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A Study of Functional Outcome in Distal Femur Fracture in Adults Treated with Locking Compression Plate: A Case Series

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ABSTRACT
Distal femur fractures comprise 6% of fractures involving femur approximately. Bimodal age distribution is seen. Open reduction and internal fixation with a locking compression plate is the preferred method of treatment for displaced distal femur fractures. This Study was conducted to assess the functional outcome and radiological union of distal femur fractures treated with open reduction internal fixation with locking compression plate and to assess the complications associated with it. Our study consisted of 30 cases of distal femur fractures treated with open reduction internal fixation with locking compression plate fixation. It was a case series study done between February 2021 to August 2022. Functional outcome was assessed through NEER'S criteria. The radiological union was achieved in all the patients between 14-28 weeks duration (mean of 17.6±4.53 weeks). The mean NEER score at 28 weeks was 76.90±9.59 and the mean visual analogue score was 1.27±0.94 at the 28 week of follow-up. Results based on NEER criteria, 08 patients had excellent, 20 had good, 1 had fair. The average patient satisfaction score was 8.90 out of 10. There was 1 case of infection, 15 cases of knee stiffness, 3 cases of delayed union and in our study. The DF-LCP is treatment of choice in management of distal femur fracture. The DF- LCP is safe and reliable implant in management of comminuted distal femur fracture AO type A and type C fractures.

INTRODUCTION

Fracture of distal femur remains a daunting challenge. Distal femur fractures comprise 6% of fractures involving femur approximately. Bimodal age distribution is seen. Peak incidence is seen in patients below 40 years of age, commonly males, experiencing high energy trauma. Incidence again rises in patients > 50 years, commonly females, with osteoporosis, who experience relatively low energy trauma. Fractures of the distal end of femur are often difficult to treat and are associated with many complications. In the early 1960s there was a great reluctance towards operative management of these fractures because of high incidence of infection, non-union, mal-union, inadequate fixation and lack of proper instruments, implants as well as antibiotics. Then the traditional management of displaced fracture of distal femur was along with the principle of Watson Jones[2] and John Charnley[3]. This consisted of skeletal traction, manipulation of fracture and external immobilization in the form of casts and cast bracings. These methods however met with problems like deformity, shortening, prolonged bed rest, knee stiffness, angulation, joint incongruity, mal-union, quadriceps wasting, knee instability and post-traumatic osteoarthritis. The trend of open reduction and internal fixation has become evident in recent years with good results being obtained with AO plate, dynamic condylar screw and intra medullary nail. In spite of these developments, numerous problems related to fixation technique failure[4], varus collapse etc. continued to be reported especially when comminuted fracture was there. So a need was felt to develop an implant which can overcome the potential limitations of earlier implants. To address these issues, distal femoral locking compression plates have been designed. Current generation of distal femoral locking compression plate has the advantage of combination of conventional compression plating and locked plating technique which enhances the plate osteosynthesis[5,6,7]. Anatomically pre-contoured built forms a toggle free fixed angle construct, reduces soft tissue problems and act as internal external fixations provide more stable fixations which is a key factor in successful treatment of this fracture. In addition, locking plates have distinct advantages of unicortical fixation and least chances of plate back out as the screw gets locked to the plate[6]. Thus achieving high union rates and generally good functional outcomes.

MATERIALS AND METHODS

This is a case series study conducted from February 2021 to July 2022 for a period of 18 months in the Department of Orthopaedics, S Nijalingappa Medical College and H.S.K. Hospital and Research Center, Bagalkot 587102 Ethical clearance was obtained from the Institute's Ethics Committee. Patients with distal femur fracture were recruited from Orthopaedic OPD and causality, HSK hospital based on the inclusion and exclusion criteria and diagnosed based on AO classification. Written informed consent (in English and the local language) was taken from patient and relative before enrolment in the study.

