures. J Orthopaed Surg. 2012; 20(1):42-7.
7. Honkonen SE. Indications for surgical treatment of tibial condyle fractures. ClinOrthop 1994; 302:199-205.
8. Kataria H, Sharma N, Kanojia RK. Small wire external fixation for high energy tibial plateau fractures. J Orthop Surg. 2007; 15:137-43.
9. Mathur H, Acharya S, Nijhwan VK, Mandal SP. Operative results of closed tibial plateau fractures. IndJOrthopaed. 2005; 30:108-112.
10. Zahid M, Sherwani MKA, Siddiqui YS, Abbas M,Asif N, Sabir AB. The role of the JESS (Joshi`s External Stabilization System) fixator in the management of Tibial Plateau fractures which are associated with severe soft tissue injuries. J ClinDiagnos Res 2010; 4:3356-3361.

11. Mikulak SA, Gold SM. Small wire external fixation of high energy tibial plateau fractures. ClinOrthop 1998; 356:230-238.
12. Mankar SH, Golhar AV, Shukla M, Badwaik PS, Faizan M, Kalkotwar S. Outcome of complex tibial plateau fractures treated with external fixator. Indian J Orthop 2012; 46:570-574.
13. Cole PA, Zlowodki M, Kregor PJ. Treatment of proximal tibia fractures using the less invasive stabilization system. J OrthopTrauma. 2004; 8:521-527.
14. Arifin HM, Mahdi NM, Rhani SA, Baharudin A, Shukur MH. Modified hybrid fixator for high energy Schatzker V and VI tibial plateau fractures.Strategies Trauma Limb Reconstr. 2011; 6(1): 21-26.

Source of Support: None Declared
Conflict of Interest: None Declared