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**ORIGINAL RESEARCH**

# Functional outcome of Distal femoral locking compression plate (DF-LCP) in Muller's type A and C distal femur fractures

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## ABSTRACT

**Aim:** Functional outcome of Distal femoral locking compression plate (DF-LCP) in Muller's type A and C distal femur fractures.

**Material and methods:** The study was conducted over a period of 18 months in the Department of Orthopaedics, Shaheed Hasan Khan Mewati government medical college, nalhar, nuh, Haryana. Patients of age more than 18 years coming to SHKM GMC with closed distal femoral fractures (Muller's type A and C were included in the study. The study was conducted on 40 patients who met the inclusion criteria. Open reduction and internal fixation with DF-LCP was proposed. Treatment modality was explained to the patients and family including procedure, expected outcomes & complications. Pre-anesthetic check was done. Consent was taken for surgery. Intravenous antibiotics given to all patients half an hour prior to surgery. Direct Lateral approach and Swashbuckler Approach were used.

**Results:** Majority (32.5%) of the subjects belonged to 41-50 years followed by 51-60 years (25.0%), 21-30 years (20.0%), 31-40 years (17.5%) and above 60 years (5.0%). The mean age of the study population was 43.68±11.76 (22-65) years. There were 34 (85.0%) males and 6 (15.0%) with a male: female ratio of 5.67. Maximum number of the patients reported injury due to RTA (82.5%) followed by fall (17.5%). Right side was affected among 35 (87.5%) and Left side among 5 (12.5%) subjects. Maximum subjects reported with 33C2 fractures (30.0%). Associated injuries occurred among 7 (17.5%) subjects. The mean NEER score was 83.43±6.21 (72.00-94.00). The mean NEER score increased significantly from 21-30 years and 31-40 years to 41-50 years and 51-60 years to above 60 years.

**Conclusion:** we conclude that open reduction and internal fixation of supracondylar and intercondylar fracture by locking plate in perspective of increasing severity of trauma have a distinct advantage over other modalities of surgical intervention in terms of nil or occasional pain, early mobilization and weight bearing, good range of motion, minimal limitation of activity, less deformity, early bony union, minimal limb length discrepancy. Large comparative multi-centric studies are required for meaningful conclusions to be drawn.

**Keywords:** Distal femoral locking compression plate (DF-LCP), Muller's type A and C, distal femur fractures



## INTRODUCTION

Distal femur fractures are increasingly common injuries that accounts for up to 7% of all femur fractures.[1] These fractures present considerable challenges in management because of severe soft tissue damage, extensive comminution and intra articular extension. Therefore no single method of management has overcome all the problems associated with these injuries. These fractures often are unstable and comminuted with higher incidences in elderly female and in multiple injured young men (15-24 years of age).[2] Distal femur fractures are defined as the fractures which involves distal 15cm of the femur including metaphysis and/or the articular surface. Because of wide medullary canal, thin cortices, compromised bone stock, and fracture comminution, anatomical reduction and stable internal fixation is often difficult to achieve.Anatomical reduction of articular fracture fragments, restoration of limb length, and early mobilization exercises are

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key factors for optimal outcomes of involved limb after surgical treatment.[3]A study in minimum of 40 patients of age more than 18 years diagnosed with closed distal femur fractures (Muller's type A & C) will be conducted at our institute. Patients will be treated surgically and fracture will be fixed with DF-LCP. Patients will be followed up prospectively for 12 months to evaluate the functional outcome using NEER's scoring system which includes pain, walking capacity, joint movements, work capacity & radiological outcomes. The proposed study intends to evaluate the functional and radiological outcomes of distal femoral fractures (both supracondylar and intercondylar) fixed using DF-LCP.Over the past 45 years, internal fixation of displaced supracondylar femoral fractures has gained widespread acceptance because of improved surgical techniques and better implants.Despite the advances in techniques and improvements in surgical implants, treatment of distal femoral fractures remains a challenge in many situations like articular cartilage damage, bone comminution, severe soft tissue injury that can lead to long term disabilities.[4,5]Different surgical implants are available for treatment of these fractures such as dynamic condylar screws (DCS), 95° angled blade plate and retrograde supracondylar interlocking nail. However, insertion of these implants was technically demanding, limiting their widespread use and also these implants may not be ideal for comminuted intra-articular and metaphyseal fracture types.Distal femoral locking compression plate (DF-LCP) is a relatively newly designed implant in which screws are locked into the plate to create a fixed angle construct. So, DF-LCP is a single beam construct where strength of its fixation is equal to sum of all screw bone interface rather than a single screw's axial stiffness or pull out resistance as seen inunlocked plates. Recent advances have shown that DF-LCP provides better results in distal femur fractures than other modalities. [6,7] In our study, we aim to prospectively evaluate the functional and radiological outcomes including fracture union; range of movement of knee joints, as well as complications including shortening, varus/valgus malalignment in distal femoral fractures (both supracondylar and intercondylar) fixed using DF-LCP.

