



International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2016; 2(3): 76-80
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www.orthopaper.com
Received: 11-05-2016
Accepted: 12-06-2016

Dr. Patil AB
Associate Professor, Department
of Orthopedics, GIMS, Gadag,
Karnataka, India.

Dr. Vijay Kumar Angadi
Senior Resident, Department of
Orthopedics, GIMS, Gadag,
Karnataka, India

Dr. Ravi kumar, Nagnur
Assistant Professor, Department
of Orthopedics, GIMS, Gadag,
Karnataka, India

Dr. Palled GS
Orthopedician, Gadag,
Karnataka, India

Correspondence
Dr. Patil AB
Associate Professor, Department
of Orthopedics, GIMS, Gadag,
Karnataka, India.

Functional outcome of high energy tibial plateau fractures treated with different modalities

Dr. Patil AB, Dr. Vijay Kumar Angadi, Dr. Ravi kumar Nagnur and Dr. Palled GS

Abstract

Introduction: Aim of the management of these fractures is to restore and preserve functional, pain free range of movements in the knee by accurate anatomical restoration of the articular surfaces of the tibial condyles

Methodology: In a retrospective-prospective study from March 20015 to March 2016 all patients of tibial plateau fractures type IV,V and VI who admitted in District hospital attached to Gadag Institute of Medical sciences Gadag were enrolled in the study. A total of 77 patients were taken in to this study initially

Results: The commonest mode of injury in the present study is the RTA seen in 43 (68.3%), Followed by fall from height 20 (31.7%). We did not have any complications in type IV fractures treated single plating either in medial or postero- medial group

Conclusion: We suggests the use of MIPPO and mini open reduction - hybrid external fixation technique as an alternative treatment for complex plateau fractures especially if it is due to high energy trauma with bad skin where dual plate osteosynthesis associated with more complications

Keywords: tibial plateau fractures, rta, mippo

1. Introduction

Fractures involving the proximal tibia affect the function and the stability of the knee. These are frequently encountered in day to day practice. These fractures are one of the commonest intra articular fractures comprising of 1% of all fractures and 8% of the fractures in elderly [1]. Over the years, the incidence of high velocity tibial plateau fractures has increased mainly due to increase in motor vehicle accidents, sports related injuries and falls.

Aim of the management of these fractures is to restore and preserve functional, pain free range of movements in the knee by accurate anatomical restoration of the articular surfaces of the tibial condyles

Outcome depends on the velocity of the injury, mechanism of the injury, fracture pattern, associated injury to the surrounding soft tissues and type of surgical treatment opted. Currently there are different surgical treatment options available for treating these high energy tibial plateau fractures. However no single treatment method has proven to be uniformly successful. There is still a controversy in selecting the type of surgical treatment, with some recommending single incision and unilateral locked plate on the lateral side [2, 3] and others recommending two separate incision with dual medial and lateral plating⁴ and in the unusual fracture like posterior or postero-lateral, posterior approach with buttress plating and also in large postero-medial fragment extending in to the diaphysis postero-medial approach with plating are used. Each of these methods are having their own advantages and complications [2, 3, 5, 6] and show variable results.

Some studies showed high energy tibial plateau fractures treated with hybrid external fixator have good prognosis for satisfactory knee function [7]. Studies of the long-term outcomes of treatment of fractures of the tibial plateau have included wide mixtures of fracture types and mostly low-energy split and split-depression fractures. Studies on long-term results of treatment of high-energy intra-articular proximal tibial fractures are lacking. The purpose of this study is to assess the functional outcome of the knee in particular and the limb as a whole in high energy tibial plateau fractures treated with plate osteosynthesis and mini open reduction external fixation. This is both a prospective and retrospective study

Methodology

Patient selection

In a retrospective-prospective study from March 20015 to March 2016 all patients of tibial plateau fractures type IV, V and VI who admitted in District hospital attached to Gadag Institute of Medical sciences Gadag were enrolled in the study. A total of 77 patients were taken in to this study initially

Inclusion criteria

All patients between ages of 18 to 65 years who presented With Schatzker's, type IV, type V and type VI tibial plateau fractures

Exclusion criteria

Patients not willing to enter the study

Patients with open fracture

Patients lost for Follow-up

Pathological fracture

Polytrauma patients

Pediatric fractures

As per inclusion and exclusion criteria, all adult patients with Schatzker's type IV; V & type VI tibial plateau fractures, were admitted and a detailed history was taken. A thorough clinical and radiological examinations were done.