Sample Size: Sample size estimation was done using open epi software version 2.3.1 at 95% confidence level and at 10% absolute precision, considering the following article: ''Outcome of supracondylar femur fracture in adults managed by distal femur locking compression plate'' By Gyanendra Kumar Jha[1]* Sample size is n = 30.
Formula used for calculation is

Sample size n = [DEFF*Np(1-p)]/ [(d^2/$Z^2$1-α/2(N-1)+*p (1-p)]

Inclusion Criteria:

- Adults of either gender with distal femur fracture of AO type33-A1, 33-A2, 33-A3, 33-B1, 33-B2, 33-B3, 33-C1, 33-C2,33-C3
- Gustilo-Anderson Type 1 fracture

Exclusion Criteria:

- Patient age less than 18 years old
- Pathological fracture
- Gustilo-Anderson Type 2 and Type 3 fracture
- Associated ipsilateral femur fractures and neurovascular injury
- Noncompliance of the patient
- Medically unfit patients for surgery
- Patient not giving consent

Pre-Operative: The demographic data, history, clinical examination radiological evaluation, investigations were recorded in study proforma. After giving initial treatment of closed reduction and high groin slab application, all the necessary investigations for the operative procedure were done and fitness was taken and posted for surgery as soon as possible.

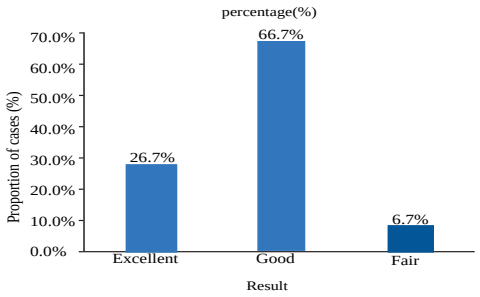
Surgical Procedure: The patient was operated either under spinal/general anesthesia in supine position, with a sand bag under knee and the ipsilateral buttock to allow slight internal rotation at the hip. Broad spectrum antibiotics were given just after spinal/general anesthesia and continued postoperatively for a minimum 5 days. The thigh was draped free and the iliac crest prepared and draped in case of bone graft requirement. Through lateral approach, skin incision was taken in line of the femoral shaft at Gerdy's tubercle and curves it proximally over the lateral femoral condyle. Iliotibialb and (tract) was

divided in line with the skin incision and the vastus lateralis muscle lying beneath the Iliotibialb band was elevated, then fracture site was visualized and fracture was reduced, suitable LCP was used and incision was closed in layers.

Post Operatively: X-rays were done to check and assess the reduction of the fracture. Analgesic and antibiotics were given and standard procedures for dressings and suture removal was followed. Regular post-operative follow up was done at regular intervals at 6th week, 10th week, 14th week, 20th week and 28th week, the union of fracture was noted by clinical examination findings, radiological union of fracture and functional outcome was measured by Neer's score. The results shall be graded as excellent, good, fair and poor.

RESULTS AND DISCUSSIONS

A total of 35 cases were included in the study. The mean age of patients is 51.37±14.99 years with eldest being 72 years and youngest being 21 years with males having a predominance of 66.7% with female to male ratio being 3:2 and 56.7% cases belonging to left side femur. The most common mode of injury was due to road traffic accidents (73.3%) the rest was due to self-fall (26.7%). This study was comprised of 30% cases were with AO 33- A3 TYPE, 16.7% were with 33-A2, 13.3% 33-C1,33- C2 33-A3 respectively, 10.0% being 33-B1 and 03.3% being 33-A1 according to AO classification. Mean radiological union time (weeks): 17.60±4.53, 50.0% with knee stiffness,10% case with delayed union and 03.3% cases with infection. Mean NEER score at 28 weeks is 76.90±9.59. 26.7% result is excellent, 66.7% result is good and 06.7% result is fair in our study. Fractures in the distal femur have posed considerable therapeutic challenges throughout the history of fracture treatment. Most of these surgical failures were due to inadequate fixation of the fracture fragments. The prognostic factors for distal femur fracture included age, intra-articular involvement, methods of treatment, timing of joint motion.



