EVALUATION OF LOCKING COMPRESSION PLATING BY MIPPO TECHNIQUE IN PROXIMAL TIBIAL FRACTURES: A PROSPECTIVE STUDY

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HOW TO CITE THIS ARTICLE:

Sujai S, Jayakrishnan S, Lokesh B. V, M. K. Siddalingaswamy, H. C. Nanjundappa. "Evaluation of locking Compression Plating by MIPPO Technique in Proximal Tibial Fractures: A prospective study". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 54, July 06; Page: 9492-9499, DOI: 10.14260/jemds/2015/1373

ABSTRACT: CONTEXT: Surgical management of proximal tibia fractures by MIPPO technique.

BACKGROUND: Tibial plateau fractures constitute about 1% of all fractures & complex tibial condylar fractures constitute 30% of all tibial plateau fractures. Majority of such fractures are secondary to high velocity RTA's/ fall from a height. With the ever increasing number of options for fracture fixation and the emergence of the concept of biological fixation, the trend of fracture fixation has shifted from Open reduction & internal fixation to MIPPO technique for fracture fixation. **AIM:** To evaluate the functional outcome of MIPPO technique with locking plates in management of proximal tibial fractures. **MATERIALS & METHODS:** We have conducted a prospective study comprising of 30 patients with proximal tibia fractures. Inclusion criteria: all closed Schatzker Types II, IV, V, VI, exclusion criteria: open fractures, Types I & III Schatzker fractures. The patients were managed by MIPPO technique with proximal tibia locking plate and the results have been evaluated with the help of Rasmussen's scoring system. **RESULTS:** in our study 90% patients had good [18 patients] & excellent [9 patients] results. 10% had fair [2 patients] and poor [1 patient] results. Average functional knee score was 23.11. Average range of movement achieved was 122 degrees. Average time for fracture healing was 16.67 weeks. **CONCLUSION:** From our study we conclude that MIPPO technique gives good to excellent results even in high energy tibial condyle fractures [90% in our study] and is a good method for treating such fractures.

KEYWORDS: Tibial plateau, Internal fixation, MIPPO, Locking plate, Functional outcome, Clinical outcome.

INTRODUCTION: Tibial plateau fractures constitute about 1% of all fractures and complex bi-condylar fractures constitute 30% of all tibial plateau fractures. Seventy-five years ago, fractures of the proximal tibia were described as "bumper fractures" because they resulted from low energy pedestrian versus car fender accidents. Presently, the majority of such fractures are secondary to high velocity injuries like high speed motor vehicle accidents or falls from heights. Due to this increase in the velocity of the injuring mechanism, we are faced with more number of complex tibial condyle fractures.

Tibial plateau fractures result from direct axial compression, usually associated with a valgus [more common] or varus [less common] component, and indirect shearing force. The anterior aspect of the femoral condyle is wedge shaped; with the knee in full extension, the force generated by the injury drives the femoral condyle into the tibial plateau. The direction, magnitude and location of the force, the position of the knee at time of impact, and the quality of the bone determine the fracture pattern.

The complex tibial plateau fractures resulting from direct forces due to high velocity injuries classically are described as "Explosion or Shattered" fractures. These fractures pose an inherent

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difficulty in treatment due to the extent of soft tissue damage, fracture comminution, instability, displacement of articular fragments and increased risk of compartment syndrome.^[1,2]

Closed management of these complex fractures with cast bracing and traction generally have been ineffective in reducing and maintaining the congruency of the articular surface and axial alignment^[3] leading to malunion and secondary degenerative arthritis.^[4]

Though anatomical reduction is possible with conventional methods of treatment such as open reduction and internal fixation, this procedure has been associated with a large number of soft tissue problems^[4,5,6] and fixation failures.^[7] This invariably leads to compromise of the overlying soft tissue envelope and results in soft tissue necrosis and deep wound infections.

To avoid such complications and maintain adequate bony reduction, the concept of Biological Fixation was developed. The objective of Biological fixation^[1,8,9,10,11,12] is to assist the physiological process of bone healing wisely and optimally with minimal amount of operative intervention.

The Various Methods of Biological Fixation are:

- Ilizarov external ring fixator.
- Hybrid external fixation.
- Limited internal fixation with external stabilization.
- Closed interlocking intramedullary nail fixation.
- Minimally Invasive Percutaneous Plate Osteosynthesis.

Minimally Invasive Percutaneous Plate Osteosynthesis [MIPPO]: is a method of biological fixation in which a plate is percutaneously inserted and fixed at a distance proximally and distally from the fracture site. By minimal exposure this helps in preservation of the essential fracture haematoma, minimal soft tissue dissection, avoidance of periosteal stripping and providing an adequate fixation.

