A PROSPECTIVE STUDY OF FEMUR LOWER END FRACTURES, MANAGEMENT BY LCP USING MIPPO TECHNIQUE

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ABSTRACT: BACKGROUND: Distal femur fractures are commonest fractures in high velocity trauma, the records of a consecutive series, from 1969 to 1976, of 135 adult patients with 137 fractures of which Eight-three fractures were caused by moderate and 52 by severe trauma.¹ Isolated fractures can lead to complications such as ARDS and pulmonary embolism. This leading to the need for early stabilization of fractures, with internal fixation being the choice of treatment for distal femur fracture by LCP. Plating has given the best results in terms of recovery, fracture union, return to work and in turn the functional outcome. **OBJECTIVES:** To study the functional outcome of the distal femur fracture fixation using LCP with MIPPO technique. **METHODS:** The surgical outcome of 30 patients (24 males and 6 females) who were treated by closed reduction with locking compression plate using MIPPO technique, were followed for an average of 12 months, then by radiological and clinical evaluation assessment was done using the NEER'S score. **RESULTS:** In the study of 30 patients with acute trauma, median age being 45 years ranging from 22-68 years. 22 fractures were caused due to RTA, 6 of them with self-fall and 2 presenting with assault. 23 amongst them were fractures of the right femur and the rest being the left. Using the NEER'S scoring system 50% excellent results were obtained, with 30% good, 20% fair results. Range of motion of hip and knee was well preserved with excellent to good results. Gait and weight bearing after complete union was satisfactory. **CONCLUSION:** Closed reduction and internal fixation of the distal femur fractures by LCP using MIPPO technique is one of the best modalities of treatment, with the extension of fractures into the articular congruencies, maintaining of the same is very vital. Fixation with locking condylar plates proved to be very effective especially in severe osteoporosis, decrease in the duration of hospital stay was also seen along with faster recovery, earlier union rates and good functional outcome compared to alternative procedures known.

KEYWORDS: Supracondylar femur fracture, locking condylar plate, MIPPO technique, intra-articular fractures, NEER's scoring system, closed reduction and internal fixation.

INTRODUCTION: With the increase of RTA and industrialization many young lives have crippled and need for decreasing their morbidity is gaining demand.

Fractures of the distal end of the femur are often difficult to treat due to their complexity and intra articular involvement at times and their associated complications.

In the early 1960's, there was a great reluctance towards the operative intervention of these fractures as they were associated with higher rates of malunion, non-union, sepsis, inadequate fixation, lack of proper tools and so on. Then the traditional management of supra condylar femur displaced fracture swept, mainly consisting of skeletal traction, manipulation of fracture and external immobilization in the form of casts and cast bracings. These were associated with problems such as deformity, shortening, prolonged bed rest, knee stiffness, angulation, joint incongruity, malunion, quadriceps wasting, knee instability and post traumatic osteoarthritis.

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In the recent years open reduction and internal fixation with the AO blade plates have given good results and so likely the dynamic condylar screw, intramedullary retrograde nail and also other implants like locking compression plates.

Difficulties in the elderly patients with added osteoporosis have become a challenge to restore the painless joint movement and articular congruency. Locking compression plates comes with innumerable advantages in such circumstances. They have the advantage of conventional compression plating and locked plating techniques which enhance the plate osteosynthesis. Anatomically pre contoured built reduces the soft tissue problems and acts as internal external fixator.

In addition the locking compression plates have got distinct advantage of unicortical fixation and least chance of plate back out as the screw gets locked to the plate. Further it reduces soft tissue injury when closed reduction along with MIPPO technique is done.

In a study by Neer et. al² in the year 1967, the results of internal fixation in cases of supracondylar fractures of femur as compared to those of closed methods of treatment. They took into consideration 110 cases with supracondylar fractures of femur out of which 29 were treated by open reduction and internal fixation and rest were treated by closed methods. They reported only 52% satisfactory results with operative methods while 90% satisfactory results with closed method were seen. They also obtained satisfactory results in 84% of displaced supracondylar fractures. Neer et. al formulated a rating system based on points given to functional and anatomical criteria. This rating system is followed by many and is recommended specifically for evaluation of distal third fractures.

Kenneth A. Egol et al³ conducted a study on biomechanics of locked plates and screws and showed that locked plates and conventional plates rely on completely different mechanical principles to provide fracture fixation and they provide different biological environments for healing to do so. Locked plates may increasingly be indicated for indirect fracture reduction, diaphyseal/metaphyseal fractures in osteoporotic bone, bridging severely comminuted fractures and the plating of fractures where anatomical constraints prevent plating on the tension side of the plate.

