

Original Research Article

A Study on Surgical Management of Tibial Plateau Fractures

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Received: 09-11-2021 / Revised: 25-12-2021 / Accepted: 15-01-2022

Abstract

Aim: The main aim of the present study to observe the surgical management of intra articular fractures of the proximal tibia in 32 cases. A review of the literature of the management of upper tibial fractures with special reference to surgical management has been presented. **Methodology:** The surgical management of tibial plateau fractures were included from inpatients of Mahatma Gandhi Memorial Hospital, Warangal. Patients above 18 years of either sex included in the study. Radiological diagnosis of fractures with classification based on Schatzker's classification. **Results:** Tibial plateau fractures has a slight predominance of right side over left side i.e. 60% and 40% respectively. Automobile accidents or road traffic accidents appeared the commonest cause of tibial plateau fractures. Males are more prone for tibial plateau fractures, i.e. 90.63% in contrast to females 9.37%. Majority of the fractures were pure cleavage (type-I) and cleavage combine with depression (type-II) fractures, in our series. The patients were admitted and operated within 2 or 5 days, or depending upon the wound status or general condition of the patient. Each case is individualized and treated. All operated patients were mobilized postoperatively as soon as possible, mostly on the 3rd postoperative day. Period of joint immobilization plays a major role in the end result. Rigid internal fixation is mandatory whenever possible. Excellent results were obtained in 44% of cases and good in 44% of cases. Depressed and split depressed fractures with 3mm were taken as borderline. X-ray beam has to be tilted to 10°-15° while taking AP view in doubtful fractures and to know particular surface status. Meniscal tears if present can be diagnosed and repair or excisions has to be done. Status of ligaments, soft tissues around the knee play a pivot role in the functional outcome, so has to be documented and treated appropriately. **Conclusion :** Minimal invasive procedures like MIPPO have got better role to play in the days to come in closed tibial plateau fractures especially by using Locking Compression Plate (LCP).

Keywords: Locking Compression Plate (LCP), MIPPO, Tibial plateau fractures, surgical management.

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Introduction

Tibial plateau fractures are one of the commonest intra articular fractures. It results from indirect coronal or direct axial compressive forces. It comprises of 1% of all fractures. These fractures encompass many and varied fracture configurations that involve medial, lateral or both plateaus with many degrees of articular depressions and displacements. Each fracture type has its own characteristic morphology and response to the treatment. It is essential to determine the force of injury since high energy trauma is associated with considerable soft tissue and neurovascular damage. Apart from tibial plateau bony injury, meniscal tear and ligament injuries should also be assessed[1].

Advance in mechanization and the acceleration of travel have been associated with increase in the number and severity of fractures. Fractures of the upper part of the tibia are no exception to this.

High velocity injury sustained in automobile disasters and increase in road traffic accidents as a whole is creating an ever growing problem. Since man has taken to travelling at high speeds in the sitting position

with the loading edge composed of flexed hind limbs, when the machine or in which the subject is travelling stops suddenly, most of the impact is taken at first upon the patella, then the tibia and femur in varying proportions and at various positions.

The stationary lower limb may be struck by a moving object, this is the common pedestrian injury, the so called "BUMPER FRACTURES" since the bumper of most vehicles being placed roughly at knee height.

The exposed knee joint may be subjected to angulation, rotation or shearing strains and when the subject is upright, his body weight assists in the injury and he falls over.

The twentieth century has seen a lot of changes in medical field, especially in orthopaedic trauma. A better understanding of biomechanics, quality of implants, principles of internal fixation, soft tissue care, antibiotics and asepsis have all contributed to the radical change. Thus we have advanced from the conservative approach to internal fixation in fractures as an acceptable mode of treatment.

Fractures of the upper tibia are difficult to treat, apart from the usual problems of confining patients to bed. Conservative treatment at any age, may be complicated by knee stiffness, malunion and nonunion. Open reduction and internal fixation has been advocated using various implants including Buttress plates, cancellous screws, external fixators etc., to achieve good fracture union and optimal knee function.

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Aims and objectives

- To restore articular congruity & limb alignment byopenreduction and rigid internal fixation.
- To foster early knee motion and improve quadriceps and hamstring power.
- To study the role of surgical treatment and functional outcome in tibial plateau fractures and its complications.

Methodology

The cases studied for this present paper, the surgical management of tibial plateau fractures were included from in patients of Mahatma Gandhi Memorial Hospital Warangal.

