



**ORIGINAL RESEARCH PAPER**

**Orthopaedics**

**A COMPARATIVE STUDY ON FUNCTIONAL OUTCOME OF SUPRACONDYLAR FEMUR FRACTURE MANAGED BY OPEN REDUCTION VS MIPPO.**

**KEY WORDS:** NEERS Score ,MIPPO,LCP ,Open reduction

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**ABSTRACT**

**Background:** Distal femur fractures are complex injuries producing long term disability and present considerable challenges in management. These fractures poses challenges to the treating surgeon because of thin cortex of the femoral condyles, wide medullary canal, relative osteopenia, short condylar fragment and comminution involving articular surface. Distal femur fracture disrupts normal knee joint functioning, hence needed anatomical reduction and stable internal fixation to prevent crippling disabilities and hardware failure

**Objectives:** This study aimed to Compare Functional outcome of supracondylar fracture femur managed by Open reduction VS MIPPO

**Material & Methods:** In this study 30 patients with fracture of distal femur were studied. The method used for fracture fixation was both closed and open reduction with internal fixation with locking compression plate. Patients were selected based on inclusion and exclusion criteria and were followed up ranged from 3 months to 1 year. The results were analysed with NEER'S score.

**Results:** In our study of 30 lower end of femur fractures, 5 was Muller's Type A1; 5 were of Muller's Type A2.; 4 were of Muller's Type A3; 2 were B; 3 was of Muller's Type C1 ; 9 were of Muller's Type C2; and remaining 2 were Muller's Type C3. Mean age of the patients was 48.4 years with age ranging from 18-70 years with more than two thirds of them being male. Right sided fractures were predominant. RTA being the cause of injury for most of them but there are also cases of fall in the older age group >50 years. MIPPO surgery was done in less time when compared to open reduction. 2/3rd of cases done by MIPPO are done in less than 90 minutes when compared to open reduction where the average duration of times was between 90 to 120 minutes accounting 60% of patients. There is not even a single case done by MIPPO with duration of more than 120 minutes. Early radiological union less than 16-18 weeks was seen in most cases of MIPPO technique when compared to OPEN reduction. Open reduction accounted nearly 20% of cases with infections while MIPPO accounted only 6.67% infections mostly of superficial type. There is single implant failure seen in our study that too with MIPPO technique which underwent revision surgery. Better functional outcome was seen in MIPPO procedure accounted 73.33% when compared to open procedure of 66.67%. Poor functional outcome was seen in 13.3% of patients who underwent open reduction and 6.67% cases who underwent MIPPO procedure. Functional outcome was based on NEER's scoring system.

**Conclusion:** Locking compression plate is an important armamentarium in treatment of fractures around knee especially when fracture is severely comminuted and in situations of osteoporosis. Overall MIPPO has better functional outcome than OPEN reduction especially in extraarticular fractures with comminution as there will be early radiological union, less soft tissue damage, least infection rate which ultimately helps in early physiotherapy and early weight bearing resulting in best functional outcome.

**INTRODUCTION**

In the last few decades, rapid industrialization and the fast pace of life have brought both comforts and catastrophe like road traffic accidents and crippling many young lives. Anatomic reductions of the articular surface, restoration of limb alignment, and early mobilization have been shown to be effective ways of managing most distal femoral fractures. Then, the traditional management of displaced supracondylar fracture of femur was along the principle of Watson Jones<sup>1</sup> & John Charnley<sup>2</sup>.

The major advances in the treatment of all types of femoral fractures were first seen in 1870 when Hugh Owen Thomas<sup>3</sup> devised the "Thomas Splint".

1909 saw the "Steinman Pin" devised by Fritz Steinman<sup>4</sup> which was used for skeletal traction replacing the age old skin traction.

James E Anderson<sup>5</sup> described the anatomy of lower end of femur which guided the treatment of fractures around knee.

Muller<sup>6</sup> classified supracondylar fracture based on AO principles and tibial plateau fractures were classified by

Schatzker<sup>7</sup> which have helped in understanding biomechanics of fracture treatment.