Graph. 1: Proportion of cases

Fig. 1: Follow-up x-rays of distal femur fracture treated with LCP

Fig. 2: Postoperative functional outcome

Table 1: Neers scoring system

Studies	No of patients	Excellent	Good	Fair/poor
Brothakur B *et al*.(2015)	32	13 (40.63%)	17 (53.12%)	2 (6.25%)
risha BA *et al*. (2017)	21	5 (24%)	15 (71%)	1(5%)
Vikranth PS *et al*.	30	18 (60%)	8 (26.6%)	4(13.4%)
Present study	30	8 (26.7%)	20 (66.7%)	2 (06.7%)

The Locking Compression Plate (LCP) system offers a number of advantages in fracture fixation combining angular stability through the use of locking screws with traditional fixation techniques. The 'Angular stability' provided by LCP at the plate- screw interface, allows extra-periosteal fixation of the plate to the bone. By preserving periosteal blood supply to the bone it addresses the importance of the biological factors involved in fracture healing. This Study was conducted to assess the functional outcome and radiological union of distal femur fractures treated with open reduction internal fixation with locking compression plate and to assess the complications associated with it. The age group included in this study ranged from 22-76 years, with a mean age of 51.37±14.99 years. Twenty patients were male and 10 patients were female. 9 (30%) patients were above 60 years. The present study does not show a biphasic age distribution of the patient population as seen in studies (Bell *et al*.). The reason being that, in male patients there was more outdoor activities, so they were more prone to vehicular accidents and majority females being housewives were less exposed to road traffic accidents.

The studies conducted by GK Gupta *et al*.[8] showed right sided fractures in most cases which was comparable with our study where 56.7% had left sided fractures. Which probably demonstrates impact on the non-dominant side following fall in majority of cases. In this study of 30 patients belonging to AO type A, B

and C of distal femur fractures, One patient belonged to A1, five to A2, nine to A3, three patients to B1, 4 to C1, four to C2 and four to C3 type fractures respectively. Majority of fractures belonged to type A3 fracture which was 30%. The observations are similar to the observations of the other studies. This signifies that most of the distal femoral fractures are caused by high energy trauma. They are associated with severe comminations and are unstable. Majority of them in our study belonged to type fracture configuration. In this study superficial infection was seen in 3 percent of cases, no deep infection was seen in our study. It may be attributed to better soft tissue handling and proper antibiotic cover. The average time to union was 17.6 weeks with a range of 15-28 weeks and a standard deviation of 2.17 in our study. The results in the present study are comparable to those obtained by various other studies by Kregor *et al.* In this study, by analysis of results done using Neers scoring system taking into account pain, knee range of motion, angulation and functional abilities. Results were excellent in 8 patients, good in 20 patients, fair in 2 patients. In our studies functional results are close to functional results achieved in other studies by Brothakur *et al*.

Case Illustration: A 65 years old male with closed traumatic left side distal femur fracture treated by open reduction and internal fixation with distal femur locking compression plate.

Limitations: The sample size used in this study is relatively small when compared to the existing population. In order to assess better outcomes further studies should be conducted in larger population groups.

CONCLUSION

The DF-LCP is treatment of choice in management of distal femur fracture. The DFLCP is safe and reliable implant in management of comminuted distal femur fracture especially type A and type C fractures as it prevents metaphyseal collapse and to maintain limb length in severely comminuted fractures. LCP provides good angular stability and thus helps in early mobilization, even in comminuted fracture. LCP with option of locking screw has provided the means to increase the rigidity of fixation in osteoporotic bone and in periarticular fractures, it provides a solution to age old problems of screw cut out, late collapse and mal alignment since the stability of the construct does not entirely depend on the quality of bone. Careful selection of patients and strict adherence to the basic principle of fracture fixation will go a long way in reducing the complication of fracture fixation using LCP. Rigid internal fixation permits early functional rehabilitation and decreases the incidence of mal-union, nonunion and loss of fixation. Knee stiffness which was the common complication in our study which can be tackled by taking the patient for surgery as soon as possible and surgical expertise, meticulous soft tissue handling and vigorous early knee mobilization.

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