

## A Prospective Study on Surgical Management of Closed Distal End Femoral Fracture in Adults Using Distal Femur Locking Compression Plate

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### Abstract

**Background:** Distal Femur fractures are a highly incident complex case and pose a challenge to the treating orthopedician.

**Aims and Objectives:** The aims and objectives of this study were to assess radiological union of distal femoral fractures by open reduction and internal fixation with locking compression plate, To study the functional outcome for internal fixation of fractures of the distal end femur by Locking Compression Plate and To evaluate the effectiveness and complications of distal end femur fractures treated with Locking Compression Plate based on, time till union, rate of infection, and fixation failures, functional outcome using NEER'S SCORE.

**Materials and Methods:** The present study was done from April 2017 to April 2018 which comprised of fifteen patients with closed Distal end Femoral Fractures who were treated by Locking Compression plate. Overall final outcome was assessed in terms of radiological union, clinical assessment and regaining the lost knee function using NEER'S Score.

**Results:** Out of 15 patients, 12 patients were males and 3 patients were females. Out of 15 patients, 14 were due to RTA. Maximum number of cases was of Muller type C2-60%. Internal fixation was considered after patients general and medical condition was stabilized. The average operative time was 90 minutes. The size of plate was selected based on the type of fracture. 6 to 10 hole plate were used most commonly. Of 15 patients, 10(66.66%) showed radiological union within 16 weeks. 9 (60%) of the patients achieved weight bearing at the end of 14 weeks. Average flexion in this study was 100 degree with more than 3 (20%) patients having knee range of motion more than 110 degree. 1 Patient had stiff knee. More than 80% patients were extensor lag less than 5 degree. 2 patients had **VARUS MALALIGNMENT** out of 15 patients. Results according to NEER'S SCORE were Excellent in 20% patients, Good in 60% , Satisfactory in 6.6% and unsatisfactory in 13.3% patients. 2 patients had superficial infection and 1 patient had delayed union.

**Conclusion:** Locking compression plate is an optimal tool for Distal end femoral fractures. It provides rigid fixation in the region of femur, where a wide canal, thin cortices and frequently poor bone stock make fixation difficult.

**Keywords:** Distal Femur Fracture, Locking Compression Plate, Distal Femur, RTA.

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## Introduction

The incidence of distal femur fractures is approximately 37 per 1,00,000 person-years.<sup>1</sup> About 4% to 6% of all femoral fractures occur in the distal femur. Distal femur fractures shows bimodal distribution age of patients with younger patient being male compared to female. Distal femoral fractures mainly occur from two different injury mechanisms. They are often caused by high energy trauma mainly sustained in road traffic accidents. Open injuries with considerable comminution of condyles and metaphysis are frequently seen, as is low energy trauma, relating to elderly patients with severe osteoporosis. In high-energy trauma, the problem of restoring the function in a destroyed knee joint persists. Complex knee ligament injuries frequently occur additionally to extensive cartilage injuries. In elderly patients, extreme osteoporosis represents a particular problem for anchoring the implant.<sup>2</sup> Treatment options include conservative and surgical management. Conservative management may result in serious complications such as knee stiffness, inadequate alignment, delayed union or non-union, prolonged hospitalization and related morbidity<sup>3</sup>. To achieve functional rehabilitation of the limb, surgical treatment should be performed to achieve complete anatomic restoration of the joint surface, adequate anatomical alignment, stable and rigid fixation without external immobilization to allow early mobilisation<sup>4,5,6,7</sup>. Most surgeons agree that distal femur fractures need to be treated operatively to achieve optimal patient outcomes. Although good internal fixation results have already been reported with these fractures, over 30 years ago the number of revisions for non union, loss of reduction and implant failure has been high. The options for operative treatment are traditional plating techniques that require compression of the implant to the femoral shaft (blade plate, Dynamic Condylar Screw, non-locking condylar buttress plate), antegrade nailing fixation, retro grade nailing, sub muscular locked internal fixation and external fixation. However, as the complexity of fractures needing treatment has changed from simple extra-articular supra-condylar types to inter-condylar and metaphyseal comminuted types, these implants may not be ideal. Double plating, and more recently, locked plating techniques have been advocated. However, with double plating