The trend of open reduction and internal fixation has become evident in the recent years with good results being obtained with the AO blade plate, dynamic condylar screw, intramedullary supracondylar nail & other implant system like locking compression plates.

Elderly patients with severe osteoporosis add further to the difficulties in management of fractures around knee which requires restoration of articular congruency for painless free movements of joint. Loss of stable fixation in osteoporotic bones is of great concern in such elderly patients. Locking compression plates with its innumerable advantage is of great use in such circumstances.

Locking compression plate has the advantage of combination of conventional compression plating and locked plating techniques which enhances the plate osteosynthesis. Anatomically precontoured built reduces soft tissue problems and acts as internal external fixator.

In addition, a locking compression plate has got distinct

advantages of uncortical fixation and least chance of plate back out as the screw gets locked to the plate. Further, Minimal soft tissue injury occurs when closed reduction is done and MIPPO technique is used.

Complications of distal femur fracture are mal-union, nonunion, implant failure, varus angulation, limb length discrepancy, infections and secondary osteoarthritis.

The purpose of this study is to Compare Functional outcome of supracondylar fracture femur managed by Open reduction VS MIPPO.

**MATERIALS AND METHODS :**

The study was conducted in the Department of Orthopaedics, Narayana Medical college and hospital, Nellore. This study consisted of 30 patients visiting outpatient department, emergency department of the hospital during Patients diagnosed with distal femur fractures were included in the study who were operated during the period from December 2019-october 2021. The follow up duration range varied from 3months to 1 year.

**Method Of Collection Of Data**

**Study design:** Comparativestudy.

**Sample size:** It was a hospital based study with sample size of 20 (calculated based on previous studies) who were fulfilling the inclusion criteria.

**Inclusion Criteria:**

1. All the patients who present with supracondylar fracture femur with all types A,B,C(AO classification)
2. Patients willing to give informed consent.
3. Patient age >18years & <70years
4. Closed fractures & Grade 1 & 2 compound fractures

**Exclusion Criteria:**

1. Patients not willing for surgery
2. Patients who are not medically fit for surgery
3. Patients age <18 years & >70 years
4. Grade 3 compound fractures of distal end femur
5. Pathological fractures

Prior informed consent, pre-operative anesthetic evaluation was done. Pre-op planning of fixation was done and proceeded with surgery.

**Surgical procedure:**

After the patient is anaesthetised, the patient is placed in supine position over a radiolucent table. The limb is painted and draped up to the level of iliac crest. The fracture is approached by a longitudinal incision over the lateral aspect of distal thigh centred over the lateral epicondyle extending distally up to the level of Gerdys tubercle distally and proximal extension as required. Fascia lata is incised longitudinally along the skin incision up to iliotibial band. The incision extends distally through lateral joint capsule and meniscal injury is avoided.

Vastus lateralis is reflected off the inermuscular septum along the linea aspera in the anterior direction. Perforating vessels transversing the muscular plane are ligated. Care is taken to avoid unnecessary stripping of soft tissue at the fracture site. Once the fracture site is exposed, haematoma is drained.

The approach of distal femur in MIPPO is shorter version of open lateral approach. The distal skin incision starts from the joint line on the lateral aspect of about 5-7 cm. Minor rotational adjustments of the plate are then made to ensure that the anterior edge of the plate parallels the anterior distal femur contour.

Post-operative wound care and physiotherapy was done

according to hospital protocol. Mobilization with Non weight bearing was started from the first post-operative week till 6-8 weeks depending on the fracture pattern and then partial weight bearing after confirmation of beginning of healing process till fracture union. Further, full weight bearing was allowed depending on the progress of fracture healing pattern clinically and radiologically.

Patients followed up at every 4 weeks up to 3 months postoperatively and then on monthly until 6 months and on 9th month and 1 year. Based on data final outcome was assessed according to NEERS scoring system.

