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# Study of Functional and Radiological Outcome of Distal Femoral Fractures Treated with Locking Compression Plate at a Tertiary Care Hospital

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**ABSTRACT**

Distal femoral fractures, which accounts for 7% of all femoral fractures, are complex injuries with the potential to cause long term disabilities. Present study was aimed to study functional and radiological outcome of distal femoral fractures treated with locking compression plate at a tertiary care hospital. Present study was single-center, prospective, observational study, conducted in fresh cases of closed fractures of distal femur who were treated with locking compression plate in skeletally mature patients. In present study, we included 22 patients in study of which fourteen were male patients and eight were females. Majority patients were from 31-50 years age group (59.08%). Operative time ranged from minimum of 40-75 min with average of 57.5 min. Majority patients operated in 51-60 minutes (36.36%). Average flexion in this study was 102 degrees with 11 patients (50%) showing range of motion more than 100 degrees. Functional outcome according to Neer's scoring system was noted as, 23% patients had excellent score (85-100) while 36% patients had good outcome (71-84) showing that 59% patients showing more than good results. At the end of 6 month the union rate was 68.71%. The most common complication in the study was knee stiffness which was attributed to the non-compliance of the patients to the postoperative physiotherapy although it improves with physiotherapy. All our patients in study showed satisfactory union and no cases of malunion or non-union. For management of distal femur fractures, locking compression plate offers good to excellent functional outcome as the plate allows stable internal fixation with its anatomically pre-contoured shape and early mobilisation.

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**Key Words**
Distal femur fractures, locking compression plate, functional outcome, Neer's scoring system

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## INTRODUCTION

Distal femoral fractures, which accounts for 7% of all femoral fractures, are complex injuries with the potential to cause long term disabilities. If fractures of the hip are excluded, 31% of femoral fractures involve the distal portion. These are the fractures involving distal 15 cm of the femur including the metaphysis and the articular surface[1,2].

Several treatment options are available for operative treatment of distal femur fractures, each with advantages and disadvantages and are dependent to a large degree on the fracture pattern, host factors and the surgeon's experience and resources[3]. The options are traditional plating technique that require compression of the implant to the femoral shaft (blade plate, dynamic condylar screw, condylar buttress plate, antegrade and retrograde intramedullary nailing, external fixation)[2].

More recently, "Locking plate" systems have been developed in which screws are inserted that lock into the plate, forming a fixed angle construct. Most of these systems were designed for insertion through minimally invasive techniques, which have been shown to decrease problems with fracture healing and infection[3]. Condylar fixation with locking screws is mechanically superior to earlier implants (e.g., blade plate or DCS) by spreading out fixation points among several screws[3]. Present study was aimed to study functional and radiological outcome of distal femoral fractures treated with locking compression plate at a tertiary hospital.

## MATERIAL AND METHODS

Present study was single-center, prospective, observational study, conducted in department of orthopedic surgery, at Mysore Medical College and Research Institute, Mysore, India. Study duration was of 18 months (August-March 2014-2016). Study approval was obtained from institutional ethical committee.

**Inclusion criteria:** Fresh cases of closed fractures of distal femur who were treated with locking compression plate in skeletally mature patients, willing to participate in present study.

**Exclusion criteria:**

- Pathological fractures
- Non-union and delayed union
- Compound fractures
- Fracture of any other bone of the ipsilateral limb
- Patients who did not give consent

Study was explained to patients in local language and written consent was taken for participation and study. After admission into the hospital, general and systemic examination as well as local examination was done along with thorough assessment of patient to rule out other systemic injuries. Thereafter patient was stabilized with intravenous fluids, oxygen and blood transfusion as and when required. Careful assessment of injured limb about to neuro-vascular status was noted. Immobilization done with a posterior above knee slab and Anterior-posterior and true lateral views of injured limb including hip and Knee joint were done. Analgesics were administered as required. The patient was evaluated in terms of age, sex, mode of trauma and period between injury and arrival. Also the ATLS evaluation and the investigations done in the casualty. Preoperative preparation included prophylactic antibiotics on the arrival at casualty and just before skin incision. The antibiotic coverage included 3rd generation cephalosporin. Either Spinal anaesthesia or general anaesthesia was used. Operating field washed with Savlon, Povidone iodine and was draped separately.