there is often extensive soft tissue stripping on both sides of the femur, resulting in reduced blood supply and potential non-union and failure of the implants. Earlier most commonly used implant for the fixation of distal femur fractures are Fixed angle devices, usually in the form of Dynamic Condylar Screw (DCS) system, which is a supracondylar plate combined with a lag screw. This two piece device is more forgiving and allows correction in the sagittal plane after the lag screw is inserted.<sup>7, 8</sup> The locking compression plate (LCP) is being used in this study is a combi hole plate which is a single beam construct where the strength of its fixation is equal to the sum of all screw-bone interfaces rather than a single screw's axial stiffness or pullout resistance as seen in unlocked plates. Its unique biomechanical function is based on splinting rather than compression resulting in flexible stabilization, avoidance of stress shielding and induction of callus formation. Further when it is applied via a minimally invasive technique, it allows for prompt healing, lower rates of infection and reduced bone resorption as blood supply is preserved.<sup>9</sup> Internal fixation with locking plates creates a toggle free, fixed angle construct. The introduction of plates with the option of locked screws has provided the means to increase the rigidity of fixation in osteoporotic bone or in the presence of periarticular or juxta-articular fractures with a small epiphyseal segment. The implant offers multiple points of fixed-angle contact between the plate and screws in the distal part of femur, theoretically reducing the tendency for varus collapse that is seen with traditional lateral plates.<sup>10</sup>

Since there have been no published studies focusing specifically on the LCP condylar plate, this study will help us in defining the role of locking compression plate in the treatment of distal femur fractures. The study is justified for the fact that it will be one of the solutions for the age old complications associated with the treatment of supracondylar fractures with traditional fixed angle plates and nails of, postoperative loss of reduction (varus collapse) and malalignment due to their inherent lack of rigidity and in some cases, eventual implant failure. The locking compression plate is based on the firm principles of locked plating, which has really yielded a lot of success in the treatment of fractures over the years.

## Materials and Methods

**Study Site:** Department of Orthopaedics, Deccan College of Medical Sciences, Hyderabad.

**Study Population:** All patients who are above the age of 20-50 years and managed surgically were included in the study admitted from emergency department and Orthopaedic OPD into Department of Orthopaedics, Deccan College of Medical Sciences, Hyderabad.

**Study Design:** This was a Hospital Based Prospective Study.

**Sample Size:** Considering the proportion of subjects with any particular category of functional outcome as %, with 80% power of study and 95% precision, the required sample size would be 15. To account for non-participation, it was decided to include 20 subjects into study.

## Methodology

The following protocol was observed for patients with fracture lower end of femur on arrival.

1. General and systemic examination as well as local examination of the patient.
2. Thorough assessment of patient to rule out head/ chest/ abdominal/ spinal or pelvic injury.
3. Evaluation of patients in terms of:
  - a) age
  - b) Sex
  - c) Mode of trauma
  - d) Period between injury and arrival.
4. Musculo-skeletal examination of patient to rule out associated injuries or fractures.
5. Stabilization of patient with intravenous fluids, oxygen and blood transfusion as and when required.
6. Careful assessment of injured limb as regards to neurovascular status.
7. Primary immobilization of involved limb in skin traction/ above knee plaster of paris slab and transport of patient to the Department of Radiodiagnosis in the same.
8. Radiological assessment: Anteroposterior and true lateral views of injured limb

including complete knee joint and distal femur/proximal leg.

### Inclusion Criteria

1. Those patients who are above the age of 20 years to 50 years and managed surgically were included in the study.

### Exclusion Criteria

1. Patients with open distal femoral fractures
2. Patient less than 20 years and more than 50 years with distal femoral fractures were excluded from study.
3. Patients lost in follow - up
4. Patients managed conservatively for other medical reasons.
5. Distal femoral fractures with neurovascular compromise
6. Patients with supracondylar fractures and associated multiple fractures were excluded from the study
7. Polytrauma patients and bilateral fractures who needed the expertise of other super specialities were excluded from the study.
8. Patients who didn't consent for surgery.

### Implant Used:

- The plate and screws were Indian manufactured from 316L stainless alloy with gun drilling technique.
- **LCP combi-holes** in the plate shaft - Intraoperative choice between angular stability and/or compression.

### Statistical Methods:

Data was collected in MS EXCEL and presented as numbers and percentages in the form of tables and figures.

