

## Original Research Article

## A short term prospective study of the functional outcome in distal femoral fractures treated by locking compression condylar plates

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**Abstract:** Distal femoral fracture with or without comminution or intra-articular extension, have always been a challenge to treat. In the elderly, where the bones are osteoporotic, hardware failure is a problem. This prospective study analyses the functional outcome of 22 cases treated with locking compression condylar plates. The OTA classification was followed. Neers' functional scoring system was used for functional outcome analysis. All the 22 cases went on for sound union at an average of 16weeks (14 to 20weeks). For carefully selected cases, locking compression condylar plates offer stable fixation, achieving sound union and a reliably good functional knee movement.

**Keywords:** Distal femoral fractures, locking compression condylar plate, Neers' scoring system, OTA classification.

### INTRODUCTION

Fractures of the distal femur are complex injuries, producing significant long term disability. They account for 7% of all femoral fractures. The management of comminuted, intra articular distal femoral fractures is challenging to the orthopaedic surgeon. These fractures occur as a result of high energy trauma, which generates severe soft tissue and articular cartilage damage with metaphyseal comminution. The incidences of malunion, non-union and infection are also relatively high. The older plating systems used in presence of either medial pillar comminution or bone loss had eventually resulted in failure of fixation and varus collapse [1, 2]. Recent advances to treat distal femoral fractures include the less invasive stabilization system (LISS) [3-5] and the locking compression condylar plates. They offer the additional benefit of multiple points of fixed angle contact between the plate and screws thereby reducing the tendency for varus collapse whilst affording better stability [6].

### MATERIALS AND METHODS

This prospective study is an analysis of functional outcome of 22 cases of distal femoral fractures, internally fixed using locking compression condylar plates, seen at Sree Balaji Medical College and Hospital, Chromepet, Chennai from May 2013 to April 2016.

Patients in the age group of 21 to 60 years were included. We classified fractures as per AO/OTA classification and excluded all B type and C3 type of fractures from our study. We included all closed fractures and excluded open fractures. We excluded patients with other associated fractures or polytrauma.

### Fracture classification

We followed OTA classification, developed by Muller because of its simplicity, reproducibility and wide acceptance among the orthopaedic surgeons.

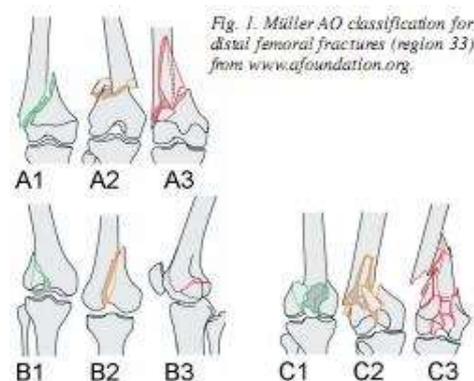


Fig. 1. Müller AO classification for distal femoral fractures (region 33) from [www.aofoundation.org](http://www.aofoundation.org).

Standard antero-posterior, lateral and oblique radiographs of the affected extremity were taken covering the distal femur with knee. CT with 3D reconstruction was done for Type C fractures and the fracture geometry assessed pre-operatively.

All patients were operated as early as possible after evaluation of medical condition and anaesthetic fitness. Open reduction and internal fixation with locking compression condylar plate was done. Autogenous iliac bone graft was used in cases where it was necessary.

**Operative procedure**

Under appropriate anaesthesia, patient in supine position under image guidance, with standard lateral approach to distal femur, the fracture site was reached and the fracture fragments were reduced temporarily with pointed reduction forceps and held with temporary K wires wherever needed. The final fixation was done with locking compression condylar plate with strict adherence to AO principles. Bone graft was harvested from ipsilateral iliac crest and used if deemed necessary.

**Postoperative care and Rehabilitation**

Post operative care in the form of intravenous antibiotics and periodic change of dressings were done. The suction drain was removed after 48

hours and sutures were removed on the 12<sup>th</sup> postoperative day. Gentle knee mobilization was started from the 3<sup>rd</sup> postoperative day onwards, emphasizing on quadriceps strengthening and hamstring stretching exercises. Gentle hip and ankle mobilization were also initiated.

Continuous passive motion was initiated for all the cases. Non weight bearing with walker support was started at the end of 1<sup>st</sup> week. Full weight bearing was allowed only after radiological evidence of union. All patients were followed at regular intervals and evaluated for fracture healing. Clinical union was defined as a painless fracture site during full weight-bearing. Radiographic union was defined as bridging trabeculation across the fracture line(s) on three of the four cortices seen on orthogonal projections.

Functional outcome was measured using Neer *et al.*, functional scoring system (Table 1).