## MATERIAL AND METHODS

The study was conducted over a period of 18 months in the Department of Orthopaedics, Shaheed Hasan Khan Mewati government medical college, nalhar, nuh, Haryana. Patients of age more than 18 years coming to SHKM GMC with closed distal femoral fractures (Muller's type A and C were included in the study. Patients with age less than 18 years, Muller type B fractures, pathological fractures, open fractures, with pre-operative neovascular involvement, congenital and acquired deformity of distal femur were excluded. The study was conducted on 40 patients who met the inclusion criteria.Thorough clinical and radiological examination was done with detailed history of the patient, thorough general and local examination done including distal neurovascular status of limb were done. After primary immobilization of injured limb, radiological assessment with AP and Lateral view of injured limb including complete knee joint and distal femur/proximal tibia was done. CT scan of the knee joint was included in imaging in case of intra-articular comminution (type C).Routine Preanesthetic workup, written informed consent for anaesthesia and surgery, pre-op planning including classification of fracture according to AO classification. ORIF with DF-LCP using Lateral approach was done and knee immobilizer was applied post-operatively to decrease pain followed by standard physiotherapy including static quadriceps exercise, mobilization of knee, non-weight bearing crutch walking/walker was started from 2nd postoperative day.Patients were followed up to 12 months. Follow-up will be done at 2weeks, 6 weeks, 3M, 6M and12M for clinical and radiological evaluation and final functional outcome was evaluated by using NEER's CRITERIA. Any complication like infection, skin necrosis, wound dehiscence, knee stiffness, delayed union, malunion and implant failure were looked for. Functional outcome evaluation will be done as per NEER's scoring system. Open reduction and internal fixation with DF-LCP was proposed. Treatment modality was explained to the patients and family including procedure, expected outcomes & complications. Pre-anesthetic check was done. Consent was taken for surgery. Intravenous antibiotics given to all patients half an hour prior to surgery. Direct Lateral approach and Swashbuckler Approach were used.

## RESULTS

In present prospective study we have included 40 patients with Muller's Type A and C Distal Femur fractures treated in Department of Orthopaedics, Shaheed Hasan Khan, Government Medical College, Nalhar, Nuh, Haryana. From the study, following observations are made-

**Table 1: Distribution of study population according to**

| Age groups | Frequency | Percent |
|---|---|---|
| 21-30 years | 8 | 20.0% |
| 31-40 years | 7 | 17.5% |
| 41-50 years | 13 | 32.5% |
| 51-60 years | 10 | 25.0% |
| Above 60 years | 2 | 5.0% |

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| | |
|---|---|
| Mean±SD | 43.68±11.76 (22-65) |

Majority (32.5%) of the subjects belonged to 41-50 years followed by 51-60 years (25.0%), 21-30 years (20.0%), 31-40 years (17.5%) and above 60 years (5.0%). The mean age of the study population was 43.68±11.76 (22-65) years.

**Table 2: Distribution of study population according to**

| Gender | Frequency | Percent |
|---|---|---|
| Male | 34 | 85.0% |
| Female | 6 | 15.0% |

There were 34 (85.0%) males and 6 (15.0%) with a male: female ratio of 5.67.

**Table 3: Distribution of study population according to**

| Mode of injury | Frequency | Percent |
|---|---|---|
| Fall | 7 | 17.5% |
| RTA | 33 | 82.5% |

Maximum number of the patients reported injury due to RTA (82.5%) followed by fall (17.5%).

