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A Study of Clinical and Radiological Outcome of Schatzker Type I To Iv Tibial Plateau Fractures Using Angular Stable Locking Plate Fixation.

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ABSTRACT-
INTODUCTION*- Proximal tibia fractures are very common type of fractures. Most common cause is RTA which is classified as high energy RTA and low energy RTA. Proximal tibia fractures are the most common intraarticular fractures and compound fractures with soft tissue complications due to their subcutaneous nature. Proximal tibia fractures should be treated promptly to avoid devastating complications like compartment syndrome .This study is done to evaluate functional outcome of proximal tibial fractures schatzker type 1-IV treated with variable angle plate.*
Methods*- The study will be prospective, time bound, hospital based study. Cases satisfying the inclusion criteria admitted in P.E.S.I.M.S.R. during the study period of JAN 2017 to SEPT 2018 will be included. Patients in our study are followed up every month for a minimum period of 6 months. At each follow up clinical and radiological evaluation will be done. Thirty patients are included in our study.Functional assessment done by1. Clinical Evaluation 2. Knee society score. 3. VAS score.4. Radiological evaluation.*
RESULTS*-The present study consists of 30 patients of tibial plateau fractures treated surgically with angular stable locking plate at P E S Medical College and Hospital, Kuppam. All the patients were available for follow-up they were followed up for a minimum of 6 months period. Results were analyzed both clinically and radiologically. At the end of 6 months follow up all the fractures united. The mean time for the fracture union noted in all the cases is 14 weeks The average range of motion achieved in all the fractures which are united and at the end of 6 months follow up is 119 degrees. Out of all the 30 patients operated 3 patients developed knee stiffness.no other complications like surgical site infection, implant failure, screw backouts, deep infections, loss of reduction were absent.*
Functional outcome after 6 months is calculated in fracture united patients using Knee society score (KSS),VAS score. In KSS score, there were 24 cases have excellent results(80%) and 6 cases have good results. The mean score obtained in KSS scoring system for our study was 90.66 which is excellent and the mean VAS score obtained was 0.33 which is a good result.
CONCLUSION*- By our study we conclude that the locking compression plate system with its various type of fixation act as a good biological fixation including in difficult fracture situations.*
Keywords*- proximal tibia fractures, variable angle plate, MIPPO plating, schatzker proximal tibia fractures.*

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I. INTRODUCTION

The proximal tibia is involved in the transmission of body weight though the knee joint and leg and plays a key role in the knee joint function and stability (1). Complicated biomechanics of weight-bearingposition and complex ligamentous structure and articular congruency are the main reason why these fractures are of great concern to surgeon.

Historically proximal tibia fractures are difficult to treat as the anteromedial surface is subcutaneous in location. Severe bone and soft tissue injuries are frequent and there is high incidence of open fractures compared to other long bones(2). The fractures of proximal tibial are one of the commonest intraarticular fractures, these fractures can be classified as, high and low energy fractures.

Mostly fractures of tibial plateau are secondary to RTA and fall from height(3), where fractures are due to direct axial compression, usually with a valgus (more common) or varus moment and indirect shear forces(4). Extra-articular fractures of the proximal tibia are caused by direct forces applied to the metadiaphyseal region of the upper leg. In old patients the subchondral bone is osteopenic and cannot resist axial direct load causing depression type of fracture(5).

The surgical treatment of proximal tibia fracture are aimed to restore joint congruity of the tibial condyles, restoring ligamentous stability and maintaining the mechanical axis. Thus it results to achieve functional painless and good range of motion in the knee joint1.There have been changes in treatment modalities of fracture proximal end tibia from conservative measures (traction,cast bracing,immobilization) to surgical intervention for better results. To reduce the complications associated with conventional plates screw system, radical exposure of fracture site and inherent fracture and soft tissue injury there is a need for better conservative, Minimal invasive surgery and better fracture fixation.

With better understanding of biology of fracture healing and biomechanics of fracture fixation and healing, new concept of fracture fixation is evolved with fixed angular stable plate and minimally invasive surgical techniques. Biological fixation is the newer trend, which can be accomplished by LCP and MIPPO technique.

