



# International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958  
P-ISSN: 2706-6630  
IJOS 2020; 6(1): 359-363  
© 2020 IJOS  
www.orthopaper.com  
Received: 06-11-2019  
Accepted: 10-12-2019

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## A prospective study of functional outcome of distal femur fractures by locking plate

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**DOI:** <https://doi.org/10.22271/ortho.2020.v6.i1g.1889>

### Abstract

**Introduction:** In last few decades, rapid industrialization and the fast pace of life have brought both comforts and catastrophe like road traffic accidents and crippling many young lives. High velocity road traffic accidents are responsible for distal femur fractures more commonly observed in the young and middle aged patients. This necessitates early stabilization of fractures. Internal fixation is the choice of treatment in fractures distal femur and Locking Condylar plate has shown to give one of the best results in terms of recovery, fracture union, return to work and the functional outcome.

**Aims and objective:** To study the outcome of open reduction and locking plate fixation of fractures of distal end of femur and to evaluate the effectiveness and complications of the Locking plate fixation method of treatment of fractures of distal end of femur.

**Material and Method:** It is a prospective observational study. Conducted in patients admitted to Department of Orthopedics' at BLDEU'S Shri B.M. Patil's Medical College, Hospital and Research Centre, Vijayapura with diagnosis of distal Femur fracture. The patients were informed about study in all respects and informed written consent was obtained. Period of study was between November 2017 to May 2019. Follow up period was for 6 months. Data was analysed by SPSS v21 and p-value <.05 was considered statistically significant.

**Results:** In our study 22 cases studied in our series were with 18 males and 4 females' patients. 15 of the fractures were caused by road traffic accidents (RTA), 6 were due to fall and 1 was due to assault. 15 patients were with fracture on right side and 7 on left side. 1 was Muller's type A1, 6 were Muller's type A2, 4 were Muller's type A3, 1 was Muller's type C1, 6 were Muller's type C2 and remaining 4 were with Muller's type C3 fracture. The duration of time required by patients to bear full weight was with mean of 15.8 weeks of time. The radiological union was seen at median of 17 weeks following surgery. Average flexion in the study of the limb was 110° angles with more than 50% patients having knee range of motion more than 120°. The outcome in form of regaining the knee function is assessed using NEER's scoring system. The median NEER's score in study was 94.5. Among 22 patients included, 12 patients showed excellent outcome, 6 with good and 4 with fair outcome at the follow-up. Poor outcome was found in patients with Muller's type C3 and type A3 fractures.

**Conclusion:** To conclude, Locking Compression Plate is an important armamentarium in treatment of fractures around knee especially when fracture is severely comminuted and in situations of osteoporosis. Fixation with locking condylar plate showed more effectiveness in severely osteoporotic bones, shorter post-operative stay, faster recovery, earlier union rates and excellent functional outcome compared to alternative procedures in other studies. Further study in large number of patients is required to comment regarding disadvantages and complications.

**Keywords:** Supracondylar femur fracture, locking condylar plate, open reduction internal fixation

### Introduction

In last few decades, rapid industrialization and the fast pace of life have brought both comforts and catastrophe like road traffic accidents and crippling many young lives. High velocity road traffic accidents are responsible for distal femur fractures more commonly observed in the young and middle aged patients. Low energy impact, such as fall at home, are usually responsible for producing fractures of distal femur in the older osteoporotic population especially women. Fractures of the distal end of the femur are tricky to treat and present constant challenges in management. Decreased range of movement, pain and compromised

function of the knee joint are the common problems resulting from improper fixation of articular fragments in such fractures [1].

The advent of fixed angle devices like the Condylar blade plate and the Dynamic Condylar Screw (DCS) needs a certain amount of bone stock which restricts their usage in comminuted fractures. This led to development of condylar buttress plate for fixation of comminuted femoral fractures. However, with the usage of condylar buttress plate, these fractures generally have a tendency to fall into a varus collapse because of toggle at the screw- plate interface. Retrograde nails have proved to be very useful in extra-articular and partial articular distal femur fractures, but fixation of comminuted articular fractures is still a grey area with such an implant. To address these issues, locking condylar plate was designed. A locking condylar plate decreases screw- plate toggle and provides more stable fixation which is one of the key factor in the successful treatment of these fractures. These devices create a fixed angle at each screw hole where the individual screw head is secured to the plate by a locking mechanism [1].