Principles of Biological Fixation/ MIPPO are:

- Repositioning and realignment by manipulation at a distance to the fracture site. [Indirect reduction techniques.
- Preservation of soft tissue envelope.
- Limited operative exposure.
- Leaving comminuted fragments out of the mechanical construct, while preserving their blood supply.
- Usage of low elastic modulus, biocompatible implants.

Advantages of Minimally Invasive Percutaneous Plate Osteosynthesis:

- Simple technique and easy to master [Short learning curve].
- No necessity for additional expensive equipment/ instrumentation.
- Improved rates of fracture union.
- Decreased rates of infection.
- Decreased need for bone grafting.
- Ideal technique for dealing with poly-trauma patients.
- Early mobilization of involved extremity.

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- Decreased incidence of refracture after plate removal.

The concept of Biological Fixation continues to evolve. Newer plate designs and plating techniques would probably contribute to improved rates of fracture union, decreased rates of infection, and decreased incidence of post-operative complications.

MATERIALS & METHODS: This is a prospective study comprising of 30 patients with tibial condyle fractures who were treated by Minimally Invasive Percutaneous Plate Osteosynthesis at MVJ Medical College & Research Hospital, Hoskote, Bangalore, from June 2012 to May 2015.

These patients were reviewed periodically both clinically and radiologically for a minimum of 6 months following operative fixation.

Inclusion Criteria:

- Patients in the age group of 16 – 70 years.
- All cases of closed proximal tibial fractures [both intra-articular and extra-articular].

Exclusion Criteria:

- Open/ contaminated tibial condyle fractures.
- Schatzker's type I fractures [treated by percutaneous screw fixation]; schatzker type III fractures [treated by elevation, bone grafting and screw fixation].
- Patients presenting with complications such as compartment syndrome and vascular injury.
- Inoperability in certain cases, due to multiple comorbid factors/ systemic disease.

Our method of Treatment: Initial Treatment:

- All our cases underwent initial stabilization as per the ATLS guidelines.
- Patients with closed tibial plateau fractures associated with a tense haemarthrosis underwent aspiration of the joint under aseptic precautions.
- X-ray of the knee with leg: AP and Lateral view were taken.
- The fracture was classified using Schatzker's classification of proximal tibial fractures.
- The limb was immobilised either in an above knee slab or through skeletal traction using a distal tibial or calcaneal pin traction on a Böhler Braun splint until definitive fixation was carried out.
- In cases complicated with excessive swelling and blistering, definitive fixation was delayed until the swelling/ blistering subsided.
- The patients were thoroughly evaluated from the systemic point of view and received appropriate treatment for existing co-morbidities like hypertension and diabetes prior to and after surgery.

Definitive Management:

- In our study, all 30 patients with proximal tibial fractures underwent definitive fixation by Minimally Invasive Percutaneous Plate Osteosynthesis technique.

Operative Technique:

- The surgery was performed with the patient under general anaesthesia or spinal/epidural anaesthesia.
- The patient was placed supine on a radiolucent fracture table with the affected extremity in longitudinal traction.

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- A pneumatic tourniquet cuff with adequate padding was applied to the proximal thigh.
- The limb was thoroughly scrubbed primarily with betadine or chlorhexidine scrub solution, painted and draped.
- The operative site and exposed portion was covered with a sterile towel and the limb exsanguinated with a sterile Esmarchs bandage and the tourniquet inflated, after which the operative site was painted with betadine and then with surgical spirit.
- With the help of an image intensifier closed reduction was achieved by ligamentotaxis using longitudinal traction. In certain cases percutaneous k-wires were introduced to aid in fracture alignment.
- A proximal tibial locking plate or a T-Buttress/L-Buttress locking plate of suitable length was taken.
- An incision was made as large as necessary to help insert the plate, which is carefully slid in the submuscular plane, extraperiosteally.
- At most care was taken in handling soft tissue with as minimal dissection and judicious use of retractors as possible.
- Normal valgus and rotational alignment was checked.
- Cancellous and cortical screws were appropriately used to secure the plate adequately proximally and distally. These were introduced percutaneously through small stab incisions centered over the plate holes.
- A thorough wash with saline and betadine was given, a suction drain placed and the wounds closed. A sterile dressing was applied and the tourniquet deflated.

Post-operative Protocol:

- The patient received intravenous antibiotics for a minimum of 5 days. They also received appropriate analgesics/anti-inflammatory drugs.
- The limb was elevated on a Bolher Braun splint until swelling/edema subsided.
- The drain was removed after 48 hrs.
- Knee mobilisation was started once the acute pain subsided.
- Non weight bearing walking was permitted from 3rd post-operative day with the help of a walker or axillary crutches.
- Sutures were removed on the 14th post-operative day.
- The patient was kept non-weight bearing until radiological signs of union were evident, after which weight bearing was commenced initially partial and gradually progressed to full weight bearing depending on fracture consolidation.