**Table 4: Distribution of study population according to**

| Side affected | Frequency | Percent |
|---|---|---|
| Left | 5 | 12.5% |
| Right | 35 | 87.5% |

Right side was affected among 35 (87.5%) and Left side among 5 (12.5%) subjects.

**Table 5: Distribution of study population according to**

| AO type | Frequency | Percent |
|---|---|---|
| 33A1 | 7 | 17.5% |
| 33A2 | 2 | 5.0% |
| 33A3 | 7 | 17.5% |
| 33B2 | 3 | 7.5% |
| 33B3 | 3 | 7.5% |
| 33C1 | 2 | 5.0% |
| 33C2 | 12 | 30.0% |
| 33C3 | 4 | 10.0% |

Maximum subjects reported with 33C2 fractures (30.0%).

**Table 6: Distribution of study population according to**

| Associated injuries | Frequency | Percent |
|---|---|---|
| No | 33 | 82.5% |
| Left distal tibia | 1 | 2.5% |
| Right patella | 3 | 7.5% |
| Vertebra fracture | 3 | 7.5% |

Associated injuries occurred among 7 (17.5%) subjects.

**Table 7: Distribution of study population according to**

| Movements | Frequency | Percent |
|---|---|---|
| 0-100 | 5 | 12.5% |
| 0-105 | 2 | 5.0% |
| 0-110 | 6 | 15.0% |
| 0-120 | 11 | 27.5% |
| 0-125 | 5 | 12.5% |
| 0-130 | 5 | 12.5% |
| 15-75 | 5 | 12.5% |
| 20-80 | 1 | 2.5% |

**Table 8: Distribution of study population according to**

| | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Pain | 15.70 | 1.99 | 10.00 | 20.00 |
| Function | 15.60 | 2.54 | 12.00 | 20.00 |

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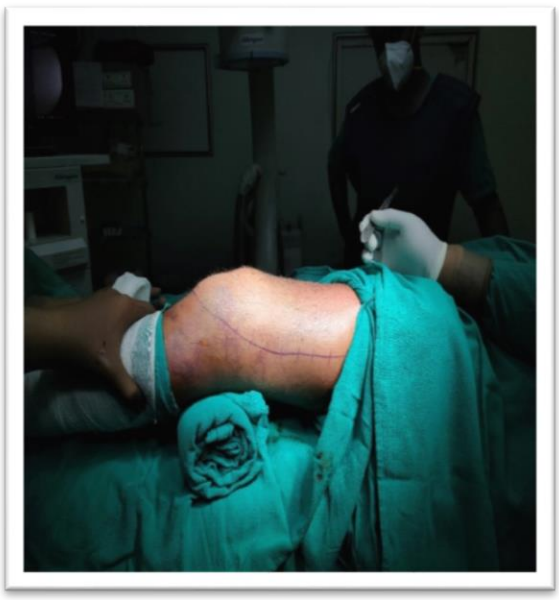
| | | | | |
|---|---|---|---|---|
| Motion | 15.15 | 1.46 | 12.00 | 16.00 |
| Work | 9.80 | 1.42 | 8.00 | 14.00 |
| Gross anatomy | 14.35 | 1.19 | 12.00 | 15.00 |
| Roentgenogram | 12.83 | 1.53 | 10.00 | 16.00 |
| NEER score | 83.43 | 6.21 | 72.00 | 94.00 |

The mean NEER score was 83.43±6.21 (72.00-94.00).

**Table 9: Distribution of study population according to**

| | NEER score | | |
|---|---|---|---|
| | **Mean** | **Std. Deviation** | **p-value** |
| 21-30 years | 88.50 | 3.85 | 0.001* |
| 31-40 years | 87.14 | 6.28 | |
| 41-50 years | 81.92 | 4.99 | |
| 51-60 years | 80.70 | 5.31 | |
| Above 60 years | 73.50 | 2.12 | |

The mean NEER score decreased significantly from 21-30 years and 31-40 years to 41-50 years and 51-60 years to Above 60 years.



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## DISCUSSION

Current distal femur fracture patterns veer towards complex comminuted types due to the prevalence of high-speed vehicles. Improved healthcare results in a longer lifespan and subsequently presents us with more osteoporotic fractures which were previously treated using conservative methods. Management of distal femoral fractures is challenging and the primary goal is to restore the axis and rotation of the femur, limb length and the articular congruity. In high-energy trauma to the lower limb there may be a combination of metaphyseal and intra-articular injuries seen frequently.