The conventional plate fixation is based on principle of friction and compression of plate to bone. Early attempts to attain angular stability with conventional screw and plate by cement fixation of screw in bone, to prevent toggling of screw was followed by fixing the screw to plate by SCHUHLI nuts (threaded washer), development of PC-fix plate, Zespol plate. Less invasive stabilization system was designed for fractures involving ends of bone. There was further research to combine conventional screw slot with Locking screw slot in the opposite ends of same hole lead to development of AO (LCP)6. Further recent changes in designs with options to change axis of screw in polyaxial plate and increase flexibility of construct by far cortex locking screw and dynamic locking screw have evolved. The new system (LCP) has been regarded as technically mature. It offers numerous fixation possibilities and has proven its worth in complex fracture situation, revisions and osteoporotic bones.

II. METHODOLOGY

Study design: The study will be prospective, time bound, hospital based study. Cases satisfying the inclusion criteria admitted in P.E.S.I.M.S.R. during the study period of JAN 2017 to SEPT 2018 will be included. Patients in our study are followed up every month for a minimum period of 6 months. At each follow up clinical and radiological evaluation will be done. Thirty patients are included in our study.
Outcome of study will be compared with previous reported series.

Inclusion criteria:
1.The patient with injuries associated with the tibial plateau fractures of
Schatzker Type 1 to type 4
2.Age Limit: >20 yrs
3.Patients with Gustilo-Anderson Type 1 and 2 tibial plateau fractures.

Exclusion criteria:
1.Patients with Pathological fractures other than osteoporosis.
2.Patients with Gustilo Anderson type 3 and type 4 tibial plateau fractues.

All the patients included in the study are treated with variable angles proximal tibia plates.
Post operatively knee was mobilized from day one.

Follow-up:Regular follow up for every 4 weeks, 12 weeks and 24weeks.
In every follow up soft tissue healing is assed and fracture healing is assessed by clinical and radiological evaluation.
Local examination of the affected tibia and fibula for tenderness, instability deformity and ankle movements were assessed.

X-rays were taken at each follow up visits to known about progressive fracture union and implant position.
Rehabilitation of the affected extremity were done according to the stage of fracture union and time duration from day of surgery.
Patients were followed up till radiological union.

III. FUNCTIONAL OUTCOME ASSESSED BY

1. Clinical Evaluation 2. Knee society score.
3.VAS score.4. Radiological evaluation.

IV. RESULTS

The present study consists of 30 patients of tibial plateau fractures treated surgically with angular stable locking plate at P E S Medical College and Hospital, Kuppam. All the patients were available for follow-up they were followed up for a minimum of 6 months period. Results were analyzed both clinically and radiologically.

AGE DISTRIBUTION
Patients age was more than 20 years with fractures being more common in age group of 40-50 yrs.The mean age was 46.16 years.
In our study 30 patients were assessed between January 2018 to July 2019 of which 18 cases were male and 12 of them were female.
There were 16 (53.33%) patients with right sided tibia fractures and 14 (46.66%) patients with leleft-sided tibia fractures.
In our study, all patients (30patients) sustained injury due to road traffic accidents.
In our study out of the 30 cases according to schatzker classification, 9 cases were type- 1,12 cases were type 2, and one case was type 2,8 cases were type 4.

TABLE 1: TYPE OF FRACTURE

TYPE OF FRACTURE	NO. OF PATIENTS	PERCENTAGE
TYPE 1	9	30%
TYPE 2	12	40%
TYPE 3	1	3.33%
TYPE 4	8	26.66%
TOTAL	30	100%

PLATING TECHNIQUE
Out of the 30 cases under study 22 cases were treated with lateral plating(73.33%) and the remaining 8 cases were treated by medial plating(36.66).
Follow up for a minimum period of 6 months in all the patients. Follow up was done at 1,3,6 months and serial x-rays were taken and the patient is evaluated clinically and radiologically using knee society scores and VAS.

