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Competency of distal femur locking plate as an answer for fixation of all varieties of distal femur fractures

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ABSTRACT

Background: Distal femur fractures are common and need to be treated operatively and for optimal functional outcome. Multiple implants are available for fixation e.g. angled blade plate, dynamic condylar screw, buttress plate, antegrade nailing, retrograde nailing, locking distal femoral plates, external fixator etc. We have designed this study to analyse clinico-radiological outcome and competency of locked plating for all varieties of distal femur fractures.
Methods: We conducted a prospective interventional study on 79 consecutive patients with fractures of distal femur operated with locking distal femur plate from January 2015 to February 2018. Patients were regularly followed up with x-rays and clinical examination. At the end of clinicoradiological union, patients were evaluated with Neer's score.
Results: Total 79 distal femur fractures were studied based on inclusion and exclusion criteria. There were 63 (79.75%) males and 16 (20.25%) females. As per AO classification fracture of type A were 39 (49.36%), type B were 10 (12.65%) and type C were 30 (37.97%). Average time period from injury to surgery was 8.2 days. In our study, the average period of clinicoradiological union was 16 weeks. 62 (78.48%) patients had excellent to satisfactory outcome, 13 (16.45%) patients had unsatisfactory and 4 (5.06%) patients had poor outcome.
Conclusions: Distal femur fractures are common, complex injuries and different implant option are available for fixation. All types of distal femur fractures can be fixed using distal femur locking compression plate. If fixed following basic principles of fracture fixation good results can be obtained.

Keywords: Distal femur locking plate, Distal femur fractures, Neer's score

INTRODUCTION

Distal femur is not uncommon fractures encountered by orthopaedic surgeons in practice. With the modernization and development the road traffic accidents are increasing day by day. One of the high velocity trauma fractures is distal femur fracture. Actually it has bimodal distribution based on age and gender. Most high energy distal femoral fractures occur in males because of road traffic accidents, while most low energy fractures occur in osteoporotic women as a result of falls.[1]

Severe soft tissue damage, comminution, extension of fracture into knee joint, open fractures with bone loss are the common patterns seen with these fractures And it is challenging to achieve stable internal fixation.[2]

Distal femur fractures need to be treated operatively and for optimal functional outcome. There are various ways for fixation e.g. angled blade plate, dynamic condylar screw, buttress plate, antegrade nailing, retrograde nailing, locking distal femoral plates, external fixator etc. Distal femur locking plates provides multiple points of fixed plate to screw contact, generating greater stability

than is provided by a single lateral construct, which potentially reduces the tendency for varus collapse. Understanding characteristics of distal femoral fractures as well as the principles and challenges of management is important in optimizing outcomes. Therefore, we have designed this study to analyse clinico-radiological outcome of locked plating for distal femur fractures at the tertiary centre in rural setup of a central India.

METHODS

This was prospective interventional study carried out between periods January 2015 to February 2018 at the department of Orthopaedics, MGIMS, Sewagram a tertiary hospital in rural setup of the central India. Total 79 cases with distal femur fracture were enrolled with inclusion criteria as all closed fractures, open fractures with grade I,II,IIIA in mature skeleton (>18 years). Pathological fractures, open grade III B, III C and fractures with distal neurovascular deficit were excluded.

Preoperative management

As soon as patient was reported to hospital careful evaluation of the injuries and initial resuscitation was done. Then radiograph of affected side including hip with thigh with knee in anterior and posterior views were taken. Radiograph of Pelvis with both hips also routinely performed to exclude pelvic trauma. Then fracture was stabilised using upper tibial skeletal traction in all cases. In open fractures single dose of I.V. antibiotics (3rd generation cephalosporins, gentamycin and metronidazole) was given in emergency room after sensitivity testing. Patients were admitted and written informed consent was taken both for study and for surgery. Blood investigations were done and patient prepared for surgery. Computed tomography scan was obtained only in comminuted intraarticular fractures.

Operative techniques

All patient underwent operative intervention with open reduction and internal fixation with distal femur locking plate. Under suitable anaesthesia patient was positioned in supine on wooden adjustable knee and tibial positioner. Cleaning and draping was done under all aseptic precautions. The skin incision in the mid-lateral line of the femoral shaft and curve it anteriorly over the lateral femoral condyle, towards the tibial tubercle. The proximal extent of the skin incision depends on the most proximal extent of the fracture. Fascia lata incised in line with skin incision. In most cases anterior part of iliotibial tract was incised through to reach deeper structures. Vastus lateralis muscle was reflected of the lateral intermuscular septum and fracture site was exposed. Open reduction of fracture done and fixed with the anatomically precontoured distal femur locking plate. After surgery wound was closed in layers under negative suction drain.

Table 1: Neers' functional scoring.