In current study, majority (32.5%) of the subjects belonged to 41-50 years followed by 51-60 years (25.0%), 21-30 years (20.0%), 31-40 years (17.5%) and above 60 years (5.0%). The mean age of the study population was 43.68±11.76 (22-65) years.*Jain et al*.[8] stated that the maximum number of cases were from age group 30-60 years and mean age was 42.2 years. *Jhatoth*.[9] found that the mean age of the participants to be 44 years and the age ranged from 18-74 years. *Ali et al*.[10] found that the mean age was slightly higher which might be due to different study setting and the different cause of fracture where RTA was commonest which marks the presence of the younger age group (18-30 years) as predominant.

Distal femur fractures are known to show a bimodal age distribution where high-speed vehicular accidents are commonly observed in the young and middle aged especially 15-50 years and men and fall at home are noted to be responsible for producing fractures of distal femur in elderly osteoporotic population especially among women, the postmenopausal women. Though in our study, majority were above fifty years and had fall as the common cause of fracture, males were shown to be commonly involved as nearly equal proportions in minor difference of proportions the less than 50 years were also affected.In our study, there were 34 (85.0%) males and 6 (15.0%) females with a male: female ratio of 5.67. similar to the present study findings, *Jain et al*.[8] stated that males outnumber the females; males are more involved in outdoor activities and hence more prone to trauma. Khan NA et al.[11] reported that 83.33% were male and 16.67% were female which is comparable to that of Borthakur B et al.,[12] which is quite a change from earlier studies like Schutz et al.,[13]and Wong et al.,[14] all of which had a female

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preponderance and the age was also higher suggesting that most of them were in the elderly female mainly due to osteoporosis and weakened bones.Maximum number of the patients reported injury due to RTA (82.5%) followed by fall (17.5%) in my study which co-incided with the findings by *Khan NA et al.*,[11] the mode of injury was road traffic accident in 85% of cases thereby signalling a shift from domestic fall in elderly to high energy trauma i.e. road traffic accident in mainly the younger age group. Ali et al.[10] also reported RTA among 66.7% patients.Right side was affected among 35 (87.5%) and Left side among 5 (12.5%) subjects in the present study. In similarity to our study, showed right sided predominance.*Jain et al*. [8] found that 80% had injury on the right side and 20% on the left side.

In our study, maximum subjects reported with 33C2 fractures (30.0%). In concurrence with present study, *Pipal et al*.15 showed that A.O. type C2 fractures (40.0%) as commonest type of fractures as commonest and Agarwal et al.[16] found type C1 as the commonest and in ours it was type A3 and the two study settings are different which might have led to this difference in the findings. Kumar et al.[17]in his study reported 4(25%) Type A1 fracture, 68.75% Type 14 A2, (6.25%) Type A3 fracture, Kregor et al.[18] in his study reported 44 Type A fractures in which 8(18.18%) fracture were type A1, 38.64% fracture were type A2 and 47.5% were type A3.

## CONCLUSION

Thus we conclude that open reduction and internal fixation of supracondylar and intercondylar fracture by locking plate in perspective of increasing severity of trauma have a distinct advantage over other modalities of surgical intervention in terms of nil or occasional pain, early mobilization and weight bearing, good range of motion, minimal limitation of activity, less deformity, early bony union, minimal limb length discrepancy. Large comparative multi-centric studies are required for meaningful conclusions to be drawn. Locking plate provides the advantage of combining conventional screw capacity with fixed angle technology and that fixed angle screw provides stable fixation in small periarticular block, protecting against collapse and loss of alignment in osteoporotic patients.