After exclusion criteria and lost follow up 63 patients were part of final study. The patients were explained about the study. Consent was taken for the same

All patients underwent surgery –

Either

1) Plate Osteosynthesis

or

2) Mini open reduction and hybrid external fixation

The choice of procedure was surgeon-dependent. It was based on the

- Fracture displacement
- Presence of soft tissue status (Blisters, Swelling)
- Wound near the surgical site
- Total WBC counts, ESR and CRP
- Co morbid conditions of patients like diabetes, hypertension etc

Timing of the surgery

Patient associated with vascular injury or compartment syndrome were treated immediately. In fractures with gross swelling, blisters and comminuted we treated with temporary knee spanning external fixators and waited till swelling to subside and anti-oedema measures (limb elevation, ice packs, trypsin).

Presence of wrinkle sign and blisters were taken in to the consideration

Results and Discussion

Keeping our aims and objectives of the study, we evaluated the results of functional outcomes in patients with Schatzker's type IV, V and type VI tibial plateau fractures treated with plate osteosynthesis and mini open reduction –hybrid external fixation and the results were compared with one to another and we did the comparison among the plate osteosynthesis group which mode is better

This study constituted of 63 cases of tibial plateau type IV, V and type VI fractures. The analysis of the results were made in terms of age and sex distribution, mode of injury, type of fracture, method of treatment, complications, functional outcome.

Age

The mean age of patients in our study is 41.3 years with lowest 18 years and highest 65 years. Mankar *et al.* in their study observed mean age of 41.9 years with the range from 18 to 64 years^[8]. Our observations are comparable with those observed by Mankar *et al.* In our study it is noted that incidence of these fractures in male was highest in 5th decade followed by 4th decade. This is the age more prone for accidents as per our accident register as well

Sex incidence

In our series majority of the patients were males forming 90% (57) and females 10% (6). Weil Y.A (2008)^[9] reported in his study, males 62.96% and females 37.03% and Beri D.P (2004)^[10] found males 62.65% and females 37.45%. This increased incidence in males in our study can be attributed to our Indian setup where males work outdoor and females largely work in indoor setup.

Mode of injury

The commonest mode of injury in the present study is the RTA seen in 43 (68.3%), Followed by fall from height 20 (31.7%). Similar observations were noted by Weil Y.A (2008)^[9] where motor vehicle accidents seen in 52% and falls in 35%. Bari D.P (2006)^[10] in his study of 83 patients RTA accounted for 51.80% and fall 28.91%. Mankar *et al.* in their study 69 out of 78(88%) due to RTA

Type of surgery

In this series we studied 63 cases of Schatzker's type IV, V and VI tibial plateau fractures

1) Plate osteosynthesis-46 patients

Depending on the fracture pattern we decide whether single plate to be used or dual or mippo technique

MIPPO - Type V and VI fractures with minimal displacement and Comminution (14 patients)

Single plating - In type IV Undisplaced type V and VI (23 patients)

Dual plating - Displaced and comminuted type V and V (9 Patients) those requiring axial stabilization on one side and Buttrressing on the other side

Plate osteosynthesis according to type of fracture –

Type IV fracture (6 patients) were treated with single plating In type V, and type VI fractures 40 patients were treated with plating among these single plating in 17, dual plating in 9 and plating using mippo technique in 14 patients.

2) Mini open reduction and hybrid exfix application

In 17 patients of fracture type V and VI we treated with this modality

Indications were

- Soft tissue status
- Fracture displacement
- Wound over the surgical incision site
- Raised total WBC counts, ESR and CRP
- Co-morbid conditions like uncontrolled diabetes, hypertension etc

Functional Outcome

We decided to use the Rasmussen scoring system¹¹. Advantages of the Rasmussens Scores that it has both

subjective components like pain, walking capacity and objective components like knee range of motion, stability of the joint and also extension of the knee are taken in to consideration and given scores from 6 to 0 depending on severity.

We did functional assessment using the Rasmussen scoring system at 3th 6th and 12 months

Type IV fractures out of 6- at first three months good results in 4 patients and fair in 4 patients, at six months good results in all 6 patients and at twelve months excellent in 3 and good in 3 patients

Type V fractures out of 32 patients - good results in 20 patients, fair in 10 and poor in 2 patients at three months; at six months good in 27, fair in 3 and poor in 2 patients; at twelve months excellent results in 9 patients, good in 18, fair in 3 and poor in 2 patients

Type VI fractures out of 25 patients –at three months good in 11 patients, fair in 13, poor in 1 patients; at six months 17 good results, 7 fair and 1 poor result and at twelve months excellent in 3, good in 16, fair in 5 and poor in 1 patient.