Functional.....(70 units)	Anatomical ……. …….(30 units)
Pain (20 units) 5. No pain..... 20 4. Intermittent..... 16 3. With fatigue..... 12 2. Restrict function..... 8 1-0. Constant or at night.....4-0	**Gross anatomy (15 units)** 5. Thickening only..... 15 4. 5 degrees angulation or 0.5 cm short..... 12 3. 10 degrees angulation or rotation, 2.0 cm short-0.....9 2. 15 degrees angulation or rotation, 3.0 cm short…... 6 1. Union but with greater deformity..... 3 0. Non-union or chronic infection..... …….0
Function (20 units) 5. As before injury..... 20 4. Mild restriction..... 16 3. Restricted, stairs sideways..... 12 2. Cane or severe restriction..... 8 1-0. Crutches or brace.....4 -0	**Roentgenogram (15 units)** 5. Near normal..... 15 4. 5 degrees angulation or 0.5 cm displacement-..... 12 3. 10 degrees angulation or 1.0 cm displacement.....9 2. 15 degrees angulation or 2.0 cm displacement..... 6 1. Union but with greater deformity; Spreading of condyles; osteoarthritis.....3 0. Non-union or chronic infection..... ……..0
Motion (20 units) knee flexion 5. Normal or 135 degrees.....20 4. 100 degrees..... ...16 3. 80 degrees..... 12 2. 60 degrees..... 8 1. 40 degrees..... 4 0. 20 degrees or less..... 0	
Work (10 units) 5. As before injury..... 10 4. Regular but with handicap.....8 3. Alter work..... 6 2. Light work.....4 1-0. No work.....2-0	**Outcome assessment** Excellent > 85 units, Satisfactory 70-85 units, Unsatisfactory 55-69 units, Failure < 55 units

Post-operative protocol

Immediate post-op radiographs in anterior and lateral views were taken, to evaluate fracture reduction and fixation. Suction drain was removed on post op day 3, check dressing done. I.V antibiotics were continued till 5-7 days post-operatively, then shifted to oral antibiotics until suture removal. All patients started isometric hamstring, gluteal and quadriceps exercises on post op day 2. Knee ROM were started on post op day 3 in almost all cases. Suture removal done around 12 days after surgery. Then patient were followed up at 1 month postoperatively and at every 6 week thereafter. Final functional evaluation were carried out after clinico-radiological union using Neers' functional scoring system.[3]

RESULTS

In our study, total 79 supracondylar femur fractures were studied based on inclusion and exclusion criteria. There were 63 (79.75%) males and 16 (20.25%) females. Following table no. 2 shows involvement of male and females.

Table 2: Distribution of male and females.

	Number	Percentage (%)
Males	63	79.75
Females	16	20.25
Total	79	100

Average age in males was 43 years (range 20-76) and in females was 65 years (range 47-74). Males were involved more than females. The incidence of open fracture was 59.5% and closed fracture was 40.5%. Considering mode of trauma 94% of patients having history of road traffic accident and only 6% patient were because of falling down. As per AO classification fracture of type A were 39 (49.36%), type B were 10 (12.65%) and type C were 30 (37.97%). Following table no. 3 shows classification of fractures according to AO type.

Table 3: AO classification of fracture.

	Number	Percentage (%)
Type A	39	49.36
Type B	10	12.66
Type C	30	37.98

All the cases were operated with open reduction and internal fixation under suitable anaesthesia. Average time period from injury to surgery was 8.2 days. In our study, the average period of clinicoradiological union was 16 weeks. The final outcome evaluated using Neer's criteria. 62 (78.48%) patients had excellent to satisfactory outcome, 13 (16.45%) patients had unsatisfactory and 4 (5.06%) patients had poor outcome.

Regarding complications we had 1 delayed union, 1 case had non-union who was treated with bone graft at 9 month. He had union after 12 month. In our study, 4 patients developed knee stiffness and 3 cases had superficial infection. The superficial infection was treated using antibiotics and cleaning dressing which responded well.

DISCUSSION

Distal femoral fracture are challenging to orthopaedic surgeon as most of the case has comminution, fracture extention to knee joint, injury to quadriceps mechanism and variable degree of soft tissue trauma. The goal of reconstruction is anatomical reduction and stable fixation so as to institute early mobilisation. Considering complex nature of this injury the prognostic factors described in distal end femur fracture are age, intraarticular extension of the fracture, comminution, open/closed fracture, early physiotherapy and surgeon's expertise.[4-7] We used locking distal femur plates which has advantage of locking screws into the plate and whole implant behaves as single solid angular stable construct. The "combi holes" in this plate offers advantage of applying cortical screws in compression mode and locking screws in locking mode that preserves blood supply of the periosteum.[8]

In our study we included total 79 patients based on inclusion and exclusion criteria. The involvement of males 63 (79.75%) is more as compared to females 16 (20.25%). Also the mode of trauma is road traffic accident (94%) in most of the cases. This is may be attributed to more involvement of males in outdoor activities as compare to females. Age of the study participants ranges from 20 to 76, signifying that this fractures is common in all age groups. Fracture in this study was classified using AO classification. Of the total 79 cases, 39 (49.36%) were type A, 10 (12.65%) were type B and 30 (37.97%) were type C fractures. Similar classification system was used in study of Kumar.[9]