In our study, lateral approach as standard surgical technique was followed in all patients. Fractures were reduced depending upon the pattern of fracture. A knee roll assisted the procurement and maintenance of reduction. The fixation done with distal femur locking compression plate following compression or bridging principle depending upon the fracture pattern. The plate length, axial and rotational alignment were checked under image intensifier (IITV). Immediately after surgery on day one or two patients were encouraged for active and passive knee bending exercises as per pain tolerance. Considering the patient's condition non-weight bearing mobilization using a walker was done as soon as possible with the help of supervised physiotherapy. Crutch walking given but weight bearing was not allowed. Weight bearing was allowed only after clinical and functional assessment. Patients were followed up clinically and radiologically at 4, 8, 12 and 24 weeks and till union. Functional outcome was accessed in terms of regaining the lost knee function using Neer's score system at every month follow-up till 6 months. Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Statistical analysis was done using descriptive statistics.

## RESULTS

In present study, we included 22 patients in study of which fourteen were male patients and eight were females. Patient's ages ranged from 18-65 years with mean age of 43.36±8.68 years. Majority patients were from 31-50 years age group (59.08%). The cause of fracture was Road Traffic accident in 17 patients while self-fall in 5 patients. As per the AO/OTA Muller's classification. Study showed that 9 cases were Muller's type A, 7 were type B and 6 were Muller's type C. All were closed fractures. Operative time ranged from

Table 1- General characteristics

| Characteristics | Numbers | Percentage |
|---|---|---|
| **Age groups (in years)** | | |
| 18 -30 | 3 | 13.63 |
| 31-40 | 6 | 27.27 |
| 41-50 | 7 | 31.81 |
| 51-60 | 3 | 13.63 |
| Above 60 | 3 | 13.63 |
| Mean age (Mean±SD) | 43.36±8.68 | |
| **Gender** | | |
| Male | 14 | 63.63 |
| Female | 8 | 36.36 |
| **Mechanism** | | |
| Road traffic accident | 17 | 77.27 |
| Self fall | 5 | 22.72 |
| **Muller's type of fracture** | | |
| A | 9 | 40.90 |
| B | 7 | 31.81 |
| C | 6 | 27.27 |

Table 2: Duration of surgery

| Time (in minutes) | Numbers | Percentage |
|---|---|---|
| 40-50 | 6 | 27.27 |
| 51-60 | 8 | 36.36 |
| 61-70 | 6 | 27.27 |
| 71-80 | 2 | 9.09 |

Table 3: Knee flexion

| Knee flexion | Numbers | Percentage |
|---|---|---|
| <90° | 3 | 13.63 |
| 91-100° | 8 | 36.36 |
| 101-110° | 7 | 31.81 |
| >110° | 4 | 18.18 |

Table 4: Functional outcome

| Grade (Neers' score) | Numbers | Percentage |
|---|---|---|
| Excellent (85-100) | 5 | 23 |
| Good (71-84) | 8 | 36 |
| Fair (56-70) | 6 | 27 |
| Poor (less than 55) | 3 | 14 |

Table 5: Time to union

| Union (Weeks) | Numbers | Percentage |
|---|---|---|
| At 20 weeks | 7 | 31.81 |
| At 24 weeks | 8 | 36.36 |
| At 28 weeks | 6 | 27.27 |
| At 32 weeks | 1 | 4.54 |

Table 6: Complications

| Complications | Numbers | Percentage |
|---|---|---|
| Knee stiffness[3] | 10 | 45.4 |
| Decreased range of motion | 6 | 27.27 |
| Knee joint pain | 2 | 9.09 |
| Post-operative infection | 1 | 4.54 |
| Delayed union | 1 | 4.54 |

minimum of 40-75 min with average of 57.5 min. Majority patients operated in 51-60 min (36.36%). Average flexion in this study was 102 degrees with 11 patients (50%) showing range of motion more than 100 degrees.

