

## Research Article

# Outcome of fracture of intra articular distal femur treated with distal femur locking compression plate

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### ABSTRACT

**Background:** Intra articular fracture of the distal femur is a composite and complex injury that poses various challenges for orthopaedic surgeon starting from management of fracture to a protracted recovery of the patient.

**Methods:** We have done retrospective study of 25 patients with intra articular distal femur fracture operated during the period of 2008 to 2014. NEER score is used as criteria for evaluation of patients.

**Results:** With use of DFLCP, anatomical reduction and rigid fixation, early mobilization and aggressive physiotherapy can be started with the use of these plates.

**Conclusions:** Our study shows that distal femur locking compression plate (DFLCP) is the evolving approach to treat distal femur fractures.

**Keywords:** Distal femur fracture, Distal femur locking compression plate (DFLCP), Intra articular fracture, Less invasive stabilization system (LISS)

### INTRODUCTION

Fracture of distal femur accounts for 7 percent of all femoral fractures and 30 percent of fractures of femur excluding hip fractures.<sup>1</sup> Distal femoral fractures mainly arise from two different injury mechanisms. (1) High energy trauma mainly sustained in road traffic accidents in younger patient. (2) Low energy trauma, in elderly patients with severe osteoporosis. Since last two decades incidence of this type of fractures has increased a lot due to a rise in road traffic accidents. The management of intra articular distal femur fractures is challenging with wide range of potential complications. In elderly patients, extreme osteoporosis represents a particular problem for anchoring the implant.<sup>2</sup> The LCP 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 pull-out resistance as seen in unlocked plates.

Distal femur locking plates can be applied in three different ways:

1. As a conventional dynamic compression plate providing absolute stability.
2. As a "pure" internal fixator providing relative stability by bridging the fracture zone according to less invasive stabilization system (LISS) principles.
3. In combined fashion where both techniques are employed using conventional lag screw as well as locked screws. 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>3</sup>

The purpose of this study is to evaluate the outcome, effectiveness and complications of distal femur fractures, treated by open reduction and internal

fixation using distal femoral locking compression Plate.

## METHODS

We have done retrospective study of 25 patients with intra articular distal femur fracture operated during the period of 2008 to 2014. All patients are included according to pre-defined inclusion and exclusion criteria.

### Inclusion criteria

1. All patients of age of 18 years or above both male and female.
2. Close or open grade fracture C1, C2, C3 according to AO classification.<sup>4,5</sup>

### Exclusion criteria

1. Conservatively treated patients.
2. AO group A and B.
3. Pathological fracture
4. Peri-prosthetic fracture
5. Patients with vascular injury.

Functional grading was done according to pain, function, mobility, and work while radiological grading was done according to varus/valgus deformity and status of union.

### Locking compression plate<sup>6,7</sup>

Fracture fixation devices with threaded screw holes function as fixed angle device.

It is a pre contoured plate with distal expanded part having multiple holes which allow placement of 4.5 mm cortical and 5 mm or 6.5 mm cancellous screw with locking head providing advantage of

1. Compression of articular fragments
2. Angular stability.

Proximal part has combi-holes which allow placement of either of locking 5.0 mm or 4.5 mm cortical screw.

### Surgical techniques<sup>8,9</sup>

1. Position: Patient is placed supine on a radiolucent table with a pillow below the knee. Knee is placed in slight flexion over a small sand bag or a triangular frame.
2. Approach: We commonly used extensile lateral approach for most intra articular distal femoral fracture. By avoiding dissection of the medial soft tissues in the distal femoral metaphyseal region, healing should proceed predictably.
3. Reduction: We first anatomically reduce articular fragments and provisionally stabilize them with k wires. Then the proper sized plate is selected and

the fracture is fixed. Then we insert minimum 5 screws including lag screws and locking head screws in distal expanded part and minimum 4 screws (8 cortices) in proximal femoral diaphysis.

We closed joint capsule arthrotomy with absorbable suture, Fascia of vastus lateralis and iliotibial band and subcutaneous tissue closed with absorbable suture. Skin closed with non-absorbable suture. Stiches were removed at 12th post-operative day.

Depending upon fixation and the bone quality, immediate post-operative knee range of motion (ROM) was started. Patients are asked to come every month for follow up till fracture union. Patient was kept non weight bearing for 12 weeks. Partial to full weight bearing was started at 12 - 14 weeks.

NEER score is used as criteria for evaluation of patients.<sup>10</sup>

## RESULTS

In our study, 25 supracondylar femur fractures with intra articular extension were studied. It is a worldwide fact that intraarticular fracture must be treated with stable internal fixation to get servicable range of movements of knee joint.

