

Research Article

Functional Outcome of MIPO (Minimally Invasive Plate Osteosynthesis) in Distal Third Femur Fractures with Intra Articular Extension

Jantaj Singh, Rajkumar Aggarwal, Chandan Jasrotia, Aarti Dewan*

Abstract

Distal femur fractures include fractures of the supracondylar and intercondylar region. They account for around 3-6% of femur fractures. They occur both in younger patients (as the result of high energy trauma) or in older patients (from low energy trauma as pathological fracture secondary to osteoporosis or malignancy). Despite advances in implant design, the management of distal femur fractures remain challenging. Fracture comminution and intra-articular extension with severe soft tissue injury can make it difficult to obtain an adequate reduction while preserving the soft tissue attachments to bone fragments to allow for bone healing. This study was done to study the functional of MIPO (Minimally Invasive Plate Osteosynthesis) in distal third femur fractures with intra articular extension.

Keywords: MIPO (Minimally Invasive Plate Osteosynthesis); Distal femur fractures; Intra articular extension; Comminution

Introduction

Distal femur fractures include fractures of the supracondylar and intercondylar region. They account for around 3-6% of femur fractures. They occur both in younger patients (as the result of high energy trauma) or in older patients (from low energy trauma as pathological fracture secondary to osteoporosis or malignancy). These fractures have the potential to generate significant long term disability particularly when they are related to marked bone comminution, extensive articular damage and severe soft tissue injury [1]. The evaluation and management of patients with distal femur fractures continue to evolve on the basis of the improved understanding of the local anatomy, impact of treatment and biomechanics of fixation techniques.

Despite advances in implant design, the management of distal femur fractures remain challenging. Fracture comminution and intra-articular extension with severe soft tissue injury can make it difficult to obtain an adequate reduction while preserving the soft tissue attachments to bone fragments to allow for bone healing [2]. There is low osteogenic potential due to osteoporotic bone in elderly patients. Knowledge of strength and weakness of different implants is necessary for successful treatment of these fractures.

Retrograde nailing cannot be used in complex intra articular fractures (AO type B/C) or simple articular fractures with extensive comminution where standard protocol is direct reduction of the articular fragment followed by lag screw fixation and indirect reduction of the metaphyseal component [3].

The main goal is to anatomical restoration of the articular surface of the knee joint, stable internal fixation, preservation of blood supply with early postoperative rehabilitation of knee joint.

Affiliation:

Department of Orthopedics, Sri Guru Ram Das Institute of Medical Science and Research, Sri Amritsar, Punjab, India

*Corresponding Author:

Aarti Dewan, Department of Orthopedics, Sri Guru Ram Das Institute of Medical Science and Research, Sri Amritsar, Punjab, India.

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The MIPO technique embodies all the biomechanical advantages of bridge plate fixation. The absolute rigidity that was initially the aim of plate osteosynthesis is now replaced by more elastic fixation allowing micromotion at the fracture level resulting in indirect bone healing and abundant callus formation [4].

MIPO technique showed a decreased incidence of implant failure and infection and reduced the need for secondary bone grafting procedures in numerous clinical series with further elaboration, the trend of indirect reduction led to the development of Minimally Invasive Plate Osteosynthesis (MIPO).

In MIPO, fracture is usually reduced by closed reduction through the soft tissue window away from fracture site, the metadiaphyseal component reduction becomes difficult and malalignment is a more common complication compared to conventional open reduction [5].

Aim and Objectives

Aim: Aim of the study is to study the functional outcome of MIPO (Minimally Invasive Plate Osteosynthesis) in distal third femur fractures with intra articular extension.

Objective: Objective of the study is to evaluate clinical and radiological outcome of patients of distal third femur fractures with intra articular extension treated with MIPO (Minimally Invasive Plate Osteosynthesis).

Material and Methods

This Interventional study was conducted from 1st April 2021 to July 2022 on patients of distal third femur fractures with intra articular extension who are skeletally mature or age of 18 years or above presented in the department of orthopedics SGRDIMSAR Amritsar in which MIPO (Minimally Invasive Plate Osteosynthesis) was included in the study to treat distal third femur fractures with intra articular extension. Patients with pathological fracture, open fracture grade 3b/3c requiring external fixation and Periprosthetic fractures were excluded from study.

Results

An interventional study comprising of 26 patients of distal femur fractures with intra articular extension treated with Minimally Invasive Plate Osteosynthesis (MIPO). Patients were admitted in Department of Orthopaedics at Sri Guru Ram Das Institute of medical Sciences and Research, Amritsar between 1st April 2021 to July 2022. This study was performed under the approval of our institution's ethical review board. Informed consent was obtained from each participant. Out of 26 patients, 4 patients were lost to follow up. The final outcome of 22 cases on the basis of radiological and functional parameters was assessed and is here under:

Baseline characteristics

Maximum percentage of Age group was >50 years contributing to 65.4 % to the present study with minimum age of 18 years and maximum age of 80 years and the mean age of 54.5 ± 14.82. Out of 26 patients, 15 were female and 11 were male.

