

## LONGITUDINAL PROSPECTIVE STUDY OF THE FUNCTIONAL OUTCOME OF A DISTAL FEMUR FRACTURE CLASSIFIED AS OTA TYPE-C, WHICH IS TREATED WITH A LOCKING COMPRESSION PLATE, IS EXAMINED.

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### Abstract

#### Background

A research investigation aimed to assess the functional outcomes achieved through the application of locking compression plates for the treatment of OTA type-C distal femoral fractures. These particular fractures constitute approximately 6.97% of all femoral fractures. The aim of this study is to evaluate the outcomes of locking compression plate in treating distal femur fractures.

#### Method

Longitudinal prospective study which included a total of 170 patients, comprising both male and female individuals, underwent treatment for distal femoral fractures using locking compression plates. Various parameters including the cause of wound, affected portion, subtype of fracture, and treatment outcomes were meticulously noted for analysis.

#### Result

Amongst the 170 patients, 89 of them were males and 81 of them were females. Notably, the leading cause of injury was falls in 38 cases and other causes in 20 cases. In terms of fracture subtypes, there were 70 cases of C<sup>1</sup>, 60 cases of C<sup>2</sup>, and 40 cases of C<sup>3</sup>. When considering laterality, 74 patients had left-sided fractures, while 96 had right-sided fractures. Importantly, these dissimilarities were found to be of statistical significance ( $P < 0.05$ ).

Regarding complications, the study identified four cases of deep infection, two cases of reduction loss, three cases of shortening, and one case of knee stiffness among the patients. Importantly, these complications also demonstrated a statistically significant distinction ( $P < 0.05$ ).

#### Conclusion

Locking compression plates have been established to be an effective approach for the treatment of “distal femur fractures”. They offer outstanding sturdiness and contribute to the preservation of limb length and alignment.

#### Recommendation

Locking compression plate method offer an absolute benefit over the other conventional method, hence this approach should be considered for treating distal femur fractures

**Keywords:** Distal Femoral Fracture, Locking Compression Plate, Internal Fixation, Fracture Sub-Type.

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#### Introduction

“Distal femur” fractures pose a significant surgical challenge due to their comminuted pattern and inherent instability. These fractures often result in long-term disability. Managing them remains a subject of debate and controversy due to the suboptimal outcomes and numerous associated complications [1].

“Distal femoral fractures” make up 6.9% of the total femoral fractures, but when fractures in hip are excluded, their prevalence increases to 29.9%. These fractures are intricate injuries that pose a substantial challenge in terms of

management and can result in enduring disability if not treated appropriately [2]. They typically occur in elderly individuals or those with multiple injuries, and they tend to be unstable, often involving intra-articular comminution. Achieving reduction in anatomy of articular fracture fragments, restoring limb length, facilitating mobilization (early) through physical movements are critical elements for achieving the best possible outcomes following surgical treatment. Several devices have evolved for the management of “distal femur fractures”, including dynamic condylar screw, angle blade plate, external fixators, flexible

nails, condylar buttress plate, intramedullary nail, and even total knee replacement [3].

A comprehensive grasp of tissue vascularity and bone biology is indispensable when employing locking plate fixation [4]. To enhance stability in bones afflicted by osteoporosis, multiple fixed-angle screws are employed in order to secure the plate locking. In cases involving multi-articular fragments in distal femur fractures, the implant permits the use of more than one distal screw [4, 5]. Locking compression plates effectively address the issue of varus collapse, which is commonly encountered with traditional plates [6, 7]. The oval-shaped holes in the locking plate facilitate excellent bone constriction when locking screws are applied. In comparison to compression and bridge plating techniques, the Locking Compression Plate (LCP) offers distinct advantages by preserving periosteal vessels and minimizing damage to soft tissues. As a result, it operates in a manner similar to an internal fixator. [8].

### Materials and Methods

The current study involved 170 patients involving both genders having distal femoral fractures all of whom provided elaborative written consent form for their indulgence in the research. A longitudinal prospective study was conducted at a tertiary care centre for one year.

### Inclusion criteria for the study

- Subjects < 18 years of age
- Both closed and open “distal femur fractures”

- Sub-type A, B and C distal femur fractures

### Exclusion criteria for the study

- Revision of previous surgeries
- Pathological fracture
- Bilateral distal end of femur fractures

Data including subject's names, ages, genders, and other relevant information were meticulously documented. A comprehensive clinical examination was conducted for all individuals diagnosed with distal femur fractures. The treatment approach for these patients involved the utilization of locking compression plates. To ensure precise placement, the position of the plate was verified with the assistance of encompassing both anteroposterior and lateral views, fluoroscopic guidance. Various parameters as the affected side, cause of wound, fracture's sub-type, and treatment outcomes being noted methodically.

### Results

According to the inclusion and exclusion criteria 170 patients were selected for the study. Amongst the 170 patients, 89 of them were males and 81 of the patients were females. Notably, one of the leading causes of injury was falls in 38 cases, and other causes in 10 cases. In terms of fracture subtypes, there were 70 cases of C<sup>1</sup>, 60 cases of C<sup>2</sup>, and 40 cases of C<sup>3</sup>. When considering laterality, 74 patients had left-sided fractures, while 96 had right-sided fractures. Importantly, these differences were found to be of statistical significance ( $P < 0.05$ ).

**Table 1: Data analysis and distribution**

Parameters	Variables	Numbers
Gender	Male	89
	Female	81
Type of Fracture	Open	8
	Closed	52
Mode of Injury	Fall	38
	Others	20
Fracture subtype	C <sup>1</sup>	70
	C <sup>2</sup>	60
	C <sup>3</sup>	40
Laterality	Left	74
	Right	96

Regarding complications, the study identified four cases of deep infection, two cases of reduction loss, three cases of shortening, and one case of knee stiffness among the patients. Notably, these complications also displayed statistical significance in variation ( $P < 0.05$ ).

