

FUNCTIONAL OUTCOME OF OPEN REDUCTION AND INTERNAL FIXATION WITH LATERAL DISTAL FEMORAL LOCKING PLATE IN SUPRACONDYLAR FEMUR FRACTURES IN A TERTIARY CARE CENTRE

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Article Received: 03-04-2025

Article Accepted: 23-05-2025

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ABSTRACT

The supracondylar region of the femur, located between the femoral condyles and the metaphysis, is a critical area for fractures. These fractures, which often occur in elderly individuals or younger patients with multiple injuries, are commonly caused by axial loading combined with forces like varus, valgus, or rotation. Supracondylar fractures account for 3-6% of femoral fractures and less than 1% of all fractures, with high-velocity trauma being a typical cause in younger patients and minor trauma in the elderly. The gastrocnemius muscle's pull can cause the distal fragment to tilt, while muscle traction can lead to limb shortening.

Historically, nonoperative treatments like traction and cast bracing were more effective than surgery, but with the development of advanced internal fixation systems, surgical treatments became preferred. Modern surgical approaches aim to restore the anatomic alignment of the femur, provide stable fixation, and enable early rehabilitation. The distal femoral locking compression plate is commonly used for these fractures, offering flexibility and stability with locking and compression screws.

The study's aim is to assess the functional outcomes of patients undergoing open reduction and internal fixation with distal femoral locking plates for supracondylar femur fractures. Key factors such as postoperative function, pain relief, limb alignment, and rehabilitation success will be evaluated to understand the effectiveness of this surgical technique and its impact on patients' quality of life.

38 adult patients with radiologically diagnosed supracondylar femur fractures participated in this hospital based cross-sectional study of 12 months duration. After all the baseline screening procedures, patients were taken up for the surgery (distal femoral locking plate fixation). Risk factors associated, and intraoperative and postoperative complications were assessed. Follow up examination was done at 14th day, after 6 weeks, 3 months. Patients were assessed functionally based on NEER'S SCORING SYSTEM OF KNEE and radiologically with full length femur X rays AP and lateral views. Data were statistically analysed.

Statistically significant difference in improvement of score was noted on follow up through 14 days, 6 weeks and 3 months following surgery.

This study demonstrates that lateral distal femoral locking plate fixation is an effective treatment for supracondylar femur fractures, providing favorable functional outcomes and high rates of radiological union

Keywords: Supracondylar femur fracture, lateral distal femoral locking plate, Neer's scoring system of knee, functional outcome, radiological union

INTRODUCTION

The supracondylar region of the femur encompasses the area between the femoral condyles and the transition from the metaphysis to the femoral diaphysis. This section of the femur extends approximately 10–15 cm proximally from the articular surface. Fractures occurring in this region are often complex and unstable, demonstrating a bimodal distribution, predominantly affecting either elderly individuals or younger patients with polytrauma (1). These fractures commonly result from axial loading combined with varus, valgus, or rotational forces (2). Supracondylar fractures constitute around 3–6% of all femoral fractures and account for less than 1% of total fractures (3). While high-energy trauma is the primary

cause in younger individuals, elderly patients with osteoporosis may sustain these fractures from low-impact injuries. The contraction of the gastrocnemius muscle can lead to posterior tilting of the distal fragment, while forces exerted by the quadriceps and hamstrings contribute to limb shortening (4).

During the 1960s, nonoperative management, including traction and cast bracing, yielded superior results compared to surgical intervention due to the lack of advanced fixation techniques. However, with the introduction of modern internal fixation systems, such as locked plates and enhanced retrograde intramedullary nails developed by the AO group, surgical treatment has become the preferred approach, offering improved outcomes (2). Initially, intramedullary nailing was employed for managing supracondylar femur fractures; however, complications such as knee stiffness and intra-articular infections led to the increased adoption of plating techniques.

The primary objectives of surgical intervention include achieving precise reduction of the articular surface, restoring limb alignment and length, ensuring stable internal fixation, promoting early mobilization, and facilitating rapid functional rehabilitation of the knee (5). The direct lateral approach is frequently utilized for exposing the distal femur, involving a longitudinal incision over the lateral epicondyle. This incision should be sufficiently long to allow for gentle soft tissue retraction. The fascia lata is incised in alignment with its fibers, exposing the vastus lateralis, which is then mobilized anteriorly by detaching it from the intermuscular septum along the linea aspera (6).