**Case 1-mippo Dflp**



Range of movements during follow up period

**Case 1-open Dflp**



Range of movements during follow up period

**OBSERVATION AND RESULTS**

A total of 30 patients with distal femur fractures was taken in our study and divided into two groups OPEN DFLP and MIPPO DFLP . OPEN DFLP: Mean age of the patients is 48.4 years, 44.6 years in MIPPO DFLP. 22 were male (10 cases are in OPEN DFLP, 12 were in MIPPO DFLP group) and the remaining patients were female (5 cases are In OPEN DFLP, 3 were in MIPPO DFLP ). right side more commonly involved than left side, 53.3% of cases in both OPEN DFLP & MIPPO DFLP . Most common mode of injury in all the groups is road traffic accidents 60% in OPEN DFLP (i.e. 9 cases), 80% in MIPPO DFLP (i.e. 12 cases) . There are 7 cases of associated injuries with 2 cases in OPEN DFLP

and 5 cases in MIPPO group. Most common type of fracture noticed in MULLERS C2 accounting 30% in both groups. Average interval between injury and surgery is 3.93 days in MIPPO group and 6.53 days in OPEN DFLP group. Only 6 out of 30 are compound cases in both groups.

**Table 1: Distribution of time period in weeks for complete radiologic union in patients studied**

UNION_TIME (WKS)	Open DFLP	Percent	MIPPO DFLP	Percent
16-18 weeks	12	80.00%	13	86.67%
19-20	3	20.00%	2	13.33%
Total	15	100.00%	15	100.00%

**Table 2: Distribution of rate of complications in patients studied**

COMPLICATIONS	Open DFLP	Percent	MIPPO DFLP	Percent
INFECTION	4	20.00%	1	6.67%
Implant Failure	0	0	1	6.67%
NO	11	73.33%	13	86.66%
Total	15	100.00%	100	100.00%

**Table 3: Distribution of Functional results in patients studied**

FUNCTIONAL RESULTS	Open DFLP	Percent	MIPPO DFLP	Percent
EXCELLENT	3	20.00%	4	26.67%
FAILURE	2	13.33%	1	6.67%
FAIR	3	20.00%	3	20.00%
SATISFACTORY	7	46.67%	7	46.67%
Total	15	100.00%	15	100.00%

**DISCUSSION**

In our study 30 fractures of distal femur were treated by MIPPO and OPEN reduction equally. Out of 30 cases studied in our series, 24 of them were closed and 6 were open. Of the 4 open fractures, 2 needed emergency debridement and primary closure, which were of Gustillo Anderson classification - Type II.

The median age was 48.4 yrs, ranging from 18-70 yrs of age. Of the 30 cases considered 21 were caused by Road Traffic Accidents, 9 were due to fall . 16 patients presented with fractures on right side and the remaining 4 with fractures on the left side.

In our study 5 was Muller's Type A1; 5 were of Muller's Type A2 ; 4 were of Muller's Type A3; 2 were B; 3 was of Muller's Type C1 ; 9 were of Muller's Type C2; and remaining 2 were Muller's Type C3.

Zhongguogushang et al ... concluded that this method for the treatment of supracondylar femur fracture can get satisfactory function, high rate of bone union and less complications. Familiar with the close reduction technique and the geometry shape of anatomic plate as well as femoral supracondylar area are important to treat the supracondylar femur fractures. In his study of 39 supracondylar fractures 28 got excellent, 10 got good and remaining got fair results by MIPPO<sup>8</sup>

Jain et al, Provided it is applied with proper understanding of biomechanics, LCP is one of the best available options for management of challenging peri- and intra-articular fractures<sup>9</sup>

EL Ganainy AR et al, concluded that minimally invasive percutaneous locked plating provided favorable results in the treatment of distal femoral fractures in this geriatric population with diabetes<sup>10</sup>

Minimally invasive percutaneous plating with the DCS or the LISS provides good outcome with few complications in the treatment of distal femoral fractures. Both systems minimize soft tissue trauma. LISS seems to have lower risk of early implant loosening than the DCS<sup>11</sup>

Subasi et al, Minimally invasive percutaneous plate fixation can be considered an alternative technique in type IIIA and IIIB open fractures resulting from high-velocity gunshot injuries<sup>12</sup>

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<sup>13</sup>

Yeap, E.J., and Deepak, A.S<sup>14</sup> 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. The 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.