As per AO/OTA guidelines, it was observed that 10 cases were classified as 33C1 (38.5%), 15 were of 33C2 (57.7%) and one case was classified as 33C3 (3.8%).

Radiological Analysis

Coronal Plane Alignment

The normal range of anatomical lateral distal femoral angle was taken from 79 to 83 degree. All the cases in this study had anatomical lateral distal femoral angle of uninjured side within this range with average mean of 80.86 ± 1.16. Postoperatively, anatomical lateral distal femoral angle was measured at 3rd month. There were 18 cases which had neutral alignment (there anatomical lateral distal femoral angle were within 79 to 83 degree). The average mean anatomical lateral distal femoral angle of operated side was 80.81 ± 2.55. This outcome was statistically insignificant (p value=0.938) (Figure 1).

There were 2 cases with valgus alignment which had valgus of 5 degree each and 2 cases had varus alignment with one case having 6 degree varus and the other case having 5 degree varus as compared to normal side of each case. (Figure 2).

Table 1: Demographic data.

Age	Frequency	Percent
≤50 years	9	34.6
>50 Years	17	65.4
Gender		
Female	15	57.7
Male	11	42.3
AO TYPE		
33C1	10	38.5
33C2	15	57.7
33C3	1	3.8

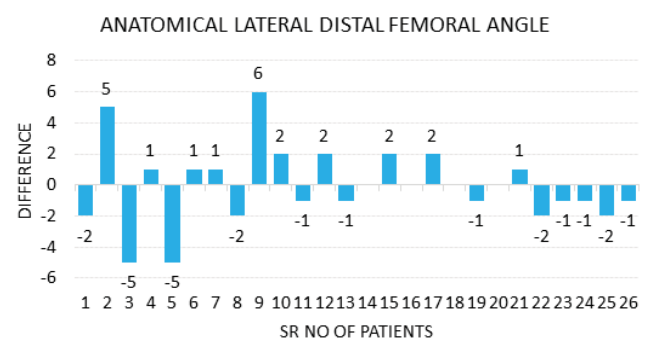


Figure 1: Anatomical lateral distal femoral angle.

Sagittal plane alignment

The normal range of angle between blumensaat line and anatomic axis of shaft of femur was taken as 35.4 ± 3 degrees [7]. The average mean angle of operated side was 35.22 ± 2.11 . This outcome was statistically insignificant (p value = 0.097). Postoperatively, there were 20 cases which had neutral alignment (there angle was within this range). There was one case with 4 degree extension and one case of 4 degree flexion (Figure 3).

Total femoral length

There was an average decrease in total femoral length at 3rd month of 7.68 mm ($p \leq 0.001$) as compared to uninjured side. This outcome was statistically significant (Figure 4).

Rotational alignment

There was an average trend toward neutral alignment of the operated limb as compared to the uninjured limb. 19 patients had neutral rotational alignment. There were 3 cases of malrotation. 2 cases had external malrotation and 1 case with internal malrotation.

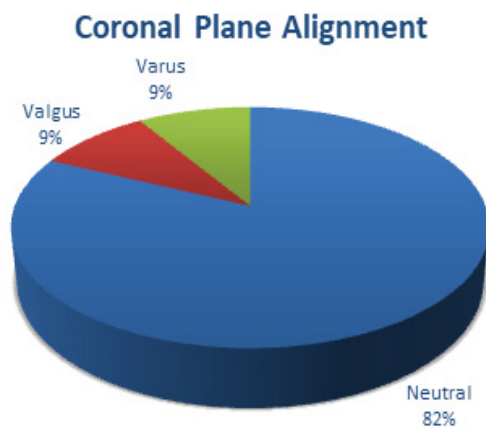


Figure 2: Coronal plane alignment.

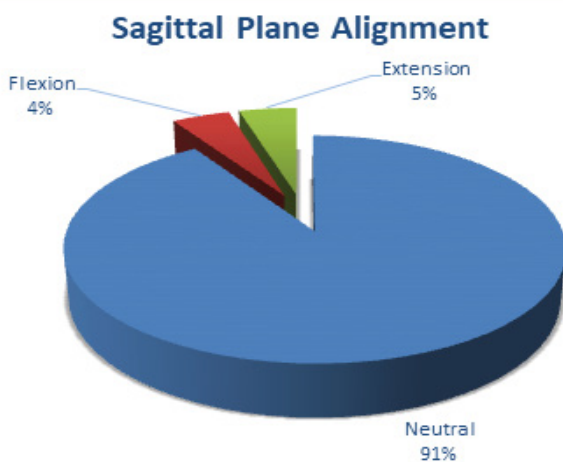


Figure 3: Sagittal plane alignment.

Union

Radiological union at 3 months was achieved in 19 cases in total. 3 cases had delayed radiological union (Figure 5).