Since, the plate does not depend on the friction created at the bone-plate interface to provide stability, it does not have to contact the bone directly. This helps in preserving the periosteal blood supply. Locked implants are typically indicated in patients with osteoporosis, fractures with metaphyseal comminution, where the medial cortex cannot be restored, or with a short articular segment. Comminuted articular fractures can also be approached more conveniently with the use of additional screws such as partially- threaded cancellous screws, herbert screws and other varieties of smaller screws.(1)

By making use of the technique of counter- sinking, the screw heads can be adjusted to seat the distal femur locking plate in a proper fashion. It also provides another useful choice for extra-articular fractures of distal femur. Thus, the flexibility of locking condylar plate with its fixed angle properties appears to offer an effective alternative to implants like DCS, condylar buttress plate and a supra- condylar or a distal femur retrograde nail. This study was done to study the functional and radiological outcome of distal femoral fractures in skeletally mature patients treated by open reduction and internal fixation with distal femur locking plate.

In addition, a locking compression plate has got distinct advantages of unicortical fixation and least chance of plate back out as the screw gets locked to the plate. Further, Minimal soft tissue injury occurs when closed reduction is done and MIPO technique is used.

The purpose of this study is to evaluate the results of fracture lower end of femur treated by open reduction and internal fixation using locking compression plate.

### Materials and Methods

It is a prospective observational study which was conducted in patients admitted in Department of Orthopaedics in BLDEU'S Shri B.M. Patil's Medical College, Hospital and Research Centre, Vijayapura with diagnosis of fracture of distal Femur. The patients was informed about study in all respects and informed written consent was obtained. The period of study was between November 2017 to May 2019. Follow up period was for 6 months Inclusion criteria included patients aged 18 years and above with Intraarticular fractures of distal femur, Comminuted fractures of distal femur, Closed and Compound fractures of distal end of femur including

Gustillo and Anderson types I and II. Exclusion criteria included patients with Pathological fractures, Associated neurovascular injury, Patients medically unfit for surgery, Immuno compromised status, Gustillo and Anderson Type III, Floating knee.

In the operating room after induction of the patient by the anaesthetic team, pre-operative preparations like shaving and scrubbing of part, betadine paint and draping were done. Standard lateral approach by developing the plane between vastus lateralis muscle and lateral inter muscular septum was used for closed fractures of distal femur. In case of open fractures incision was tailored in such a way to include the pre- existing wound to facilitate debridement which was carried out as per standard protocol. Lateral para- patellar arthrotomy by using the Swash- buckler approach or its modifications were used to address the articular involvement of the lateral femoral condyle or the inter- condylar notch. A dual incision (standard lateral plus a medial subvastus incision) was also done in cases where a Hoffa's fracture or articular fracture of the medial femoral condyle had to be addressed in cases where access via the lateral approach was not possible. We always strived for obtaining anatomical reduction and good solid fixation in the articular area of the distal femur even at the cost of spending an extra amount of time, rather than giving the patient an incongruous joint. Distal femur locking condylar plate was used for fracture fixation using locking, 4.5mm cortical screws and partially- threaded cancellous screws of diameter 4.5mm, Herbert screws for smaller articular fragments and 6.5mm for articular reduction of condyles. Technique of counter sinking for screws heads was used when proper seating of the plate had to be obtained. Length of the plate used was judged based on the extent of fracture of distal femur. In cases of fractures with metaphyseal-comminution with no bony reference point along the lateral cortex for direct fracture reduction the shaft of femur was aligned in the center of the condyles and it was ensured to prevent lateralization of the shaft at time of plate application. Primary bone grafting was done in closed cases where the demand for such a procedure was gauged by the operating surgeon. On an average, operating time varied from 2 to 3 hours in majority of the cases with certain comminuted fractures of type C3 even requiring 4 to 5 hours. The average blood loss was 300- 400ml in each case. No use of tourniquets was done in any of the case. Post-operatively suction drain was removed after 48 hours and first wound inspection was done on 3rd post-operative day. Intra-venous antibiotics were continued for 24 hours in closed fractures and 72 hours in case of open fractures. Post-operative physiotherapy regime was tailored according to the fracture pattern and fixation achieved. In cases where ever possible, knee bending was started on post-operative day 3. On post-operative day 3, active and assisted knee Range of Motion (ROM) exercises were initiated. Patients were mobilized based on the degree of bone quality, severity of injuries, and pattern of fractures. At post-operative day 5 to 6, the patients were mobilized with crutches/walker until 6 weeks. Full weight-bearing ambulation without any aids was started at approximately 3 months in majority of the cases with radiographic evidence of fracture union. Patients were discharged at post-operative day 12 with stitch removal being done at the time of discharge, making it convenient for the patient to take bath and maintain good body hygiene. The first follow- up was at 6 weeks and subsequent follow-ups were done at 3 months, 6 months. No patients were lost to follow-up

