



## Distal Femur Fractures Treated by MIPO Locking Compression Plate – A Prospective Study on the Functional Outcome

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### Abstract

**Introduction:** Fractures of distal femur are one of the complex injuries that are encountered in our day-to-day practice with the incidence of about 37% in 100,000 people. These injuries have potential to generate significant long-term disability particularly when they are related with marked bone comminution, extensive articular cartilage damage and severe soft tissue injury. Several treatment options are available for the treatment of these injuries but with less predictable outcome.

**Objectives:** The aim of the present study is to assess the functional outcomes of Minimally Invasive Percutaneous Plate Osteosynthesis (MIPO) for distal femur fractures.

**Materials & Methods:** In the present prospective study, 23 patients with distal femur fractures in adult were treated using locking compression plate and MIPO technique. The patients were selected from Mahatma Gandhi Medical College and Research Institute, Pondicherry. Rasmussen's scoring system was used for evaluating the functional assessment, focused on Clinical and radiological parameters. In this system, there are scoring points for subjective complaints, clinical signs, available range of motion and stability.

**Results:** The analysis was done in terms of gender, age group, Mode of injury, frequency and type of injury, surgical intervention and complication. Majority of the injured patients were male (56.5%). Among male patients 73.3 % of the injury was due to road traffic accidents, whereas among females majority of them were injured due to domestic fall. Common age group was found to be 41-60 years accounting 39%. All fractures in our patients went on to unite and the average union time was about 16 weeks with the range of 12 to 20 weeks. Of 23 patients only one patient had restricted ROM of about 70\* and all the other patients had ROM of about 110\* - 130\*. Two patients had limb shortening of 5-8 mm. Functional outcome was assessed using Rasmussen's scoring and we had excellent and good results in 15 (65%), 8 (35%) patients respectively. No poor results in our series.

**Conclusion:** This study evaluated the results of radiological union and functional outcomes of distal femoral fracture treated by LCP MIPO. The operative interval was lesser with decreased loss of blood, fractures healed rapidly with no significant complications. MIPO gives better results when comparing other techniques but requires special attention to master the technique thereby prevent the complications.

**Key words:** MIPO, Distal femur fracture, Rasmussen's scoring system and locking compression plate.

## Introduction

Fractures of distal femur are one of the complex injuries that are encountered in our day-to-day practice with the incidence of about 37% in 100,000 people. Generally in younger individual, distal femur fractures are due to high-energy injury mechanism whereas in elderly especially in woman it occurs due to low-energy mechanism<sup>1</sup>. Ironically these injuries are prone to produce long-term disability for the patient. Fracture at the lower end of femur and upper end of tibia are often difficult to treat and tend to relate with several complications<sup>2</sup>. Fractures of distal femur alone accounts for approximately 4% to 7% of all femoral fractures.<sup>3</sup> Distal femoral fractures have wide variety of fracture pattern and they are often associated with injuries like patellar fracture, open wounds and ligament disruption. These injuries have potential to generate significant long-term disability particularly when they are related with marked bone comminution, extensive articular cartilage damage and severe soft tissue injury.<sup>4</sup> The present study includes both types of distal femur fractures such as supracondylar (distal 15 cm of the femur) and intercondylar (articular surface) fractures.

Minimally Invasive Plate Osteosynthesis (MIPO) has been widely used in the treatment of long bone fractures and it was introduced by Wenda et al<sup>7</sup> and Farouk et al<sup>8</sup> Krettek et al<sup>9</sup>. The MIPO technique was introduced to prevent extensive exposure at the fracture site and thereby reduces soft tissue damage.<sup>8</sup> The MIPO technique allows biological fracture healing by protecting the vascularity of all bone fragments which will serve as a living bone graft. In Minimally Invasive Plate Osteosynthesis (MIPO), the plate inserted by a percutaneous approach minimizes soft tissue disruption, periosteal injury, and also protects the fracture integrity and vascular integrity of the bony fragments. MIPO is a method that combines both principles of the biomechanical properties of the fixation and an optimum bone to implant contact with preservation of biology of healing.

## Objectives

To assess the functional outcome of MIPO-LCP for distal femur fractures.

Union rate and soft tissue related complications

## Materials and methods

Patients with fractures around the knee presented to the emergency Department at our institute and diagnosed to have supracondylar fractures of the femur in an adult were included in our study. It was a prospective study and the period of study was from Jan 2012 to Feb 2014 with a minimum follow up of 18 months. A total of 23 patients of both sex were included in the study after obtaining proper consent and approval from the institutional ethical committee. All patients were operated within 5 days of the injury. MIPO technique was used for all patients. Patients with associated ipsilateral fractures, pathological fractures, delayed presentation of more than one week and age less than 18 years were excluded from the study. The functional outcome was assessed using the criteria given by Rasmussen for all the patients.