Advantages include minimal soft tissue exposure, closed reduction technique, shorter operating time, minimal blood loss and early recovery. This prospective study aims to evaluate the surgical outcome of distal femoral fractures treated with locking compression plates by MIPPO.

MATERIALS AND METHODS: Between 5th October 2011 to 5th October 2013, a total of 30 patients were operated and evaluated in our hospital. The method used was closed reduction and internal fixation operated by the same surgeon and follow up ranged from 3 months to 1 year.

All fractures were post traumatic and no pathological, supra condylar fracture in children were included.

Inclusion Criteria:

- Patients with lower third femoral fractures aged 20 years and above.
- Patients willing for treatment.

Exclusion Criteria:

- Patients with pathological fractures except for osteoporosis.
- Patients below 20 yrs of age.

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- Patients not willing for treatment.
- Patients managed conservatively due to other medical ailments.
- Lower third fractures with neuro-vascular deficit.

Implant used:

- The plate and screws manufactured from 316L stainless steel alloy with gun drilling technique.
- The locking compression plates are available from 5 holed to 12 holed, with 4.5mm thickness plate for lower end of femur.
- Anatomically precontoured plate head with soft edges.
- Locking screws in the head of the plate for a secure support.
- The head of the locking screw is threaded which gets locked to the plate as it is tightened.
- LCP combi-holes in the plate shaft – intraoperative choice between angular stability and/or compression.

SURGICAL PROCEDURE: Patient placed in supine position on a standard radiolucent operating table. C-arm image intensifier was used in the operating room for closed reduction technique, adjusted accordingly to take AP and lateral views.

Skin incision taken from joint line on the lateral aspect of about 5-7 cms, fascia incised in the same incision and branches of superior geniculate artery/vein ligated.

Distal incision for entry of plate

Creating space in the sub-muscular plane

Fractures after the anatomical reduction stabilized temporarily using K-wires. Plate passed from the distal incision into the sub-muscular plane holding the sleeve fixed to it. The plate is applied to the lateral aspect of the femur. Wires are maintained after the placement is confirmed using the fluoroscope.

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Entry of the plate using the sleeve

Fixing distal part using K-wire

Fixation at distal end

Fixation at proximal end

Once the plate has been provisionally applied to the proximal segment and length, rotation and alignment has been checked, locking screws can be placed. It is essential that the plate is properly centered on the shaft for secure locking screw insertion. Again it is critical to pre-drill through the appropriate, plate mounted drill sleeve in the locking screw holes, to be sure of the correct alignment. The length of the screw measured using depth gauge and screw placed and locked using a screw driver. If conventional and locking screws are used together then conventional screws must be used before inserting the locking screws.

For some cases cortical screws are used to bring the plate and fragment nearer.

Proximal and distal plate seen through the incision

Closure

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RESULTS: In our study 30 femoral fractures were treated, all acute trauma cases considered with median age being 45, ranging from 22yrs to 68yrs. 22 fractures were caused due to RTA, 6 of them with self-fall and 2 presenting with assault. 23 amongst them were fractures of the right femur and the rest being the left.

In our study of 30 lower femur fractures, 3 were Muller's type A₁; 11 were of Muller's type A₂; 2 were of Muller's type C₁; 8 were of Muller's type C₂; 6 were Muller's type C₃. Of these, 6 were open fractures and 2 needed prior debridement and primary closure.

4 patients had associated injuries; 2 patients had fractures of proximal tibia along with the patella, 1 patient had fracture of ulna, 2 patients had proximal tibia fracture and all the patients with associated injuries were treated accordingly.

All these patients were treated by MIPPO (Minimally Invasive Percutaneous Plate Osteosynthesis). All patients were treated within 8 days of injury, average time duration was 100 minutes, shortest being 75 mins and longest being 150 minutes.

Size of the plates used was depending on the fracture with 6 and hole plates more commonly used. Of 30 patients, 19 patients (65%) showed radiological union within 18 weeks. Only one patient had problem of screw cut out due to premature weight bearing by the patient.

Average flexion achieved in this study by >50% of patients is 110°.

Out of the 30 patients 3 patients have limb discrepancy <1cm and only 1 patient had a shortening of around 3 cms. The average duration of follow up was from 3 months to 18 months. In this study very few patients had varus/valgus mal-alignment.