MATERIALS AND METHODS

Study design:

Hospital based prospective observational study.

Study setting:

Study conducted at Government TD Medical College Hospital, Alappuzha in the department of Orthopaedics.

Study population:

Study conducted on patients above 18 years with supracondylar femur fractures in department of Orthopaedics, Govt.TD MCH ALAPPUZHA, during the study period of one year .

Study subjects:

Inclusion criteria

1. Patients age above 18 years.
2. Radiologically diagnosed supracondylar femur fractures.

Exclusion criteria

1. Open fractures, type 3B and 3C.
2. Supracondylar femur fractures with medial comminution fixed with double plates.
3. Pathological fractures other than due to senile osteoporosis.
4. Pregnant females.
5. Patients sustaining peri-prosthetic fractures.

Sample size:

Sample size is calculated from similar study conducted on Functional Outcome of Distal Femoral Fractures using NEER'S Scoring System Managed by Distal Femoral Locking Plate versus Retrograde Intramedullary Nail: A Cross-sectional Study by Arshad Ahmed and et al (37)

$$n = \frac{Z_{1-\frac{\alpha}{2}}^2 p (1 - p)}{d^2}$$

By substituting the values we get the sample size as 38.

SAMPLING PROCEDURE

Consecutive sampling

A total of 38 patients admitted in department of Orthopaedics, Govt. T.D. Medical College Hospital, Alappuzha during the study period of one year. will be taken after considering the inclusion and exclusion criteria.

DATA COLLECTION TOOL

Functional outcome assessment using NEER'S SCORING SYSTEM OF KNEE

The following variables are analysed

- i) pain(maximum score-20)
- ii) function(maximum score-20)
- iii) range of motion in knee(maximum score-20)
- iv) amount of work done by patient(maximum score-10)
- v) gross anatomy(maximum score-15)

vi) roentgenogram(maximum score-15)
Outcome assessment is done based on total score out of 100.
Excellent outcome - >85
Satisfactory outcome – 70-85
Unsatisfactory outcome – 55-69
Failure - <55

DATA COLLECTION TECHNIQUE

Patients (>18 years) who sustained supracondylar femur fractures attending the department of Orthopaedics will be selected for the study. After all the baseline screening procedures, patient taken up for the surgery. Study parameters like pain, tenderness, condition of wound, range of movements of ipsilateral knee were evaluated. In follow up phase patient will be assessed functionally on the basis of NEERS SCORING SYSTEM OF KNEE

DATA COLLECTION PROCEDURES

- Informed consent
- History by verbal communication with patients and their bystanders
- Clinical examination ie ;general, systemic and local
- Diagnosis both clinical and radiological
- Baseline investigations
- Basic radiological examination (X ray : femur full length AP and lateral views)
- Surgical findings
- Postoperative evaluation by clinical examination

METHODOLOGY

Preoperative assessment evaluating the age group affected > 18 years, finding the risk factor associated resulting in supracondylar femur fractures and note the intraoperative and postoperative complications and assess the functional outcome and rate of union of these fractures with distal femoral locking plate fixation.

Follow up examination at 14th day, after 6 weeks, 3 months. Patients will be assessed functionally based on NEER'S SCORING SYSTEM OF KNEE and radiologically with full length femur X rays AP and lateral views.

DATA ANALYSIS

The data collected will be checked by guide periodically, under his guidance necessary changes will be done. Data collected will be entered into Excel sheet and analysed with the help of SPSS version 27 for analysis. All the quantitative variables will be expressed as frequency and percentage and quantitative variables as mean and standard deviation or median with Q1, Q3. Appropriate statistical test will be used for finding association. Student t test for association between quantitative variables with outcome and Chi square test for finding any association between quantitative variable with the outcome. For stating significance P value <0.05 is considered. Regression analysis is done to find out predictors of outcome.

RESULTS AND DISCUSSION

In our study, we prospectively observed 38 patients with supracondylar femur fractures, all managed by lateral distal femoral locking plate fixation.

Gender distribution

Majority (60.5%) of study population were males and 39.5% were females.

In the study by Ahmed A, et al (37), the total number of participants was 40, with 70% male and 30% female; comparable with our study.

Age category

Majority of patients (36.8%) belonged to 41-60 years age group, followed by 20-40 years (31.6%) and 61-80 years (26.3%) successively. Only a minority of patients (5.3%) belonged to 81-100 years age group.