## Surgical procedure

All patients were operated on fracture table with the fractured limb on traction and normal limb in lithotomy position under regional anaesthesia. A 4.5 mm distal femur locking compression plate (Indian implant) was used in all patients. Fractures involving articular surfaces were reduced anatomically by closed techniques and provisional fixation was done using 2.5 mm K wires from medial to lateral. Then the metaphyseal reduction was achieved to get anatomical alignment, and rotation rather than anatomical reduction. Through 5 – 6 cm oblique lateral incision was made through lateral approach for the distal femur and extra periosteal dissection was carried out using a 10mm Cobbs elevator from distal to proximal direction. An appropriate sized plate to get 4 to 5 screws in distal and 5 screws in proximal segment of bone was chosen and was slid through the extraperiosteal plane across the fracture site and proximally plate was

aligned through a separate 2-3 cm incision. Plate was provisionally fixed with k wires in the femoral condyles as well as in the diaphysis under image intensifier guidance after obtaining satisfactory reduction, rotation, and length. Then fixation with cancellous and cortical locking screws were carried out checking in both anteroposterior and lateral views in the image intensifier. Condylar fixation carried out through the 5-6cm incision and diaphyseal fixation done using percutaneous incisions over the corresponding screw holes. After satisfactory fixation, stability was assessed under fluoroscopic imaging of the knee movement upto 90 degrees. Wound closed without drain and compressive dressing applied with long knee brace support to the limb. Gentle ROM exercises, quadriceps exercises, ankle and toe pump exercises were initiated from the 2<sup>nd</sup> postoperative day onwards. Patients were allowed to have non weight bearing walking for the first 6 weeks following which progressive weight bearing was allowed depending on the radiological evidence of union. All patients were followed upto 2 years with 6 weeks followup for the first 3 months and then every 3 months for the next 6 months and then at 6 months interval. During each visit patients were assessed by Rasmussen's criteria apart from radiological assessment.

### Results

In the present study the patients were relatively young on an average and the fractures were mostly extra articular. Majority of the distal femur fracture occurred in men - 13 (56%) when compared to females - 10 (43.5%), with the majority involving 41 – 60 years (39%) followed by 20 – 40 years age group accounting 35%. In the present study the Road Traffic Accident (65.2%) was the common mode of injury and the frequency of injury was greater on the right side (61%) of the limb. In the present study of 23 patients most of the patients were found to have closed (87%) type of injury followed by Grade 2 in two patients and Grade 1 in one. Among the Mullers type, A2 fracture type was higher with 26% than other

fracture types followed by C1 & C2 each accounting for 21%. Mean operative time was about 110 minutes with a range of 80 to 130 minutes. Average blood loss was about 100ml. All fractures in our patients went on to unite and the average union time was about 16 weeks with the range of 12 to 20 weeks. Of 8 type A fractures, only one patient had an metaphyseal angulation of about 10°. Of 14 Muller type C fractures, two patients had intraarticular step of about 5 mm at the intercondylar notch level. Of 23 patients only one patient had restricted ROM of about 70° and all the other patients had ROM of about 110°. Rasmussen's scoring system was used to assess the functional outcome at the end of 6 months, result was excellent in 15 (65%) patients followed by 35% (8 patients) good result. In our series we did not have any poor results.



**Fig. 1** showing operative technique in fracture table



**Fig 2** pre op xray showing Muller- AO type A3 fracture of distal femur



**Fig 3** – immediate post op xray showing good reduction and fixation



**Fig 4** – at 6 months followup fully consolidated fracture



**Fig 5** showing functional outcome in one of our patient.



**Fig 6** showing functional outcome, postop MIPO scar and healed fracture

### Discussion

Fractures involving the distal femur have posed considerable therapeutic challenges in their management and is one of the commonest articular fractures, which is increasing day by day due to road traffic accident. After the 1980s, several studies have shown that operative treatment of the distal femur fractures resulted in better functional outcome than nonoperative treatment.<sup>10, 11, 12</sup> Then later studies were done to compare the outcomes of open Vs closed reduction with internal fixation and found to have significant excellent or good results with lower incidence of malunion in the ORIF group.<sup>12,13</sup> However ORIF required extensive surgical dissection with long duration of exposure to environment and achieved very rigid fixation which lead to devascularisation of fracture fragments and increased rate of soft tissue, implant related complications apart from delayed or non union<sup>10,11,18</sup>. In an effort to minimize all these complications, the concept of biological fixation evolved and a technique introduced by Mast et al<sup>14</sup> using indirect reduction significantly decreased the fracture fragment devascularisation, and stripping of soft tissues and promoted faster fracture healing. Later in 1997, Wenda<sup>7</sup> and Krettek<sup>9</sup> introduced a percutaneous plating technique called “minimally invasive plate osteosynthesis (MIPO)” following which Farouk et al<sup>8</sup>. studied the vascular supply to the femur in the cadaver and compared the effects of two surgical plating techniques, the conventional lateral plate osteosynthesis and MIPO, on femoral

vascularity. The results showed that MIPO maintained the integrity of the perforators and nutrient arteries and was associated with superior periosteal and medullary perfusion.

Current study presents the clinical and radiological evaluation of 23 patients with distal femur fracture treated using MIPO technique with distal femur locking compression plate. Many studies have been done to assess the effectiveness of locking implants in the treatment of distal femoral fractures.<sup>15, 16, 17</sup> Locking compression plates which are biomechanically stronger than the conventional plates and can provide compression apart from adequate stability serves in dual mode known as Hybrid construct. Considering all these factors MIPO should yield superior results compared with all the conventional techniques when it is executed in an appropriate manner. Our study showed excellent and good results in our patients with no significant complications. All fractures went on to unite without any delayed, nonunion or malunion. No soft tissue related complications; no significant blood loss.

### Conclusion

Minimally invasive percutaneous plate osteosynthesis is an excellent option in treating the distal femoral fractures of both the articular and extra articular types. Complications in this technique can be minimized by mastering the surgical procedure with sound knowledge about the complex anatomy of the distal femur.

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