- In our study the youngest patient was 18 years and the eldest was 55 years. Average age in our study was 36.36 year.
- With advances in mechanization and acceleration in travel, the incidence of vehicular accident has increased a lot, in our study 96% of patients having history of RTA and only 04% of because of fall down.
- The incidence of open fracture was 56% and close fracture was 44%.
- In our study, the incidence of C2 type and C3 type fracture was same incidence 40% and the incidence of C1 type was 20%.
- Average injury-surgery interval was 03.04 days.
- Majority of patients were with follow up of more than 24 months. None of the case having less than 6 months follow up.
- In our study, 16 patients having excellent to satisfactory result and 19 patients having 80° or more knee flexion.
- 5 out of 8 patients having extension lag of 10° and 2 patients had 5° extension lag and 1 patient had 20° extension lag.
- Average month of union was 6.24 month. 24 patient had union and 1 in our study was having nonunion who was treated with bone graft at 9 month. He had union after 12 month.
- In our study, 10 patients out of 25 developed knee stiffness, which is the most common complication in post-operative period in intra-articular fractures. One

patient developed knee instability. 2 patients had delayed union and 2 patients had infection.

**Table 1: Criteria for evaluation of results (NEER Score).**

<b>Functional:</b>	
<b>Pain</b>	
No Pain	20
Intermittent / Bad Weather	16
With Fatigue	12
Restricted Function	06
Constant/At Night	04-00
<b>Function</b>	
As before Surgery	20
Mild Restriction	16
Restricted Stairs / Sideway	12
Severe restriction	08
Crutches / Brace	04-00
<b>Motion</b>	
Normal or 135	20
100	16
80	12
60	08
40	04
20 or Less	00
<b>Work</b>	
As Before Injury	10
Regularly but Handicapped	08
Altered Work	06
Light Work	04
No Work	02-00
<b>Anatomical</b>	
<b>Gross anatomy</b>	
Thickening only	15
5° Angulation	12
10° Angulation / Rotation/2 cm Shortening	09
15° Angulation/ Rotation/ 3 cm Shortening	06
United by Greater Deformity	03
Nonunion or Chronic Infection	00
<b>Roentgenogram</b>	
Near Normal	15
5° Angulation / 0.5 cm Shortening	12
10° Angulation / 1 cm Shortening	09
15° Angulation / 2 cm Shortening	06
United by greater deformity	03
Nonunion or Chronic Infection	00
<b>NEER score</b>	
Excellent	>85
Satisfactory	70-85
Unsatisfactory	55-70
Failure	<55

**Table 2: Distribution of age.**

Age	Number	Percentage
<20	3	12%
20 – 29	6	24%
30 – 39	5	20%
40 – 49	4	16%
50 – 59	7	28%
>60	0	00%

**Table 3: Type of injury.**

Type	Number	Percentage
Closed	11	44%
OG 1	8	32%
OG 2	2	08%
OG 3	4	16%

**Table 4: Distribution of side of injury.**

Right	15	60%
Left	10	40%

**Table 5: Mode of injury.**

RTA	24	96%
Fall down	01	04%

**Table 6: Type of fracture.**

Type	Number	Percentage
C1	5	20%
C2	10	40%
C3	10	40%

**Table 7: Injury surgery interval.**

Day	Number	Percentage
0 – 3	19	76%
4 – 8	3	12%
>8	3	12%

**Table 8: Duration of follow up.**

Month	Number	Percentage
0 – 6	0	00%
7 – 12	1	04%
13 – 18	1	04%
19 – 24	2	08%
>24	21	84%

- We have evaluated the results of DFLP in distal femur fracture with intra articular extension according to NEER score.
- In our study, 5(100%) out of 5 patients with type C1 fractures had excellent to satisfactory result, 6(60%)

out of 10 patients with type C2 fractures had excellent to satisfactory result, 5(50%) out of 10 patients with type C3 fractures had excellent to satisfactory result.

**DISCUSSION**

Distal femur fractures present considerable challenge in management due to

1. Sever soft tissue damage
2. Comminution
3. Fracture extending to knee joint
4. Injury to quadriceps mechanism

**Table 9: Bone union time.**

Month	Number	Percentage
4	2	8%
5	10	40%
6	7	28%
>6	6	24%

**Table 10: Post-operative complication.**

Complication	Number	Percentage
Knee stiffness	10	40%
Knee instability	01	04%
Infection	02	08%
Delayed union	02	08%
Nonunion	01	04%

**Table 11: Extension of lag.**

Extension lag	Patient number
No	17
5 degree	2
10 degree	5
20 degree	1

**Table 12: Range of movement.**

Type	100°-130°	80°-100°	60°-80°	40°-60°	0°-40°
C1	4	1	0	0	0
C2	7	0	1	1	1
C3	4	3	0	1	2
Total	15	4	1	2	3

Before 1970s majority of these fractures were treated conservatively but most traumatologists now prefer internal fixation of such fractures because of poor results of conservative treatment.