Table number 1 depicts gender, type of fracture, mode of injury and laterality in the individuals. Whereas, Table 2 comprehends complications found in the patients in course of study.

**Table 2: Assessment of adverse effects**

Adverse effects	Variables
Shortening	8
Reduction loss	4
Deep infection	6
Knee stiffness	2

## Discussion

Several advances in surgeries has been initiated to ensure sufficient disclosure of the “distal femoral articular surface”, involving medial or lateral parapatellar approaches, the “swashbuckler approach”, tibial tubercle osteotomy, and combined medial and lateral approaches. To inscript the comminution often present in these complex injuries, external ring fixators have been employed with varying degrees of success, as noted by several previous authors [9]. Some practitioners have opted for dual medial and lateral plates for fracture management. Moreover, many earlier researchers have integrated bone grafting (primary) to promote unification in such intricate fracture. Notably, it's worth highlighting that the utilization of the swashbuckler approach for C3 fractures remains unreported in the existing literature.

In their investigation involving 355 “distal femur fractures”, researchers. [10] found that substantial portion of cases required resurgery to enhance union. Specifically, 37% of open fractures (41 out of 110) and 10% of closed fractures (23 out of 225) necessitated additional surgical intervention. Among patients with diabetes, 28% (18 out of 65) experienced the need for resurgery, while 17% (46 out of 270) of non-diabetic patients required it. Notably, when they examined open fractures associated with diabetes, a significant 67% (8 out of 12) required resurgery. Conversely, only 8% of patients necessitating resurgery were non-diabetic and had closed fractures (13 out of 172). It was observed in this study, that out of four patients with open fractures, three had diabetes. Interestingly, despite the existence of open fractures in diabetic patients, all fractures healed without complications and the outcome was good functions.

In this study which included 170 patients, there were 89 males and 81 females. Our approach was influenced by a study [11], where they assessed the clinical and radiological outcomes of a modified swashbuckler approach to affix utilising a single locked plate for C3 type “distal femur” fractures in 24 patients.

In their research, they addressed the extraarticular component of these fractures by employing depending on the fracture pattern either constrictor plating or bridge plating. It's noteworthy that none of the cases underwent primary bone grafting. The clinical assessment at the one-year mark, utilizing the Knee Society Score (KSS), yielded encouraging results. All fractures unified, with an approximate union duration of  $15.03 \pm 3.76$  weeks, and no noteworthy adverse effects, such as deep infection, non-

union, or implant failure, were reported. Only a single patient necessitated secondary bone grafting, which was performed three months post-operation.

As for knee function, the average range of motion measured  $120^\circ \pm 14.8^\circ$ , resulting in seven patients attaining an excellent outcome, three patients achieving a good outcome, and two patients securing positive effects, as per the KSS evaluation in the follow-up. During an average pursuation period of 17.6 months, three patients exhibited radiological indications of secondary osteoarthritis in the knee joint. Importantly, it's noteworthy that only one of these patients reported experiencing symptomatic issues related to osteoarthritis.

In this study, it was observed that the primary causes of injury were as follows: falls in 38 cases, and other factors in 20 cases. The distribution of fracture subtypes showed 70 cases of C<sup>1</sup>, 60 cases of C<sup>2</sup>, and 40 cases of C<sup>3</sup>. Regarding laterality, 74 patients had fractures on the left side, while 96 had fractures on the right side.

In a research study [12], they enrolled a total of thirty-five cases for their investigation. All distal femoral fractures in their study were managed utilizing a distal femoral locking compression plate. The study group comprised 27 males and 8 females, with an average age of 48.5 years, spanning a range from 25 to 94 years. The majority of these cases were classified as type C<sup>2</sup> according to the AO classification system, and they primarily resulted from high-energy trauma.

The functional outcome in Kumar et al.'s research was assessed using NEER's criteria. They reported that, on average, fractures united at 16 weeks. Among the cases, 26 (75%) achieved effective results [13]. After the operation adverse effects in connection with the fractures included stiffness in knee in 6 cases (17.1%), varus deformity in three cases (8.5%), shortening in five cases (14.2%), and superficial wound infections in two cases (5.7%).

## Conclusion

Distal femur fractures exhibit a distinct pattern of occurrence, with a high incidence among young patients involved in high-velocity injuries and accidental falls, while older patients display a bimodal distribution. Notably, this approach offers improved fracture fixation in elderly patients who may suffer from osteoporosis.

Post-operatively, the early passive mobilization of the knee has shown to yield a favorable range of motion. Additionally, surgical time is reduced due to the pre-

contoured nature of locking compression plates, eliminating the need for precise anatomical fracture reduction.

In the context of comminuted fractures, preventing non-union and implant failure hinges on the precise positioning of screws and optimizing the working length. Increasing the working length augments interfragmentary motion, which can enhance fracture healing characterized by callus formation while reducing the risk of implant breakage.

### Limitation

The study conducted has been done on a small sample size, a more inclusive study of large population size is required to extrapolate the findings and get the probability of occurrence of the adverse events

### Recommendation

locking compression plate method offer an absolute benefit over the other conventional method, hence this approach should be considered for treating distal femur fractures.

### List of abbreviation

KSS- Knee Society Score

LCP- Locking Compression Plate

OTA- Orthopaedic Trauma Association

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### Conflict of interest

The author had no conflict of interest.

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