Follow Up:

- Our patients were reviewed periodically after discharge at 6 weekly intervals for a minimum of 6 months or until complete radiological union.
- Knee movements were measured using a goniometer and the amount of extensor lag and flexion were recorded.
- Weight bearing was permitted only after radiological evidence of fracture union/ adequate callous formation was present.
- At the time of follow up a functional assessment was done according to Rasmussen's scoring system.

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RESULTS: Our study comprises 30 cases of Proximal Tibial fractures, which have been managed by MIPPO technique at MVJ Medical College & Research hospital, Bangalore from June 2012 to May 2015. The sex distribution in our study was 24 males and 6 females.

The age distribution in our study; the youngest aged 30 years and the oldest aged 57 years. The average age was 42.22 years.

The most common mode of injury in this study was road traffic accident [25 patients]. The remaining 5 patients sustained injuries due to a fall from a height.

Type V Schatzker tibial plateau fractures were the commonest: 18 patients, Type II schatzker: 4 patients, Type IV schatzker: 4 patients and Type VI schatzker: 4 patients.

In our study, patients were treated and mobilized as early as possible, surgery was on second post injury/ admission day: 24 patients. 6 patients had a delay in surgery: 10 days post injury. The delay in surgery was mainly due to presence of abrasions over the operative site and patients underwent surgery only after the abrasions healed. We observed that patients with a shorter time interval between injury and surgery had a better functional outcome irrespective of the fracture type. 90% of our patients had excellent [9 patients] and good [18 patients] results in the functional outcome. These results were attributed to patients who underwent early surgery and early mobilisation. 2 patients had Fair results and 1 patient had poor results [Associated ipsilateral femoral condyle fracture] in our study the average functional knee score was 23.11. The average range of movement achieved was 122 degrees.

The average time taken for fracture healing was 16.67 weeks.

We had only 1 case of post-operative infection, which was treated aggressively by debridement, re-suturing and IV antibiotics. 3 of our patients had knee stiffness, 2 of which responded well to physiotherapy. Two of our patients had limb shortening of less than 2 cm which was attributed to the extent of comminution at the fracture site. We did not encounter any varus collapse as a complication. This could possibly be attributed to the fact that we allowed our patients to weight bear only after signs of radiological union.

The results obtained in our study are comparable with the results obtained by other authors.

DISCUSSION: Proximal tibia fractures are injuries which are associated with significant early and delayed complications. A thorough pre-operative assessment of the bony and soft tissue injury is imperative. The condition of the soft tissue envelope is to be adequately monitored. Anatomical reduction with good fracture fixation allows for early joint movement. Early intensive rehabilitation is mandatory for good clinical results.

Careful evaluation of the soft tissue envelope was the key factor in timing of definitive fracture fixation, as well as the major predictor of certain complications like infection and delayed wound healing.

In view of the necessity of anatomical reduction in all intra-articular fractures, open reduction and rigid fixation with plates and screws with or without bone grafting is considered as the gold standard for such fractures.^[13,14] However in 1971 Lucht and Pilgaard stated that a good outcome occurred in 78% of the patients even if articular depression was up to 10mm.

The implementation of contemporary reduction techniques and novel implants allow the surgeon to attain stable fixation without compromising the surrounding soft tissue. In our study group as well as in other studies,^[13,15,16] MIPPO technique with application of proximal tibia locking plates offers the ideal combination in terms of fracture fixation and soft tissue sparing.

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CONCLUSION:

- MIPPO technique gives good to excellent results even in high energy tibial condyle fractures [90% cases in our study].
- Our patients were able to achieve a good functional range of movement, averaging 122 degrees. [Krettek et al-124 degrees].^[17]
- Those who were treated with early fixation and early mobilization were found to have a better functional outcome irrespective of the fracture type.
- No secondary bone grafting was required.
- The average time taken for fracture healing was 16.67 weeks. [Krettek et al – 16 weeks].^[13]

Skin incision

Plate being slid into place

Plate in place with sleeve

C-arm image: Plate in situ and held temporarily by k-wires

C-arm image after screw placement

Surgical incisions for plate and screw fixation

Pre-operative x-ray

Post-operative x-ray

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FINANCIAL OR OTHER

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Date of Submission: 12/06/2015.
Date of Peer Review: 13/06/2015.
Date of Acceptance: 26/06/2015.
Date of Publishing: 06/07/2015.