**Discussion**

Treatments of distal femur fractures have been controversial subject over two decades. In our study 22 fractures of distal femur were treated. Overall final outcome of the surgical management of fracture lower end of femur using locking compression plate was assessed in terms of regaining the knee function in term of weight bearing and the angle of rotation using NEER's score. All 22 cases studied in our series were with 18 males and 4 females patients. 15 of the fractures were caused by road traffic accidents (RTA), 6 were due to fall and 1 were due to assault. 15 patients were with fracture on right side and 7 on left side. In our study, of the 22 lower end femur fractures, 1 was Muller's type A1, 6 were Muller's type A2, 4 were Muller's type A3, 1 was Muller's type C1, 6 were Muller's type C2 and remaining 4 were with Muller's type C3. In a study by Schutz M, Muller M *et al.* [2] Internal fixation using the LISS was performed at an average of 5 days (range: 0–29 days) after the injury. 48 fractures were operated on within the first 24 hours. Revision operations were required for 2 cases of implant breakage. 4 cases of implant loosening and 7 débridement's do deal with infections. The study showed clearly that when working with LISS, primary cancellous bone grafting is not necessary. This is comparable to other result so recent, retro-prospectively evaluated study using the retrograde IM nailing. The total follow up rate was 93%. 5% nonunion was observed. Regarding the associated injuries, two patients had proximal tibia and patella fracture, one with fracture left ulna, one with proximal tibia fracture. The duration of time required by patients to bear full weight was with mean of 15.8 weeks of time. The radiological union was seen at median of 17 weeks following surgery. Yeap, E.J., and Deepak, A.S [3] conducted a retrospective review on eleven patients who were treated for Type A and C distal femoral fractures (based on AO classification) between January 2004 and December 2004. All fractures were fixed with titanium distal femoral locking compression plate. The patient's ages ranged from 15 to 85 with a mean of 44. Clinical assessment was conducted at least 6 months post-operatively using the Schatzker score system. Results showed that four patients had excellent results, four good, two fair and one failure. Zlowodzki *et al.* [4] combined these series (n=327) and evaluated the outcomes as part of a systematic literature review. Average nonunion, fixation failure, deep infection, and secondary surgery rates were 5.5%, 4.9%, 2.1%, and 16.2% respectively. Some of the technical errors that have been reported for fixation failure have involved waiting too long to bone graft defects, allowing early weight bearing, and placing the plate too anterior on the femoral shaft. Locked implant are typically indicated in patients with osteoporosis, fractures with metaphyseal comminution where the medial cortex cannot be restored, or a short articular segment. Several case series have evaluated the use of locked implants in the treatment of distal femur fractures. The most commonly used implant in these case series has been the Less Invasive Stabilization System (LISS) with unicortical locking screws [5]. On assessment of 22 fractures of lower end of femur outcome treated with open reduction and internal fixation, average duration of surgery was 101 minutes with shortest duration being 91mins and longest being 112mins. Radiological union of fracture was median of 17 weeks. Average flexion in the study of the limb was 110° angles with more than 50% patients having knee range of motion more than 120°. The average knee extensor lag in present study was

5.0°. Out-of 22 patients, few patients had virus/valgus mal-alignment ranging between 5°, 8° and 10° of valgus in study. Patients with Muller's type C3 (n=5) showed valgus mal-alignment compared to other type of fractures in the present study. Normal knee flexion is 140 degree. Laubenthal has demonstrated that average motion required for:  
 Normal sitting 93degree  
 Stairclimbing 100degree  
 Squatting 117degree