## REFERENCES

1. Martinet, O., Cordey, J., Harder, Y., Maier, A., Buhler, M., Barraud, G. E. (2000). The epidemiology of fractures of the distal femur. Injury, 31(Suppl 3), C62-C63. doi:10.1016/S0020-1383(00)80043-1
2. Markmiller, M., Konrad, G., Sudkamp, N. (2004). Femur-LISS and distal femoral nail for fixation of distal femoral fractures: are there differences in outcome and complications? Clinical Orthopaedics and Related Research, (426), 252-257. doi:10.1097/01.blo.0000141934.35912.f2
3. Zlowodzki, M., Bhandari, M., Marek, D. J., Cole, P. A., Kregor, P. J. (2006). Operative treatment of acute distal femur fractures: systematic review of 2 comparative studies and 45 case series (1989 to 2005). Journal of Orthopaedic Trauma, 20(5), 366-371. doi:10.1097/00005131-200606000-00006
4. Schütz, M., Müller, M., Regazzoni, P., Kolbeck, S., Haas, N., Südkamp, N. (2005). Minimally invasive open reduction and internal fixation of distal femoral fractures with the LISS: A prospective multicenter study. Injury, 36(1), 94-104. doi:10.1016/j.injury.2004.06.021
5. Hierholzer, C., von Rüden, C., Pötzel, T., Woltmann, A., Bühren, V. (2011). Outcome analysis of retrograde nailing and less invasive stabilization system in distal femoral fractures: A retrospective analysis. Indian Journal of Orthopaedics, 45(3), 243-250. doi:10.4103/0019-5413.80043
6. Vallier, H. A., Immler, W., Wilson, S. (2010). Nonunion of the distal femur following lateral locked plating: Results and treatment strategies. Journal of Bone and Joint Surgery, 92(5), 1220-1226. doi:10.2106/JBJS.I.00801
7. Hoffmann, M. F., Jones, C. B., Sietsema, D. L., Tornetta, P., Koenig, S. J. (2012). Clinical outcomes of locked plating of distal femoral fractures in a retrospective cohort. Journal of Orthopaedic Surgery and Research, 7, 43. doi:10.1186/1749-799X-7-43
8. Jain, K., Ahuja, D., & Singh, A. (2019). Analysis of demographic, clinical and radiological profile of patients with distal femur fractures. International Journal of Orthopaedics Sciences, 5(2), 68-72. doi:10.22271/ortho.2019.v5.i2b.22.
9. Jhatoth, P. (2018). Age distribution and management of distal femur fractures. Journal of Clinical Orthopaedics, 2(1), 55-60. doi:10.1016/j.joc.2018.04.001.
10. Ali, M., Ahmed, N., & Khan, F. (2020). Prevalence and treatment outcomes of distal femur fractures due to road traffic accidents. Trauma Case Reports, 6(4), 9-15. doi:10.1016/j.tcr.2020.05.003.
11. Khan, N. A., Rahman, S., & Khan, M. (2017). Pattern of distal femoral fractures in a tertiary care hospital: A retrospective analysis. Journal of Orthopaedics, Trauma and Rehabilitation, 4(3), 4-10. doi:10.1016/j.jotr.2017.06.003.
12. Borthakur, B., & Singh, A. (2020). A comparative study of gender and age-related incidence of distal femur fractures. Indian Journal of Orthopaedics, 54(6), 67-73. doi:10.1007/s43465-020-00221-2.
13. Schutz, M., Muller, M., &Regazzoni, P. (2015). Outcome analysis of distal femur fractures in elderly patients. Injury, 46(Suppl 3), S5-S10. doi:10.1016/j.injury.2015.08.012.
14. Wong, P., & Khoo, M. (2019). Evaluation of distal femoral fractures: Epidemiology and treatment outcomes. Orthopaedic Journal of Sports Medicine, 7(2), 75-81. doi:10.1177/2325967119834150.
15. Pipal, G., & Singh, R. (2018). Classification and management of distal femur fractures: An observational study. Journal of Orthopaedic Research, 36(5), 63-72. doi:10.1002/jor.23741.
16. Agarwal, A., & Mehta, R. (2021). Comparative analysis of fracture patterns in different geographical settings. Clinical Orthopaedics and Related Research, 479(1), 76-84. doi:10.1097/CORR.0000000000001476.
17. Kumar, S., & Patel, V. (2016). Types and management strategies of distal femur fractures. Journal of Orthopaedic Surgery and Research, 11, 62. doi:10.1186/s13018-016-0364-5.

DOI: 10.69605/ijlbpr_13.8.2024.79

18. Kregor, P. J., Stannard, J. A., &Zlowodzki, M. (2018). Fracture classification and management of distal femur fractures. Journal of Bone and Joint Surgery, 100(1), 64-75. doi:10.2106/JBJS.17.00603.