Although various modalities are available for fixation e.g. Angled blade plate - dynamic condylar screw (DCS), or condylar blade plate (CBP), retrograde IM nail, antegrade nailing, buttress plates, locking distal femoral plates etc., we fixed all varieties of distal femur fracture by using distal femur locking plate. The management principles include anatomic restoration, axial alignment and rotational stability of particular surface and goal is to achieve full knee range of motion and function. Almost all the plating options were single beam construct and were based on biological fixation rather than compression. Due to flexible stabilization fracture heals by induction of callus formation. Fractures in our study were fixed using distal femur locking compression plate (DF-LCP). Average time period from injury to surgery was 8.2 days. We evaluated outcome by using Neers criteria. Out of the total 79 patients, 62(78.48%) patients

had excellent to satisfactory outcome, 13 (16.45%) patients had unsatisfactory and 4 (5.06%) patients had poor outcome. Following Table 4 shows outcome of the other studies after distal femur fixation.

Table 4: Outcome in other studies.

	Excellent (%)	Satisfactory (good) (%)	Unsatisfactory (fair) (%)	Failure (poor) (%)
Krishna et al[4]	50	36.6	10	3.3
Konuganti et al[10]	30	45	25	0
Rao et al[11]	32	48	16	4
Girisha et al[12]	24	71	5	0
Sah et al[13]	66.6	23.80	4.76	4.76

The complication observed in our study were 1 delayed union, 1 case had nonunion who was treated with bone graft at 9 month. He had union after 12 month. In our study, 4 patients developed knee stiffness and 3 cases had superficial infection. The superficial infection was treated using antibiotics and cleaning dressing which responded well.

CONCLUSION

Distal femur fractures are complex and common injuries and different implant options are available for fixation. All types of distal femur fractures can be fixed using distal femur locking compression plate. If fixed following basic principles of fracture fixation good results can be obtained.

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REFERENCES

1. Egol KA, Koval KJ, Zuckerman JD (Eds.). Handbook of fractures. 4th edn. Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins Health; 2010: 420-428.
2. Daroch MS, Vashisht D, Sreen S. Management of intra-articular fracture of distal femur with LCP and Lag screws in adults. Int J Res Med Sci, 2017;5:1434-8.
3. Neer CS 2nd, Grantham SA, Shelton ML. Supracondylar fracture of the adult femur. A study of one hundred and ten cases. J Bone Joint Surg Am. 1967;49(4):591-613.
4. Krishna KR, Nayak B, Amrit G. Study of surgical management of distal femoral fractures by distal femoral locking compression plate osteosynthesis. Indian J Orthop Surg. 2015;1(1):22-6.
5. Lujan TJ, Henderson CE, Madey SM, Fitzpatrick DC, Marsh JL, et al. Locked plating of distal femur fractures leads to inconsistent and asymmetric callus formation. J Orthop Trauma. 2010;24(3):156-62.
6. Gupta GK, Sudha Rani D, Kumar R, Singh B. Analysis of management of supracondylar femur fracture by locking compression plate. Int J Orthop. 2016;2(4):218-22.
7. Chander A, Ganesan GR, Jayabalan V. Is Distal Femur Locking Plate a Superior Implant in Distal Femur Fracture?. Open J Orthop. 2015;5(9):258.
8. Virk JS, Garg SK, Gupta P, Jangira V, Singh J, Rana S. Distal Femur Locking Plate: The Answer to All Distal Femoral Fractures. J Clin Diagn Res. 2016;10(10):1-5.
9. Gyanendra Kr J, Deepesh K Y, Pravin T. Outcome of Supracondylar Femur Fracture in Adults Managed By Distal Femur Locking Compression Plate. iomed J Sci Tech Res. 2018;3(1):1-7.
10. Konuganti SR, Jakinapally SR, Rao VP, Rapur S. Management of distal femur fractures with locking compression plate: a prospective study. Int J Res Orthop. 2018;4:208-13.
11. Rao LL, Kumar TD, Paleti ST. Evaluation of functional outcome after open reduction and internal fixation of distal femur fractures by locking compression plate. J Evid Based Med Healthc. 2016;3(73):3966-72.
12. Girisha BA, Manchani S, Shah R, Muralidhar N. Outcome of distal femoral fractures treated with locking compression plates. Int J Res Orthop. 2017;3:676-80.
13. Sah S, Karn NK, KC B, Yadav R, Dangi SJ, Adhikari AR. Outcomes of Surgical Management of Distal Femur Fracture with Distal Femoral Locking Compression Plate At Koshi Zonal Hospital. BJHS. 2017;2(3)4:260-5.

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