These are certain features leading to difficulty in osteosynthesis as follow:

1. Thin cortices
2. Osteopenia
3. Comminution and displacement with defect in cortex
4. Wide medullary canal
5. Muscle pulls between flexors and extensors.
6. Cartilage and osteochondral defect

As these fractures are metaphyseal fractures important considerations are achieving length, correction of rotational malalignment and axial alignment of extremity.

**Table 13: Evaluation of result (NEER score).**

Type	Number	%	Excellent	Satisfactory	Unsatisfactory	Failure
C1	5	20	2	3	0	0
C2	10	40	4	2	2	2
C3	10	40	2	3	1	4
Total	25	-	8	8	3	6
%	-	100	32%	32%	12%	24%

**Clinical cases**

**Case 1**

A 28 year old male patient having history of RTA, had fracture right intra articular distal femur type C- 3 treated with DFLP, fracture united in 4 months, having range of motion 0°-120°. He is able to squat and do crossed leg sitting also.



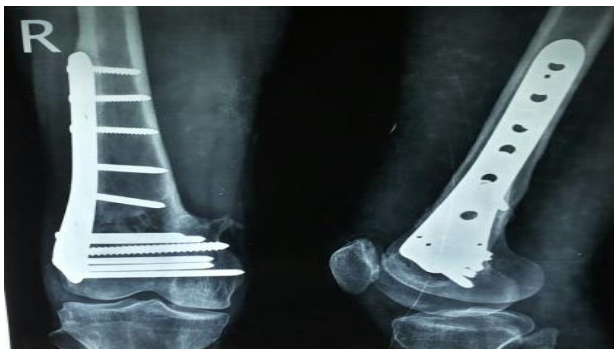
**Figure 1: (a) Pre-Operative X-ray.**



**Figure 1: (b) Post-Operative X-ray.**



**Figure 2 (c): 6 month follow up.**



**Figure 1 (c): 6 month follow up.**



**Figure 2 (d): 18 month follow up.**

**Case 2**

A 25 year old male patient with history of RTA had fracture C2 type distal femur, treated with DFLP, fracture united in 5 months, range of motion is 0 to 120 degree. Patient is able to squat with difficulty and does crossed leg sitting.



**Figure 2 (a): Pre-operative.**



**Figure 2 (b): Post-operative.**

- Management of distal femur fracture is always going to be a challenge for the orthopaedic fraternity.
- Distal femur locking plate provides angular stability and provides multiple options to secure fracture fragments both metaphyseal and articular.
- Anatomical reduction of articular fragments and rigid fixation of reduction of this fracture is must.
- This restores limb length, joint congruity and varus-valgus alignment.
- Along with anatomical reduction and rigid fixation, early mobilization and aggressive physiotherapy can be started with the use of these plates.

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**REFERENCES**

1. Arneson TJ, Melton LJ, Lewallen DG. Epidemiology of diaphyseal and distal femoral fractures in Rochester, Minnesota, 1965 Clin Orthop Relat Res. 1988;234:188-94.
2. Schandelmaier P, Partenheimer A, Koenemann B. Distal femoral fractures and LISS stabilization. Injury. 2001;32(Suppl 3):SC55-63.
3. Heather V, Theresa H, John S. Failure of LCP condylar plate fixation in the distal part of the femur. J Bone Joint Surg. 2006;88-A:846-53.
4. Muller. Available from URL: <https://aotrauma.aofoundation.org/Structure/educati>

on/selfdirectedlearning/referencematerials/classifications/Pages/ao-ota-classification.aspx.

5. Kim PH, Leopold SS. Gustilo-Anderson Classification. *Clin Orthop Relat Res*. 2012;470:3270–3274.
6. Biomechanics and clinical application principles of locking plates: Christoph Sommer, Head Of Traumatology, Kanton hospital, Loestrarse, Switzerland.
7. Egol KA, Kubiak EN, Fulkerson E, Kummer FJ, Koval KJ. Biomechanics of locked plates and screws. *J Orthop Trauma*. 2004 Sep;18(8):488-93.
8. Bucholz RW, Heckman JD. *Rockwood and Green's Fracture in Adults*, 8th Edition 2015 Lippincott Williams and Wilkins, a Walters Kluwer business, USA.
9. Canale and Beaty. *Campbell's Operative Orthopaedics*, 12th ed. 2012 Mosby, An Imprint of Elsevier.
10. Neer CS, Grantham SA, Shelton ML. Supracondylar fracture of the adult femur. *J Bone Joint Surg*. 1967;49A:591-613.

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