The mean age of the patients was 52.15 ± 18.4 years. The minimum age was 23 years and maximum age was 92 years.

In the 2024 cross-sectional study by Ahmed A, et al (37), the average age of participants in the distal femoral locking plate group was 55.5 years, while in the distal femoral nail group, it was 53.2 years; which are quite comparable to our study demographics.

This must be reflecting the extent of osteoporosis in this age group worldwide.

Mode of injury

Majority of patients (55.3%) sustained RTA following which they developed supracondylar fracture femur. 44.7% had history of fall.

Study held in 2024 by Ahmed A, et al (37), showed similar outcomes; where the most frequent cause of injury was a road traffic accident (accounting for 52.5%), followed by a fall from height (17.5%).

Comparison of results among different studies mirror the main mechanism of supracondylar fracture femur; which is high velocity trauma.

Functional Outcome using NEER'S scoring system of knee

In our study at 14 days post-surgery, mean NEER score of the patients was 86.1 ± 9.2 . At 6 weeks post-surgery, mean NEER score was 88.7 ± 9.1 and at 3 months post-surgery, mean NEER score was 92.4 ± 9.4 . Majority of patients (73.7%) had excellent outcome post-surgery in our study, while 21.1% had satisfactory outcome and only a small fraction (5.3%) had unsatisfactory outcome.

In the study by Ahmed A, et al (37); in the distal femoral locking plate group, the mean NEER score was 84.10; results being comparable. In the distal femoral locking plate group, 55% of participants achieved an excellent NEER score, and 35% had a satisfactory NEER score.

Complications

Majority (94.7%) of patients did not have any post-surgical complication. Only a minority (5.3%) of patients developed varus.

NEER'S Scoring based evaluation

Statistically significant difference in improvement of score on follow up through 14 days, 6 weeks and 3 months was noted (P value < 0.05) following surgery.

Complications among gender

Among females, 86.7% had no complication, 13.3% had varus.

No males had complications following the procedure.

No significant association drawn between gender and post-surgical complications in present study (Chi-square value-3.237, P value (Fisher's exact test)-0.149).

Detailed profile of post operative complications has not been described in contemporary literature. Our study offers new insights into this matter.

Results of surgery among gender

Significant association was noted between gender and results of surgery in our study (Chi-square value-20.81, P value <0.001)).

Among males, 100% had excellent results.

Among females, 33.3% had excellent results; while 53.3% had satisfactory results and 13.3% had unsatisfactory results.

Results of surgery in mode of injury

Significant association was noted between mode of injury and results of surgery in our study (Chi-square value-11.348, P value (Fisher's exact test)- 0.002 (Significant)).

Among patients who sustained supracondylar fracture following fall, 47.1% had excellent results, 41.2% had satisfactory results and only a small fraction (11.8%) had unsatisfactory results.

Among RTA patients with fractures, 95.32% had excellent results with surgery, 4.8% had satisfactory results. No unsatisfactory results were reported among RTA population.

Radiological union

Majority of patients (94.7%) showed radiological union by 3 months post surgery.

In the study by Ahmed A, et al (37); distal femoral locking plate group, the mean time for radiological union was 16.0 weeks with a median of 16 weeks.

Excellent radiological union points towards the superior union rates of femur fractures treated by lateral distal femoral locking plate fixation.

LIMITATIONS

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1. **Small Sample Size:** The study included only 38 patients, which may limit the generalizability of the results. A larger sample size could provide more robust and reliable data.
2. **Single-Center Study:** Conducting the study at a single center might introduce institutional bias, and the findings might not be representative of practices or outcomes in other settings or regions.

Addressing these limitations in future research could enhance the study's validity and applicability in broader clinical settings.

CONCLUSIONS

In conclusion, this study demonstrates that lateral distal femoral locking plate fixation is an effective treatment for supracondylar femur fractures, providing favorable functional outcomes and high rates of radiological union. The majority of patients in this cohort experienced excellent results, as assessed by the NEER scoring system, and showed minimal post-surgical complications. However, significant differences in outcomes were noted based on gender and the mode of injury, suggesting that these factors may influence recovery. Despite the promising results, the study's limitations, including the small sample size and study being done in a single-centre, highlight the need for further research. Larger, multicenter, long-term studies are recommended to confirm these findings and provide a more comprehensive understanding of the long-term efficacy and safety of lateral distal femoral locking plate fixation.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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