Functional outcome was evaluated at every follow up and at the end of six months of follow-up using Neer's scoring system. 23% patients had excellent score (85-100) while 36% patients had good outcome (71-84) showing that 59% patients showing more than good results. The cases were followed up at monthly basis. At the follow up of 5 months the rate of union was 31.81% while the 6 month follow up showed another 36.36% union. So, at the end of 6 month the union rate was 68.71%. Rest cases showed union at 28 weeks except 1 case which was showing signs of delayed union underwent secondary procedure of bone grafting. In our study, at the follow up the 10 cases which were showing the early signs of knee stiffness after consistently showing lower rates of Neer's score, underwent rigorous physiotherapy and Continuous Passive Motion. Almost all the distal femur fractures showed the lower range of motion, even at the 6 month follow up compared with the normal limb, with 6 cases (27.26%) showing less than 100 degrees. There were 2 cases with complaints of pain at and around knee joint. There was 1 case of delayed union, underwent secondary bone grafting at 20 weeks and showed union at 32 weeks. We had 1 case of post-operative superficial infection which healed with intravenous antibiotics after culture. All our patients in study showed satisfactory union and no cases of malunion or non-union.

## DISCUSSIONS

Distal femur fractures consist of supracondylar and intercondylar fractures, that is distal 15 cms of femur. With the introduction of AO principles, these fractures were managed with cancellous screws for intercondylar fractures, angled blade plate and dynamic condylar screw for the fractures extending above the condylar area. But the rate of complications was still high, even though comparatively lower than conservative management[3].

In our study, mean age of patients was 43.36±8.68 years, majority patients were from 31-50 years age group (59.08%). Similar findings were noted by Hoffman *et al.*,[4] (mean age 54 years) and Menon *et al.*,[1] (mean age 51.24 years). In our study the fractures were classified according to Muller's classification. The study showed that 9 cases were Muller's type A, 7 were type B and 6 were Muller's type C. All were closed fractures. Similar findings were noted by Toro *et al.*[5] Hoffman *et al.*[4] Menon *et al.*[1] Doshi *et al.*[6] and Pascarella *et al.*[7]. This finding is very helpful as there is more chances of secondary osteoarthritis in type C fractures. So the distal femur fracture fixation should be considered as an utmost priority fracture pattern which needs good reduction for better functional outcome.

In our study the cases were followed up at monthly basis. At the follow up of 5 months the rate of union was 31.81% while the 6 month follow up showed another 36.36% union. So, at the end of 6 month the union rate was 68.71%. Toro *et al.*[5] achieved union in 9 cases (75%) with 2 cases of non-union and 1 case of implant failure. Hoffman *et al.*[4] study showed union in 83 fractures (74.77%) with 20 cases of non-union (18%). Menon *et al.*[1] study showed union in 24 fractures (96%) with 1 case of non-union (4%). Doshi *et al.*[6] studied distal femur fractures with the mean time of union was 13.48 weeks (range 8-28

weeks). Pascarella *et al.*[7] showed the union rate in the 58 fractures out of 89 fractures was 16.3 weeks. Knee joint is the main weight bearing joint in the body. Any of the abnormalities in the joint reflects in the disturbed gait cycle. Previous studies have consistently shown decreased range of motion in the knee, even after stable fixation and early mobilisation. In study by Hoffman *et al.*[4] the range of motion achieved was more than 110 degrees in 22 cases, 91-110° in 29 cases, 75-90° in 48 cases and less than 75 degree in 7 cases. Similar findings were noted in present study.

In our study the functional outcome was evaluated at every follow up and at the end of six months of follow-up using Neer's scoring system. 23% patients had excellent score (85-100) while 36% patients had good outcome (71-84) showing that 59% patients showing more than good results. In Hoffman *et al.*[4] study the functional outcome at the end of follow up was excellent in 22 cases (20.8%) good in 29 cases (27.4%) fair in 48 cases (45.3%) and poor in 7 cases (6.6%). In Menon *et al.*[1] study functional outcome according to Neer's score was excellent in 10 cases (40%) satisfactory in 12 cases (48%) and poor in 2 cases (8%). Even though the results have shown delayed union in our study compared to other studies the range of motion and functional outcome achieved in our study at the end of six months is comparable to these studies.

In our study at the follow up the 10 cases which were showing the early signs of knee stiffness after consistently showing lower rates of Neer's score, underwent rigorous physiotherapy and Continuous Passive Motion. In our study, there was 1 case of delayed union, middle aged man, Muller's type C fracture the case underwent secondary bone grafting at 20 weeks and showed union at 32 weeks. In our study, almost all the distal femur fractures showed the lower range of motion, even at the 6 month follow up compared with the normal limb, with 6 cases (27.26%) showing less than 100 degrees. In our study, we have had 1 case of superficial infection which healed with intravenous antibiotics after culture report. We have not found any case of deep infection, wound dehiscence or implant exposure, compartment syndrome, malunion or non-union, hardware failure. Similar findings were noted by Toro *et al.*[5] Hoffman *et al.*[4] Menon *et al.*[1] Doshi *et al.*[6] and Pascarella *et al.*[7].