## Results

**TBALE 1: AGE DISTRIBUTION**

AGE IN YEARS	DISTAL END OF FEMUR	%
21-30	3	20%
31-40	6	40%
41-50	6	40%
TOTAL	15	100%

**TABLE 2: GENDER DISTRIBUTIONS**

SEX	DISTAL END FEMUR	%
MALE	12	80%
FEMALE	3	20%
TOTAL	15	100%

**TABLE NO. 3 STUDY RESULTS**

Cases	Complications	Radiological Union	Knee Flexion	Knee Extension Lag	Work capacity	Total Period of follow up	Functional Outcome (NEER'S)
1	Nil	< 16 Weeks	110 Degrees	<5 Degrees	Normal	8 Months	Excellent
2	Nil	< 16 Weeks	110 Degree	<5 Degrees	Normal	8 Months	Excellent
3	Nil	30 Weeks	30 Degrees	10 Degrees	Light work	9 Months	Satisfactory
4	Nil	< 16 Weeks	110 Degrees	< 5 Degrees	Normal	6 Months	Excellent
5	Nil	< 16 Weeks	100 Degrees	< 5 Degrees	Alter Work	8 Months	Good
6	Nil	< 16 Weeks	100 Degrees	5 Degrees	Normal	6 Months	Good
7	Superficial Infection	< 16 Weeks	100 Degrees	5 Degrees	Alter Work	6 Months	Good
8	Delayed Union	34 Weeks	< 90 Degrees	10 Degrees	No Work	10 Months	Unsatisfactory
9	Superficial Infection	24 Weeks	Stiff Knee	No Extension	No work	8 Months	Unsatisfactory
10	Nil	< 16 Weeks	100 Degrees	5 Degrees	Regular	6 Months	Good
11	Nil	24 Weeks	100 Degrees	< 5 Degrees	Regular	6 Months	Good
12	Nil	< 16 Weeks	100 Degrees	5 Degrees	Regular	6 Months	Good
13	Nil	<16 weeks	100 Degree	<5 Degree	Regular	6 Months	Good
14	Nil	24 weeks	100 Degree	5 Degree	Regular	6 Months	Good
15	Nil	<16weeks	100 Degree	5 Degree	Regular	6 Months	Good

## Discussion

Present study was done at Deccan College of Medical Sciences, Hyderabad which comprised of fifteen patients with closed Distal end Femoral Fractures which were treated by Locking Compression plate. Overall final outcome was assessed in terms of radiological union, clinical assessment and regaining the lost knee function using NEER'S Score.

Out of 15 patients, 12 patients were males and 3 patients were females. This may suggest that RTA were most commonly seen in males when compared to females. Out of 15 patients, 14 were due to RTA which is attributable to the fact that fracture distal end of femur are associated with high velocity trauma. When seeing the relationship between age and mechanism of injury it was found that most of the vehicular accidents were seen in patients below the age of 50 years, and that of fall was not contributory. On seeing the relationship between sex and cause of fracture it was found that most of the vehicular accidents were seen in males rather than females, whereas it was not contributory in terms of fall from height. Maximum number of cases was of Muller type C2-60%. Internal fixation was considered after patients general and medical condition was stabilized. As we performed open reduction and internal fixation, the average operative time was 90 minutes. The size of plate was selected based on the type of fracture. 6 to 10 hole plate were used most commonly. Radiological union was defined as presence of bridging callus across three cortices. Of 15 patients, 10(66.66%) showed radiological union within 16 weeks. 9 (60%) of the patients achieved weight bearing at the end of 14 weeks. Average flexion in this study was 100 degree with more than 3 (20%) patients having knee range of motion more than 110 degree. 1 Patient had stiff knee. More than 80% patients were extensor lag less than 5 degree. 2 patients had **VARUS MALALIGNMENT** out of 15 patients. Results according to NEER'S SCORE were Excellent in 20% patients, Good in 60%, Satisfactory in 6.6% and unsatisfactory in 13.3% patients. 2 patients had superficial infection and 1 patient had delayed union.

In the study of Distal Femoral Locking Compression Plate Fixation in Distal Femoral Fractures: Early Results by EJ Yeap et al<sup>11</sup>, there were

four excellent results, four good, two fair and one failure out of 11 cases. These results are comparable to our study and can be attributed to the learning curve involved with usage of LOCKING COMPRESSION PLATES.

## Conclusion

Locking compression plate is an optimal tool for Distal end femoral fractures. It provides rigid fixation in the region of femur, where a wide canal, thin cortices and frequently poor bone stock make fixation difficult. Surgical exposure for plate placement requires significantly less periosteal stripping and soft tissue exposure than that of normal plates. Orthopaedic surgeons experience with locking compression plating technique will find it a useful technique. However careful understanding of its basic principles, identification of appropriate fracture patterns for use of LCP is essential to avoid complications like *generation of non union*.

**Locking Compression Plate** is an important armamentarium in treatment of fractures of distal end femur, especially when fracture is severely comminuted and in situations of osteoporosis. However a more comprehensive study with longer follow up periods is essential to throw more light into the advantages, complications and possible disadvantages of the use of Locking Compression Plate with special attention to the long term outcome.

**Ethical Clearance:** Ethical clearance was obtained from the Institutional Ethics Committee prior to the commencement of the study.

**Conflict of Interest:** We declare no conflict of interest.

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