Functional Outcome

Functional outcome at 3rd month was assessed using oxford knee score showed a mean score of 40 ± 1.83 with most cases having satisfactory outcome ≥ 40 score (14 cases). The mean range of motion achieved at 3 months was 96.14 ± 22.88 degrees (Table 2).

There were 2 cases with restriction of movement with both patients achieving 45 degree flexion. The flexion deformity (inability to achieve full extension) was present in 4 cases.

Discussion

Distal femur fractures include fractures of supracondylar and intercondylar region and have always been difficult to treat. They tend to occur in elderly population but incidences in younger age group have also been increasing due to increasing road traffic accidents. The goals for treatment are the anatomical restoration of articular surface, length, alignment and rotation with early mobilisation of joint. Various fixation methods for distal femur fractures have been described. it can be categorized into retrograde intramedullary nailing and plating. Plating can be further categorized into open anatomical reduction and fixation with plate or Minimally Invasive Plate Osteosynthesis (MIPO).

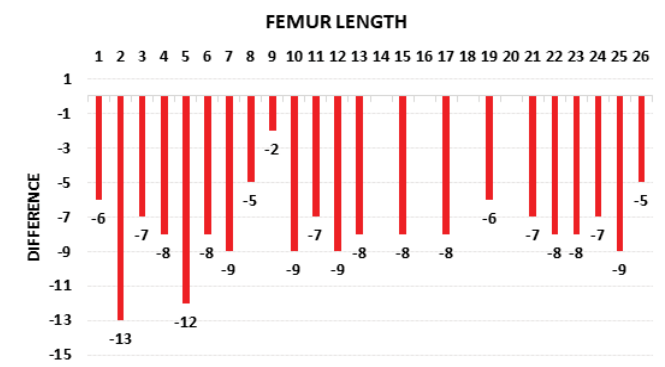


Figure 4: Difference in femoral length.



Figure 5: Radiological union of patients.

Table 2: Functional outcome of patients.

	Mean ± SD	Minimum	Maximum
Oxford Knee at 3 Months	40 ± 1.83	36.00	43.00
Range of Motion	96.14 ± 22.88	45.00	120.00



Figure 6: Showing method of templating.

Our study comprised of 26 patients of distal femur fractures with intra articular extension (Ao type C) which were treated with Minimally Invasive Plate Osteosynthesis (MIPO). Out of the 26 patients, 4 patients were lost to follow up. The patients were treated with distal femur locking plate with direct articular reduction using lateral parapatellar approach and indirect reduction of metaphyseal component by Minimally Invasive Plate Osteosynthesis (MIPO). The functional outcome depends on adequacy of reduction and rigid fixation of articular fragment and maintenance of length, alignment and rotation in all the planes with early union of the fracture.

There were 18 cases in our study which had neutral coronal alignment (there anatomical lateral distal femoral angle were within 79 to 83 degree) 6 with 2 cases of varus alignment and 2 cases of valgus alignment, whereas Ajeet et al. [8] in 2018 had 5 patients who had varus deformity more than 10 degree.

Functional result in our study at 3rd month was assessed using oxford knee score showed a mean score of 40 ± 1.83 with most cases having satisfactory outcome ≥40 score (14 cases) and The mean range of motion achieved at 3 months was 96.14 ± 22.88 degrees. There were 2 cases with restriction of movement with both patients achieving 45 degree flexion, whereas Jati S et al. [9] in 2021 evaluated according to NEER's scoring system 38 cases had excellent results and 8 cases had satisfactory results according to NEER's scoring

system with a mean NEER's score of 90.133 (range 74 to 96) at a mean follow-up of 1 year and Knee stiffness was seen in 4 cases. This study had 4 cases of superficial infection, whereas there was one case of infection in our study which was treated with thorough debridement with retention of implant. This study had 2 cases of rotational mal-alignment whereas we had 3 cases of rotational malalignment.

Conclusion

At the end we can concluded that good functional and radiological outcome can be achieved in distal femur fractures with intraarticular extension by direct open reduction of the articular block and indirect reduction of the metaphyseal component via Minimally Invasive Plate Osteosynthesis (MIPO) (Figure 6).

According to standard teaching, the screw should be placed parallel to the knee joint in order to restore the anatomical lateral distal femoral angle. This depends on the native anatomical lateral distal femoral angle and also on the angle of the shaft of plate to the central locking screw. We have studied there is a variation in the normal anatomical lateral distal femoral angle and variation in the angle between shaft of plate and central locking screw of plates manufactured by different vendors. So we should template the uninjured side first in order to assess whether the screw should be put parallel or away from the knee joint in order to restore the native anatomical lateral distal femoral angle.

Limitation of Study

The limitation of the present study was that we did not use single standard plate for fixation in all the cases of our study. We used different plates in our study which had variation in angle between shaft of plate and central locking screw.

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None

Conflicts of interest

There is no conflict of interest.

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