**Table-1: Neers’ functional scoring [7]**

Variable	Unit value
<b>Pain (20 units)</b>	
5-No pain	20
4-Intermittent	16
3-With fatigue	12
2-Restrict function	8
1-0 constant or at night	4-0
<b>Function (20 units)</b>	
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
<b>Motion (20 units) Knee Flexion</b>	
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
<b>Work (10 units)</b>	
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
<b>Gross Anatomy (15 units)</b>	
5 Thickening only	15
4 5 degrees angulation or 0.5 cm short	12
3 10 degrees angulation or rotation, 2.0 cms short	9
2 15 degrees angulation or rotation, 3.0 cms short	6
1 union but with greater deformity	3
0 non union or chronic infection	0
<b>Roentgenogram (15 units)</b>	
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 cms displacement	6
1 Union but with greater deformity; spreading of condyles; osteo-arthritis	3
0 Nonunion or chronic infection	0

**Overall Rating**

Excellent	Above 85 units
Satisfactory	70-85 units
Unsatisfactory	55-69 units
Failure	Below 55 units

**RESULTS**

**Table-2: Age and sex distribution**

Age Group	No. of Patients	Percentage (%)	Males	Females
21-30	12	54.6	10	2
31-40	5	22.7	4	1
41-50	3	13.6	2	1
51-60	2	9.1	0	2
Total	22	100	16	6

**Table-3: side of affected limb**

S.No.	Side involved	No. of Patients
1	RIGHT LIMB	14
2	LEFT LIMB	8

**Table-4: Fracture distribution pattern**

Fracture Classification (OTA) Distal femur	No. of Patients
A1	2
A2	2
A3	3
C1	4
C2	11

The mode of injury was road traffic accident in 12 patients (54.6 %), fall from height in 5 patients (22.7%) and by other modes in 5patients (22.7 %).

Majority of injured patients were males 16/22(72.7%). Highest number of patients was in their 3<sup>rd</sup> decade12/22(54.5%). Road traffic accident was the most common mode of injury12/22(54.5%). All the patients reported within the 1<sup>st</sup> week of injury to the hospital. Type C2 Muller’s fracture was the most common fracture type {11 out of 22patients (50%)}

The average stay in hospital was about 10days.Postoperative immobilization with knee brace was advised for type C fractures for 3 weeks. Gentle physiotherapy exercises were started earlier. Autogenous ipsilateral iliac crest grafts were used in 16 out of 22patients.All patients were followed at regular intervals, once in a month for the first 3 months and once every 2 months thereafter, until sound union was established clinico-radiologically. The minimum follow up period was 11 months and the maximum follow-up

was 24 months. The mean follow-up period in this study was 18 months.

The results were evaluated by taking into consideration the following factors in Neers’ scoring system – Pain, Function, Motion, Work, Gross Anatomy and Roentgenograms. It consists of Functional (70 units) and Anatomic (30 units).

Early complications were encountered in 3 patients, 2patients developed superficial wound infection and one patient had wound gaping. This was satisfactorily treated with intravenous antibiotics and secondary suturing. Late complications included restricted knee ROM in 2patients, in whom flexion did not improve beyond 100 degrees. The knee flexion achieved in the series was between 100 and 125 degree. Overall results were excellent in 8 out of 22 cases and were satisfactory in remaining cases and the average knee score was 78%, as assessed by NEERS functional score.

**Case Illustration**



**DISCUSSION**

The use of locked plates and percutaneous techniques has evolved together while remaining true to the AO principles of internal fixation. The overlying principle is to preserve the blood supply and minimize soft tissue injury. High energy distal femoral fractures are frequently associated with intra-articular fracture and metaphyseal comminution[3,4,5]. Coronal plane fracture and extensive distal comminution generally preclude the use of traditional fixed-angle devices or retrograde nails[1]. Earlier, fixation of these fractures with a lateral plate alone had historically been associated with non-union or malunion with a varus collapse. Prior to the advent of the locking plates, these problems were addressed with dual plating methods albeit with not so satisfactory results [9].With the introduction of plates with the option of locked screws; the results are indeed encouraging, as it increases the stability of fixation in osteoporotic bone [11]. The LCP condylar plates provide multiple points of fixed plate to screws contact, thereby reducing the tendency of varus collapse[12]. LISS plating allows minimally invasive approach by submuscular insertion of plates and thereby preservation of vascularity to the lateral cortex. We attributed the favourable results in our series by strict adherence to the principles of stabilization, with stable internal fixation and early functional rehabilitation. Bone grafting was considered critical for rapid union of comminuted fractures [11]. None of our patients had loss of fixation or malunion. In our study, radiological union was seen at an average of 16 weeks which is comparable to study of LISS plates by Max Markmiller *et al.*, which averaged 13.8 weeks [3-5]. Overall results were excellent in 8 out of 22 cases and were satisfactory in remaining cases. The overall average knee score in our study was 78%, as compared to 81% in J.M. Siliski

*et al*[10]. Locking condylar plates solves the problem in fixing distal femoral fractures with osteoporosis and comminution. However, the locking plates can fail when physiological loads are outside plate-design parameters [13]. The locked screws can disengage from the plate secondary to failure of the screw to seat into the plate properly, as a result of cross threading or when insufficient screw torque is used to engage the screw threads into the plate threads.

**CONCLUSION**

Distal femoral fracture with or without comminution or intra-articular extension, have been challenging to treat and achieve union without varus collapse, malunion and nonunion. If the cases are properly selected and especially in the elderly where the bones are osteoporotic, the LCP condylar plate is an implant with distinct advantages. It acts as an extra-medullary load bearing device. It stabilizes the fracture fragments and bone union is ensured in a reasonable time limit. Malrotation and shortening are also minimized. As it is a stable fixation device, early knee rehabilitative program can be initiated, which ensures good functional outcome.

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