The intention of this dissertation was to study the Surgical Management of Intra-articular fractures of proximal tibia to obtain a stable, Pain free, mobile joint to prevent the development of osteoarthritis and to correlate the radiological findings with the type of fracture and the functional end result.

Period of Study

September' 2019 to December'2020

Inclusion Criteria**Age**

Patients above 18 years of eithersex.

Radiological diagnosis of fractures with classification based on Schatzker'sclassification.

Exclusion Criteria**Age**

Less than 18years.

Patients who are medically unfit for the surgery.

Compound tibial plateau fracture.

The ethical clearance for this study has been obtained from institution. As soon as the operation was planned, certain routine procedures were regularly followed:

1. Use of antibiotics pre-operatively and continued till the removal of sutures.
2. Preparing the part for surgery.
3. Selection of proper size of buttress plate, condylar screws and

cortical screws.

4. Assessment of the joint instability under anesthesia.
5. To check for any associated fractures.
6. To verify if any other associated procedures might be required like bone grafting.
7. In our series, we have used image intensifier for most of the patients.

Out of 32 patients treated surgically, 8 cases treated with percutaneous cancellous screws, 2 cases with cancellous screws and bone grafting, 15 patients were treated with buttress plate and screws (out of which one patient was treated by MIPPO), 6 patients were treated with bone grafting and buttress plate with screw, one case fixed with buttress plate supplemented with external fixator.

Whenever rigid internal fixation was achieved, the patient was mobilized after 48 hours after removal of the drains, for 2-5 days the range of motion allowed was 0-20°, from the 5th day the range of motion was gradually allowed to be increased to 90° or more. After suture removal, full range of movements was allowed.

Results

Observation and analysis of results was done in relationship to age, sex, occupation, laterality of fracture , type of fracture, method of treatment, duration of immobilization, complications and the remarks of different age groups in details as follows. The youngest being 24 years and the eldest being 60 years.

Age distribution

This study was done to find out the age incidence in our Indian set up and to know the type of fracture incidence and outcome as different age groups present and different response to fracture healing.

The tibial plateau fractures are commonly seen in the active and productive age group in our setup as they engage in more activities and travels. The type of fracture and fracture pattern depends on many factors like amount of force, age, degree of knee flexion, rate of loading of force, valgus / varus stresses, etc. The graphs shows patient age groups Vs number of cases.

Table 1: Age in years

Age in years	No. of Cases	Percentage
21-30	3	9.37
31-40	17	53.12
41-50	8	25.0
51-60	4	12.5
Total:	32	100

In our series, the majority of the patients are found to be between the age group of 31-40 years (17) and 41-50 years (8).The least number of cases are found in the age group between 21- 30 and 51-60years.

Table 2: Sex incidence

Sex	No . of Cases	Percentage
Male	29	90.63
Female	3	9.37
Total:	32	100

This incidence of sex versus upper tibial fractures can be attributed to an over-whelming large proportion of male patients because in our Indian setup, the female population largely working indoors or in the agricultural fields and do not indulge themselves In Travelling Or Out door activities.

Occupation

The relationship of fractures to different occupations is shown below

Table-3: Occupation

Occupation	No . of Cases	Percentage
Agriculturist	8	25.0
Employee	4	12.5
Businessman	12	37.5
Housewife	3	9.37
Laborer	5	15.62
Total:	32	100

The tabular column clearly shows that the major preponderance of upper tibial fractures is seen in people with a high level of activity, who indulge themselves in travelling like businessmen because majority of the morbidity is due to R.T.A. The group like farmers, housewives, retired people have a comparatively lesser fracture rate as they do not travel very frequently, but if the farmer group were to sustain a fracture, it is mainly due to agricultural accidents and automobile accidents. Workers and laborer's tend to have violent injuries commonly due to industrial accidents, automobile accidents, housewives sustaining fractures through fall from height, when they climb up ladder or stool to pickup objects from the shelves.

Mode of violence

In this series, the majority of the patients treated are due to road traffic accidents or automobile accidents up to the extent of 75%.

Table-4: Mode of Violence

Mode of Violence	No. of Cases	Percentage
RTA	24	75.0
Fall from height	4	12.5
Athletic Injury	1	3.13
Assault	3	9.37
Total:	32	100

Laterality of fractures

Table-5: Laterality of fractures

Laterality of Fractures	No. of Cases	Percentage
Right	20	62.5
Left	12	37.5

In our series, there is a slight right sided predominance, compared to the left side.