Results noted are,

- 65% radiological evidence seen between 16-18 weeks, 35% seen in the 19-20 weeks.
- 15% with <90° knee flexion, 30% with 91° – 109° and >110° flexion in the rest 55%.
- Knee extensor lag with 0-5 degrees seen in 55% of patients, 6-10 degrees seen in 35% and >10 degrees seen in the rest 10%.
- Limb length discrepancy of about 0.5-1 cms seen in 10% of cases, >1cm in 3% of the cases.
- Varus deformity of more than 5 degrees in about 15% and valgus of more than 5 degrees in 10% of the cases.
- 50% of the patient could resume the same work as before accident, 25% could resume regular work but with handicap, 15% with alter work, 5% with light work and 5% with no work.
- Complications such as superficial infection was seen in about 10% of the cases and implant failure – screw/plate breakage in about 3%.
- 50% of the cases gave excellent results, with 30% good and 20% fair results.

Following are the images of 3 cases, A, B and C with pre-op, immediate post op and follow up X-ray images.

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CASE A:

Pre-op image

Immediate post-op X-ray image

6 weeks follow up X-ray image

12 weeks post-op X-ray image

CASE B:

Pre-op X-ray image

Immediate post-op image

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8 Week follow up X-ray image

12 month follow up X-ray image

CASE C:

Pre-op X-ray image

Immediate post-op image

6 week follow up X-ray image

12 months follow up image

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DISCUSSION: In our study 30 fractures of distal femur were treated by MIPPO, overall assessment was done using the NEER's score.

25 of them were closed and 5 open, of which 3 needed emergency debridement and primary closure, which were classified under Gustillo Anderson type III A.

Zhongguogushang et al concluded that this method for the treatment of supracondylar femur fracture can get satisfactory function, high rate of bone non-union and fewer complications. Familiar with the closed reduction technique and the geometry shape of anatomical plate as well as femoral supracondylar area are important to treat the supracondylar femur fractures. In his study of 39 fractures 28 got excellent, 10 got good and remaining got fair results by MIPPO.⁴

EL Ganainy AR et al, concluded that minimally invasive percutaneous locked plating provided favourable results in the treatment of distal femoral fractures in geriatric population with diabetes.⁵

Farouk et al, a percutaneous minimally invasive plating technique disrupts the femoral blood supply less than the traditional open method. Such minimally invasive methods may be more advantageous biologically than the traditional method.

Laubethal has demonstrated that average motion required for:

Normal knee flexion is	140°
Normal sitting	93°
Stair climbing	100°
Squatting	117°

Thus the acceptable knee flexion compatible with daily activity would be 110°.

Average flexion achieved in this study by more than 50% of patients is 110°.

Average knee extensor lag in this study was 5.50° out of 30 patients in this study very few patients had significant varus/valgus mal-alignment.

Yeap, E.J., and Deepak, A.S⁶ conducted a retrospective review on eleven patients who were treated for type A and C distal femoral fractures (based on AO classification) between January 2004 and December 2004. All fractures were fixed with titanium distal femoral locking compression plate. This patient's ages ranged from 15 to 85 with a mean of 44. Clinical assessment was conducted at least 6 months post-operatively using the Schatzker score system. Results showed that four patients had excellent results, four good, two fair and one failure.

The duration of follow up ranged from 3-18 months, with average hospital stay of 19 days. Images showing post-op patients with implant insitu and knee ROM.

With full flexion

With knee extension

CONCLUSION:

- Locking compression plate is a good fixation system for distal end femoral and proximal end tibia fractures, particularly intra-articular type.
- Operative time lessened and lesser blood loss.
- Great use in elderly patients with osteoporotic bones.
- Closed reduction and plate fixation by MIPPO is soft tissue friendly approach in the treatment of fracture around the knee preserving the blood supply to bone.
- Non-requirement of bone graft decreases the morbidity of the donor site.
- Early surgery, at least two screws in each fragment and early post-operative knee mobilization are essential for good union and good knee range of motion.
- MIPPO in the treatment of supracondylar femur fracture can get satisfactory function, high rate of bone union and fewer complications, with minimal periosteal stripping.
- Locking compression plates provide rigid fixation in the region of femur where wider canal, thin cortices and frequently poor bone stalk make the fixation difficult.

To conclude, locking compression plate is an important armamentarium in treatment of fractures around knee especially when fracture is comminuted and in situations of osteoporosis. Further study in large number of patients is required to comment regarding disadvantage and complications.

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