Type IV Fractures In our study we managed the type IV fracture with single plating and results were 50% excellent and 50 % good results at the end of 12 months

Type V and VI Fractures

Comparison between plate osteosynthesis and hybrid ex-fix

These fractures were managed with either plate osteosynthesis or mini-open reduction and hybrid external fixation. Functional scores were evaluated

In plating group at 3months 19 were good, 20 were fair and 1 had poor result. At 6 months 31 were good, 8 were fair and 1 was poor and at the end of 12 months 7 were excellent, good in 26, fair in 6 and poor in 1

In hybrid group 9 had good, 6 had fair and 2 had poor result at

3 months. At 6 months 13 had excellent, 2 had good and 2 had poor result; 12 months excellent result was seen 5, good in 8, fair in 2 and poor in 2 patients

The results were analyzed in the both the groups, it was found that at all the time the p value(0.96;0.88 and 0.84 at 3;6 and 12 months) was found to be >0.05 which is not significant comparable

Comparison within plate osteosynthesis group

In the plate osteosynthesis group we further studied to know which modality is better - single plating, dual plating or single plate using MIPPO technique

In single plating group 8 good, 8 fair and 1 poor result at 3months, 13 good, 3 fair, 1 poor at 6months and 12 months excellent in 2, good in 12, fair in 2 and poor in 1 patient

In dual plating group 3 good, 6 fair at 3months ;5 good, 4 fair at 6 months; At 12 months excellent in 1, good in 5, fair in 3 patients

In MIPPO group- 8 were good, 6 were fair at 3 months; 13 were good; 1 was fair at 6 months; At 12 months excellent in 4; good in 9 and fair in 1 patient

Results of these three groups were analyzed and p value (0.45;0.35 and 0.19 at 3;6 and 12 months) was found to be >0.05 at all the time which is not significant and it is found that MIPPO group has better functional outcome compared to other groups at all the time

Comparison of our results with other studies

We compared the results of our series to the standard series in literature. There were various scoring systems (SF-36 score, Iowa, knee society scoring system, oxford knee scoring etc) used in different studies making comparison unlikely. Very few studies had used Rasmussen’s scoring for functional outcome.

| Features | Plating by Krupp <i>et al.</i> ¹² | External fixator by Krupp <i>et al.</i> ¹² | Plate osteosynthesis in our study | Mini open reduction and hybrid appln in our study | Outcome of complex tibial plateau fracture by Mankar <i>et al.</i> ^{18]} |
|----------------|--|---|-----------------------------------|---|---|
| No of patients | 28 | 30 | 40 | 17 | 75 |
| Mean age group | 47yrs | 49yrs | 41yrs | 45 yrs | 41.96yrs |
| Mean follow up | 10mths | 16mths | 12mths | 12mths | 26.16mths |
| Non union | 3 (10%) | 4 (13%) | 0 | 2 (12%) | 1 |
| Mal union | 4 (14%) | 13 (43%) | 4 (10%) | 2 (12%) | 12 (6%) |
| Infection | - | - | 4 (10%) | 2 (12%) | 9 (12%) |
| Knee ROM | 109 ⁰ | 103 ⁰ | 112 ⁰ | 101 ⁰ | 122.6 ⁰ |

Complications

We did not have any complications in type IV fractures treated single plating either in medial or postero- medial group

In type V and VI - Plating group

We had four (10%) patients with infection in plating group among these one patients treated with MIPPO technique for we removed the implant after 8 months and 3 patients treated with dual plating, of these one patients implants were removed after 9 months and two patients infections were controlled with wound wash and intravenous antibiotics



Fig 1: Infected wound

In two patients (5%) we had superficial skin infection one in dual plating group and one in single plating group



Fig 2: Superficial skin infection

We had stiffness in six patients (15%); three in dual group, two in plating group and one in MIPPO group
We had Varus Malunion in four (10%); one in single plating, Two in MIPPO and one in dual plating group but functionally they were graded as good



Fig 3: Varus mal union

We did not had Non union in plating group

Hybrid group

We had two patients with pin tract infection (12%) which resolved with antibiotics and pin tract care
Stiffness in four patients (23%) which may be due to frame cumbersome in flexing the knee fully
Non-union in two patients (12%) for which we re-operated with bone grafting and plating



Fig 4: fracture showing non-union and redo with plate and bone graft

Varus malunion of 5 degrees in two patients (12%) which was acceptable

Conclusion

According to our study Type IV fractures can be managed with single plating either medially or postero-medially with minimal complication and good functional outcome
Type V and type VI fractures treated with either plate osteosynthesis or mini open reduction and hybrid external fixation both were comparable functional outcome with infection complication in plating group and Non union and pin tract infection in hybrid group

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