Type of fracture and percentage of cases Schatzker's classification

Table-6: Schatzker's Classification

Type of Fractures	No. of Cases	Percentage
Pure Cleavage	10	31.25
Cleavage with depression	6	18.75
Central depression	2	6.25
Medial Condyle Fracture	4	12.5
Bicondylar fracture	6	18.75
Metaphysio diaphyseal dissociation	4	12.5

In our series, the majority of the fractures were found to be of type I and type II fracture types i.e. pure cleavage fractures and cleavage combined with depression fractures

Methods of treatment

Table-7: Methods of Treatment

Methods of Treatment	No. of Cases	Percentage
Percutaneous cancellous screw fixation	8	25.0
Cancellous screw and bone grafting	2	6.2
ORIF' with buttress plate and screws	15	46.8
ORIF' with buttress plate and bone graft	6	18.8
ORIF with buttress plate and external fixator	1	3.12

Period of immobilisation

Table-8: Period of Immobilisation

Period of Immobilization	No. of Cases
<10 days	24
Up to 3 Weeks	5
up to 6 Weeks	3

None of the patients were immobilized when secure, rigid fixation was done. When there was doubt about rigidity of fixation, associated ligament injury or osteoporosis the immobilization extended preferably in above knee cast up to 3 weeks. Two cases of infection and another case of severe metaphyseal comminution had to immobilize for 6-8 weeks.

Most of the cases had good range of painless knee motion (0- 130°), except three patients developed knee stiffness.

Associated injuries

Bony Injuries

1. Ipsilateral femur shaft fracture - treated with intramedullary nail.
2. Ipsilateral lower pole patella fracture (osteochondral) conservative

3. Ipsilateral lower third tibial fracture - ORIF with DCP.
4. Ipsilateral Colle's fracture of radius - closed reduction and POP cast application.
5. Contralateral communicated distal end radius fracture - Universal Mini External Fixator (UMEX).
6. Head injuries (2) - Conservative.
7. Chest Injury (rib fracture) (1) - Conservative.

All associated skeletal injuries are attended and given due care appropriately. Patient with ipsilateral shaft femur fracture has shown knee stiffness even at the end of complete follow-up. The 2 patients who presented with head injury were admitted in Neuro - ICU initially under neurosurgeons care and got operated 5-6 days later for tibial plateau fracture. All these associated fractures did not hamper the functional outcome of tibial plateau fracture much.

Ligament Injuries

1. Medial collateral ligament (3) - two cases were managed conservatively with cast and in one case the ligament was surgically repaired during fracture treatment.
2. Lateral collateral ligament (1) - one case was managed conservatively with cast immobilization.
3. Anterior cruciate ligament (2) - one case was operated for ACL reconstruction after 6 months of the definitive fracture surgery. Another patient refused ACL repair surgery though he did not

show functional limitation but only the clinical instability. We did not come across any other ligament injuries around the knee joint.

Complications

All fractures united within expected time. Not a single case of nonunion noted in our series. Average time for union was 14 weeks (range 10-22 weeks). The two cases of wound infection were also having stiffness of the knee joint.

Table-9: Complications

Complications	No. of Cases
Knee stiffness	3
Malunion	2
Infection and wound dehiscence	3
Extensor Lag	1
Re depression	1

Clinical results

Table-10: Clinical Results

Clinical Results	No. of Cases	Percentage
Excellent	14	44
Good	14	44
Fair	2	6
Poor	2	6

Out of 32 cases treated with surgical procedure, 14 cases gave excellent result, 14 cases came out with good result, fair in 2 cases and 2 cases of poor result mainly due to the severity of the injury and infections. Retrospectively it was found that high velocity injuries (type IV - VI) have poorer outcome than low velocity injuries (type I - III) 38.

Case No. 1





Fig. 1:Range of movements

Discussion

Tibial plateau fractures, one of the common extraarticular fractures are major traumatic injuries occurring as a result of RTA, fall from height, violence etc. It is sometimes associated with other bony or soft tissue injuries. Any fracture around the joint (especially weight bearing knee joint in the lower limb) is of paramount importance as would result in significant morbidity and quality of life. Hence the treatment of upper tibial fractures with intra articular extension have become a challenge for the orthopaedic surgeons.

Keeping our aims of the study at high, we presented the clinical study of surgical treatment of 32 tibial plateau fractures. The analysis of the results were made in terms of age of the patient, sex distribution, occupation, mode of violence, laterality of the fracture, analysis of the types, modalities of treatment, complications associated injuries and the functional outcome.