Zlowodzki et al<sup>15</sup> combined these series (n=327) and evaluated the outcomes as part of a systematic literature review. Average nonunion, fixation failure, deep infection, and secondary surgery rates were 5.5%, 4.9%, 2.1%, and 16.2% respectively. Some of the technical errors that have been reported for fixation failure have involved waiting too long to bone graft defects, allowing early weight bearing, and placing the plate too anterior on the femoral shaft.

Locked implants are typically indicated in patients with osteoporosis, fractures with metaphyseal comminution where the medial cortex cannot be restored, or a short articular segment. Several case series have evaluated the use of locked implants in the treatment of distal femur fractures. The most commonly used implant in these case series has been the Less Invasive Stabilization System (LISS) with unicortical locking screws<sup>16</sup>.

Most of patients are of age 40 to 70 years constituting nearly 60% with more than two thirds of them being male. RTA being the cause of injury for most of them but there are also cases of fall in the older age group >50 years. Nearly 23% of cases are associated with other injuries. MIPPO surgery was done in less time when compared to open reduction. 2/3rd of cases done by MIPPO are done in less than 90 minutes when compared to open reduction where the average duration of times was between 90 to 120 minutes accounting 60% of patients. There is not even a single case done by MIPPO with duration of more than 120 minutes Early weight bearing less than 15-16 weeks was seen in patients operated by MIPPO constituting 60% of cases when compared to 53.33% of OPEN reduction technique. Late weight bearing was seen in both the techniques most commonly in fractures with intraarticular extension. Extraarticular fractures are having early weight bearing in MIPPO when compared to open reduction.

Early radiological union less than 16-18 weeks was seen in most cases of MIPPO technique when compared to OPEN reduction. Nearly 86.67% of patients operated by MIPPO surgery are having early radiological union when compared 80% of patients operated by OPEN reduction. Radiological union was early in patients with comminuted fractures operated with MIPPO when compared to open reduction surgery Knee flexion post operatively was similar in both MIPPO & OPEN reduction surgeries accounting 60% of cases with knee flexion of >90°. Decreased knee flexion was noted

in mostly in fractures types of intraarticular extension. Patients who have kept on slabs for long term also experienced decreased knee flexion in later periods. Knee extension lag was more in MIPPO operated patients when compared to OPEN reduction. The range of 0 to 5° was present in 50% of cases with nearly equal share of both MIPPO and OPEN reduction surgeries but MIPPO constituted large share of 5 to 10° knee extensor lag especially in the fractures involving intra articular extensions.

Infections are seen more commonly with open procedures when compared to MIPPO. Open reduction accounted nearly 20% of cases with infections while MIPPO accounted only 6.67% infections mostly of superficial type. There is single implant failure seen in our study that too with MIPPO technique which underwent revision surgery.

Better functional outcome was seen in MIPPO procedure accounted 73.33% when compared to open procedure of 66.67%. Poor functional outcome was seen in 13.3% of patients who underwent open reduction and 6.67% cases who underwent MIPPO procedure. Functional outcome was based on NEER's scoring system

**CONCLUSION**

Locking compression plate is a good fixation system for distal end femoral particularly intra-articular type. The operative-time is lessened with decrease in blood loss in MIPPO when compared to OPEN reduction. Provides good angular stability both in MIPPO and OPEN reduction. Closed reduction and plate fixation by MIPPO is soft tissue friendly approach in the treatment of fracture around knee preserving the blood supply to bone.

Early surgery, at least two screws in each fragment and early postoperative knee mobilization are essential for good union and good knee range of motion. There is difference slight difference in weight bearing time of 1 to 2 weeks earlier in MIPPO when compared to OPEN reduction and earlier radiological union in MIPPO by 2 weeks when compared to OPEN reduction. MIPPO in the treatment of supracondylar femur fracture can get satisfactory function, high rate of bone union, less infections and good working capacity like before. OPEN reduction was best for intraarticular extension fractures with least chances of implant failure and knee extension lag compared to MIPPO.