FRACTURE UNION
At the end of 6 months follow up all the fractures united.The mean time for the fracture union noted in all the cases is 14 weeks

TABLE 2 TYPE OF FRACTURE

TYPE OF FRACTURE	TIME FOR UNION IN WEEKS
1	12.4
2	16.72
3	12
4	14
MEAN	14

The average range of motion achieved in all the fractures which are united and at the end of 6 months follow up is 119 degrees.
Out of all the 30 patients operated 3 patients developed knee stiffness.no other complications like surgical site infection, implant failure, screw backouts, deep infections, loss of reduction were absent.

Functional outcome after 6 months is calculated in fracture united patients using Knee society score (KSS),VAS score. In KSS score, there were 24 cases have excellent results(80%) and 6 cases have good results. The mean score obtained in KSS scoring system for our study was 90.66 which is excellent and the mean VAS score obtained was 0.33 which is a good result.

TABLE 3 FUNCTIONAL OUTCOME

RESULTS	NO. OF CASES	PERCENTAGE
EXCELLENT	24	80%
GOOD	6	20%
FAIR	-	-
POOR	-	-
TOTAL	30	100%

TYPE	KSS SCORE MEAN	RESULT
1	95.44	EXCELLENT
2	86.08	EXCELLENT
3	98	EXCELLENT
4	91.25	EXCELLENT
MEAN	90.66	EXCELLENT

V. DISCUSSION

Fractures of the Tibial plateau are more common complex fractures and account for 1.2% of all fractures(6). These fractures affect knee function and stability which results in considerable morbidity. High-velocity injuries cause these fractures are caused by and often associated with soft-tissue damage and severe comminution. The aims of treatment are to restore joint congruity, limb alignment and early mobilisation of joint(7,8,9),good internal plate fixation without damaging the soft-tissue around knee is very difficult to achieve (10) only good results are seen in 20% to 50% in these fractures(11)

Open reduction and internal fixation (ORIF)of fracture with plates and screws provide direct visualization of fracture, reduction, and fixation, but there is high risk of soft tissue injury, stiffness and deep infection(12). The soft tissue problemcan be avoided by hybrid external fixator , but complications like malalignment, pin tract infections and poor patient compliance(13)

The concept of biological fixation helps in preserving the blood supply and atraumatic surgical technique. Using this biological fixation technique, soft tissue damage is reduced and shows higher union rate.

The development of locking plates has allowed the use of minimally invasive technique for unilateral plating with improvement in handling the soft tissue(14-17).

Locking plates placed laterally provide better stability in the presence of complex proximal tibia fracture with metaphyseal comminution and serves as an better alternative for medial plate or external fixator for additional support of the medial column when a non-locking plate is used for bicondylar fractures(18,19) This plate allows fixation through single incision which avoids wound dehiscence, infection and prolonged immobilisation associated with extensile approaches(20).

MIPPO plating enables indirect fracture reduction and percutaneous sub muscular implant placement. Acceptable outcome is due to less extensive dissection of soft-tissue envelope and less devitalisation of fracture fragments and soft tissue damage.

Our study is aimed to evaluate the functional outcome of tibial condyle fractures treated by angular stable locking compression plate osteosynthesis.

There is no universal scoring system for assessing the functional outcome for these fractures.

The patients in our study,have been evaluated the patients using knee society score which is an objective score and visual analogue score.

We present a clinical study of 30 tibial plateau fractures treated using angular stable locking plate. The results of our study were analysed in terms of age of patients, sex distribution, laterality of fracture, mode of injury, type of fracture, fracture union, range of motion and complications.

The results of our study are then compared with previous studies and analysis among various parameters in the study is done and final conclusion is achieved.

The mean age of all patients in our study group is 46.16 which is comparable with the mean age group in a study conducted by P A Cole et al(19) but slightly less when compared to , Jain R et al(21)& Mardian et al(22), which is respectively.

In our study,there is a male predominance for these kind of fracturesandhigh as60% and is comparable to mardian (22)et al study and lower than Jain andRamnathetal(23) study.