There is no universal scoring system for assessing the functional outcome for these fractures. Literature shows multiple scoring system like Rasmussen, Knee society score and Oxford knee score.

In our study, we have evaluated the patients using Rasmussen score, which is a subjective score. We have Endeavor to present the various types of tibial plateau fractures in our Indian setup. It is found that the zeal of modernization, mechanization and industrial development made more automobile accidents due to increase in the number of population and automobiles.

The majority of fractures occur between the age of 20 and 60 years with maximum incidence being involving the productive age group 31-40 years (53.12%). Boune in 1981 also found that the majority of the patients are aged between 15-55 years with an average of 38.5

years, correlates well with the study. Seppo³² also showed age incidence 20- 60 years with an average of 39.8 years which correlates with the present study.

In our series majority of the patients were males (90.63%). This can be attributed to our Indian setup where the female population largely work in door or in agricultural fields and do not travel much. This reflects the fact that under Indian circumstances, males are more exposed.

Occupationally, tibial plateau fractures were seen in people with high level of activity, movement and travel. It is most commonly seen with people who travel more like businessman, agriculturist. In our series majority were businessmen (37.5%), followed by agriculturists (25%), laborer's (15.25%) and housewives (9.37%).

In our study the commonest mode of injury being the automobile accidents (75%), next common being fall from height (12.5%) and followed by violence (9.37%). The study is well comparable with other studies.

There was not much difference in the laterality of the fracture. The right tibia was affected in 62.5% and left tibia in 37.5% of cases.

In this series, we studied 32 cases of simple tibial plateau fractures treated only by surgical methods. Different authors use different criteria for the surgical management of these fractures. Seppo^{E[8]}. Honkonen conducted 130 tibial plateau fractures taking into consideration of:-

Condylar widening of >5mm.

Lateral condyle step off >3mm.

All medial condylar fractures for the surgical management.

In our study, the indications for the surgery were the same standard indications as for the tibial plateau fractures. 3mm depression was considered as an indication for surgery in our series.

In our series, Schatzker type I and type II dominated the total fractures making 50%. It is also to be noted that bicondylar fracture was not that uncommon.

We have not formulated the stringent criteria as to particular method of fixation for particular type of fracture. So each case was individualized and treated accordingly as it needs. The fractures were classified by Schatzker's classification. 10 patients belonged to Type I, 6 patients belonged to type II, 2 patients belonged to type III, 4 patients belonged to type IV, 6 patients belonged to type V and 4 patients belonged to type VI. In our study,

Type I fractures are the most common accounting to 31.2% as compared to the study of Tampere Hosp Finland study accounting to 11.5% of type I and 30.5% of type II fractures. Most of the type I, some type II and case of type V.

Patients in whom operation could not be carried out and in patients who have <3mm articular step off are treated conservatively which are not included in our study.

The major problem faced by us during the study was infection and wound dehiscence, hence immobilization was more in these patients. One patient had to undergo muscle flap cover and healed well later. The infection might be attributed to nosocomial infection [9].

In spite with all these associated bony fractures, ligament injuries and complications, we are able to achieve 44% excellent results, 44% good results (overall 88% acceptable results) with our standard surgical care using various standard fixation methods. In addition, we have 6% fair and 6% poor results in terms of functional outcome. These results are comparable and on par with other documented standard studies using Rasmussen Score [9,10].

We have surgically treated one case by MIPPO technique and had got excellent result. Probably, if we were less invasive at surgery, still more rigid in fixation and further aggressive in physiotherapy, we would not even have these complications and at the same time achieving these goals much earlier.

Conclusion

At the end of our study, following conclusions could be drawn from the surgical management of tibial plateau fractures.

- Tibial plateau fractures are increasing (especially the high velocity injuries) with the increase in automobile accidents.
- These fractures need optimum treatment as most of them involve the productive men.
- Preoperative soft tissue status and their repair at right time,

significantly changes the outcome.

- Surgical treatment when indicated (particularly in depressed and displaced fractures) is advantageous to get a stable knee.

Hence, to conclude, the surgical management of tibial plateau fractures is challenging and gives excellent anatomical reduction & rigid fixation to restore articular congruity, facilitate early knee motion by reducing post-traumatic osteoarthritis and thus achieving optimal knee function. In the background, it reminds us to remember the remarks given by Hohl at the presidential guest lecture at the Chicago Orthopaedic Society (1997). "These fractures are tough."

Acknowledgment

The author is thankful to Department of orthopaedics for providing all the facilities to carry out this work.

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Conflict of Interest: Nil Source of support: Nil