To conclude, locking compression plate is an important armamentarium in treatment of fractures around knee especially when fracture is severely comminuted and in situations of osteoporosis. Overall MIPPO has better functional outcome than OPEN reduction especially in extraarticular fractures with comminution as there will be early radiological union, less soft tissue damage, least infection rate which ultimately helps in early physiotherapy and early weight bearing resulting in best functional outcome.

**REFERENCES**

1. Wilson JN, Watson Jone's: Fractures and joint injuries. 6th ed, pg. 1003-070, 1982.
2. Charnley John. The closed treatment of common fractures. 3rd ed, Pg. 197-204.
3. Hugh Owen Thomas. Quoted by Rockwood CA, Green DP. Fractures in adult, 4th ed, Vol. II, pg. 1972-1993, 1996.
4. Fritz Steinman. Quoted by Rockwood CA, Green DP. Fractures in adult, 4th ed, Vol. II, pg. 1972-93, 1996.
5. James E Anderson. Grant's Atlas of Anatomy. 8th Edition, Anastomosis Around Knee, 4-54, 4-55; Knee Joint, 4-56, 4-57, 4-60.
6. Weil Kuenher, Henry. Quoted by Stewart MJ, Sisk TD, Wallace SL. Fractures of distal third of femur-A compression method of treatment. JBJS, 48-A, pg. 784-807, June 1966.
7. Tees. Quoted by Stewart MJ, Sisk TD, Wallace SL. Fractures of distal third of femur - A compression method of treatment. JBJS, 48-A, pg. 784-807, June 1966.
8. Ricci W, Zheng, Z, Jones, B, Cartner, J. Does Locked Plating Provide Improved Fatigue Properties over Nonlocked Plating and Does Bone Quality Matter? OTA Annual Meeting Poster Presentation Boston, MA; 2007.
9. Close reduction by manipulation and minimally invasive percutaneous plate

- osteosynthesis for the treatment of supracondylar femur fractures]. Orthopaedics Hospital of Sichuan, Chengdu 610041, Sichuan, China. liuxiandong@163.com-2011
10. Locked Compression Plating for Peri- and Intra-articular Fractures Around the Knee. Department of Orthopaedics, Jawahar Lal Nehru Medical College, Aligarh Muslim University, Aligarh, India. 2013
11. Treatment of distal femoral fractures in elderly diabetic patients using minimally invasive percutaneous plating osteosynthesis (MIPPO). El-Ganainy AR, Elgeidi A. Department of Orthopaedic Surgery, Mansoura University, Faculty of Medicine, Mansoura, Egypt.
12. Treatment of distal femoral fracture by minimally invasive percutaneous plate osteosynthesis: comparison between the dynamic condylar screw and the less invasive stabilization system. Kao FC, Tu YK, Su JY, Hsu KY, Wu CH, Chou MC. Institute of Medicine of Chung Shan Medical University, Taichung County, Taiwan, ROC.
13. Minimally invasive plate osteosynthesis in the treatment of femur fractures due to gunshot injuries]. Necmio lu NS, Suba i M, Kayikci C. Department of Orthopedics and Traumatology (Ortopedi ve Travmatoloji Anabilim Dalı), Medicine Faculty of Dicle University, Diyarbakir, Turkey.
14. Yeap, E.J., and Deepak, A.S., (2007) Distal Femoral Locking Compression Plate Fixation in Distal Femoral Fractures: Early result Malaysian Orthopaedic Journal, 1 (1). pp. 12-17. ISSN 1985 2533
15. Zlowodzki M, Bhandari M, Marek DJ, Cole PA, Kregor PJ. Operative treatment of acute distal femur fractures: systematic review of 2 comparative studies and 45 case series (1989 to 2005). J Orthop Trauma. 2006; 20(5):366-371.