Table4:comparisonoftypeoffracture

Study	Lateralcondyle	Medialcondyle	Bicondylar
Our study	73.33%	26.66%	-
Jainr etal	60%	13.3%	26.7%
Rasmussenetal	70%	12%	18%
Lansingeretal	70%	11%	19%

VI. FRACTUREUNION

The average time taken for fractureunion in our study for all the fractures is 14 weeks which is better when compared to other studies.

Table5:comparisonofmeanfractureuniontime

STUDY	FRACTUREUNIONTIME(WEEKS)
OURSTUDY	14
JAINR ETAL	17
MARDIANETAL	16.8
DS RAMNATH ET AL	15.6

VII. COMPLICATIONS

In our study there was only one complications i.e knee stiffness in 3 patientswhich is better when compared to other studies where infections,varus/valgusdeformity,lossof reductionwereobserved.

Table6:comparisonofcomplications

	Kneestiffness	Infections	Loss ofreduction	Varus/valgusdeformity
Our study	3	-	-	-
Mahendra ket al	1	1	-	1
Jain etal	7	5	-	5
Mardianet al	8	6	2	5

VIII. FUNCTIONALOUTCOME

Functional outcome after 6 months is calculated in fracture united patients usingKnee society score (KSS),VAS score. In KSS score, there were 24 cases have excellentresults(80%) and 6 cases have good results. The mean score obtained in KSS scoring system for our study was 90.66 which is excellent and the mean VAS score obtained was 0.33 which is a good result when compared to other studies.

TABLE 7: COMPARISON OF FUNCTIONAL OUTCOME

	EXCELLENT	GOOD	FAIR
OURSTUDY	80%	20%	-
JAINR ETAL	73.3%	16.7%	10%
MARDIANETAL	42.6%	30.7%	8.9%
DS RAMNATH ET AL	60%	30%	10%

IX. CONCLUSION

Proximaltibialfractures are increasing with the increase in number of RTA cases.These fracture need optimum treatment as most of them involved the productive men. Preoperatives of tissue status and the irrepair at right time significantly changes the outcome. Displaced in traarticular fractures those belonging to Schatzker's type I ,II and III ,IV should be treated by surgical methods.

In osteoporotic bone also the anchorage of the locking head screw was found to be excellent.

When LCP used as combined principle of fixation we can reconstruct tibial plateauwith compressionandpreventit from collapse bybridgingprinciple.Fractures treated with angular stable platehealed rapidly by secondary fracture union at a muchearlier time compared to open reduction and internal fixation due to less soft tissue injury leads to minimal blood supply interruption to proximaltibia.

Thus by our study we conclude that the locking compression plate system with its various type of fixation act as a good biological fixation including in difficult fracture situations.

X. SUMMARY

In this study, 30 cases with fractures of tibial plateau of schatzer type I to IV in adults were surgicallymanaged by fixation with Angular Stable Locking Plate between December 2017 toSeptember 2019 at P E S Institute of Medical Sciences & Research, Kuppam, AndhraPradesh.

All patients were evaluated clinically and radiologically beforeand following surgery,foranaverageperiodof followup was6months.

Theagegroupunder studyis>20 yrswithmeanagegroup40-50yrs.

Therewasamalepredominance(60%), with RTA being most common cause and

common in right side.

Type 1-4 fractures of tibial plateau were included in study of which 9 were type 1, 12type2,1type3,8 type4.

Outofthe30casesunderstudy22underwentlateralplatingand8medialplating.

Regularfollowupsaredone at1,3,6monthspostoperatively.

Themeanfractureuniontimeinweeksforallthestudypopulationwas14weeks.

MeanRangeofmotionachievedaftersurgerywas119degrees.

Complicationsinourstudywerekneestiffnesspresentin3cases.

All the 30 cases, functional outcome was assessed using knee society score and VAS score.According to KSS score 24 patients had excellent score and 6 had good score.The mean VAS score for all the patients was 0.33.

The over all clinical and radiological outcome of tibial plateau fractures treated with angular stable locking plate was found to have results in par with literature.

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