The introduction of locking plate revolutionized the treatment approach. The anatomically pre-contoured plates have helped the indirect reduction. Locking plates have the advantage that there is no need for plate and bone reduction, which allows the preservation of periosteal blood supply. The same principal allows good hold in the osteoporotic fractures[3]. The principle of the locking compression plate (LCP) is represented by the combination of two completely different anchorage technologies and two opposed principles of osteosynthesis in one implant as it combines the principles of conventional plate osteosynthesis for direct anatomical reduction with those of bridging plate osteosynthesis[8-10]. Since the LCP can be used as a conventional plate using only dynamic compression, as a pure internal fixator using locking head screws or as both combined, it provides the surgeon with multiple variations.

We found that the surgical management of distal femur fracture with locking compression plate gives good functional outcome and reduces the incidences of complications. Our early results are encouraging but long term studies with larger study group are needed to prove a comparable or better outcome so that the technique can become a part of the armamentarium of the orthopaedic trauma surgeon.

## CONCLUSION

For management of distal femur fractures, locking compression plate offers good to excellent functional outcome as the plate allows stable internal fixation with its anatomically pre-contoured shape and early mobilisation. The most common complication in the study was knee stiffness which was attributed to the non-compliance of the patients to the postoperative physiotherapy although it improves with physiotherapy.

## REFERENCES

1. Choudhary, D.S., D.V.S. Mane, D.N.K. Gaonkar and D.V. Sharma, 2019. Evaluation of functional outcome of treatment for distal femur fractures. Int. J. Orthop.s Sci., 5: 587-595.
2. Rudloff, M.I., S.T. Canale and J.H. Beaty, 2015. Campbell's Operative Orthopaedics. 11th Ed Edn., Mosby Elsevier Philadelphia, ISBN-13: 9780323033299, Pages: 2702.
3. Collinge, C.A. and D.A. Wiss, 2015. Rockwood and green's Fractures in adults. 8th Ed Edn., Wolters Kluwer Health Philadelphia, ISBN-13: 9781451175318, Pages: 2269.
4. Hoffmann, M.F., C.B. Jones, D.L. Sietsema, P. Tornetta and S.J. Koenig, 2013. Clinical outcomes of locked plating of distal femoral fractures in a retrospective cohort. J. Orthop. Surg. Res., Vol. 8 .10.1186/1749-799x-8-43.
5. Toro, G., 2015. Locking plate fixation of distal femoral fractures is a challenging technique: A retrospective review. Clin. Cases. Mineral. Bone. Metab., 12: 55-58.
6. Dhanasekaraprabu and R. Chandra, 2013. Results in Distal Femoral Fractures after Fixation with a Locking Compression Plate in a Level 1 Trauma Centre in India. J. Young. Med. Rese., Vol. 1.

7. Pascarella, R., C. Bettuzzi, G. Bosco, D. Leonetti, S. Dessì, P. Forte and L. Amendola, 2013. Results in treatment of distal femur fractures using polyaxial locking plate. Strategies. Trauma. Limb. Recon, 9: 13-18.
8. Dhanasekaraprabu and R. Chandra, 2013. Results in Distal Femoral Fractures after Fixation with a Locking Compression Plate in a Level 1 Trauma Centre in India. J. Young. Med. Rese., Vol. 1.
9. Erhardt, J.B., M. Vincenti, J. Pressmar, F.A. Kuelling, C. Spross, F. Gebhard and G. Roederer, 2014. Mid term results of distal femoral fractures treated with a polyaxial locking plate: A multi-center study. Open. Orthops. J., 8: 34-40.
10. Kumar, G.N.K., G. Sharma, K. Farooque, V. Sharma, R. Ratan, S. Yadav and D. Lakhotia, 2014. Locking compression plate in distal femoral intra-articular fractures: Our experience. Int. Scholarly Res. Notices, Vol. 5 .10.1155/2014/372916.