Thus, acceptable knee flexion compatible with daily activity would be 110 degree. Markmiller *et al.* [5] prospectively compared the outcomes of LISS and retrograde intramedullary nailing. At 12 months, no statistically significant differences were noted for nonunion, fixation failure, infection and secondary surgical procedures. However, this was a relatively small series and no power analysis was reported. Vallier *et al.* [6] concluded that locking plates should only be used when conventional fixed-angle devices cannot be placed. They also noted the significant added cost of locking plates. To decrease the risk of implant failure with locking plates, they recommended accurate fracture reduction and fixation along with judicious bone grafting, protected weight bearing, and modifications of the implant design. Higgins *et al.* [7] compared the Locking Condylar Plate, with distal locking screw fixation and bicortical locking and no locking diaphyseal fixation, to the angled blade plate in axial load to failure and cyclic axial loading in a cadaveric 1cm fracture gap model. The locking construct had a significantly higher load to failure and less permanent deformation with cyclic loading. All of these studies reveal that locking plates with unicortical or bicortical diaphyseal fixation have adequate axial stiffness but more flexibility when compared to conventional fixed-angle implants. Although they have less torsional stiffness, the studies that evaluated torsional stiffness have shown that the distal fixation in locked implants is typically maintained while conventional fixed-angle implants have a higher rate of distal cutout from the femoral condyles. The outcome in form of regaining the knee function is assessed using NEER's scoring system. The median NEER's score in study was 94.5. Among 22 patients included, 12 patients showed excellent outcome, 6 with good and 4 with fair outcome at the follow-up. Poor outcome was found in patients with Muller's type C3 and type A3 fractures.

**Table 1:** Functional outcome factors after Distal Femur Fracture Treated with Locking Plate\* Full weight bearing in weeks

Variables	Distal Femur Fracture Treated with Locking Plate		Statistic
	Mean and Std. Error		
Full weight bearing in weeks	Mean and Std. Error		15.80(.395)
	95% Confidence Interval for Mean	Lower Bound	14.97
		Upper Bound	16.63
	Std. Deviation		1.765

**Table 2:** Functional outcome factors after Distal Femur Fracture Treated with Locking Plate\* Radiological union in weeks

Variables	Distal Femur Fracture Treated with Locking Plate	Statistic
Radiological union in weeks	Median	17.00
	Minimum	16
	Maximum	20
	Interquartile Range and 25-75 <sup>th</sup> percentile	3(16-19)

**Table 3:** Functional outcome factors after distal femur fracture treated with locking plate\* knee flexion in degrees

Variables	Distal Femur Fracture Treated with Locking Plate	Statistic
Knee flexion in degrees	Median	110.00
	Minimum	50
	Maximum	130
	Interquartile Range and 25-75 <sup>th</sup> percentile	19(100-118.75)

**Table 4:** Distal Femur Fracture Treated with Locking Plate \* Results

	Results			Total
	Fair	Good	Excellent	
Count	4	6	12	22
%	20.0%	30.0%	50.0%	100.0%

**Case 1**



**Fig 1:** showing Pre op Xray



**Fig 2:** showing post op x ray of case



**Fig 3:** showing Intra-operative picture



**Fig 4:** showing intra op C-Arm



**Fig 5:** showing follow up xray at 6 months





**Fig 6:** Showing patient ROM at 6 months Image 6 and 7 showing pre op CT scan and Post op X ray

### Conclusion

Locking compression plate is the optimal tool for many fractures in distal femur. It provides rigid fixation in the region of femur, where a widening canal, thin cortices and frequently poor bone stock make fixation difficult. Surgical exposure for plate placement requires significantly less periosteal stripping and soft tissue exposure than that of other techniques by use of LISS. Orthopedic surgeons experience with locking compression plating technique will find the locking compression plate a useful technique, but requires attention to prevent complications. To conclude, Locking Compression Plate is an important armamentarium in treatment of fractures around knee especially when fracture is severely comminuted and insinuations of osteoporosis. Further study in large number of patients is required to comment regarding disadvantages and complications.

### References

1. Cory AC, Donald AW. Distal Femur fractures. In: Tornetta P, Brown Court C, Heckman JD, McQueen M, Ricci W, editors. *Rockwood and Green's Fractures in adults*. 8th ed. Philadelphia, PA: Welter Kluwer Health. 2014, 1719-28.
2. Mu"ller ME, Nazarian S, Koch P. *Classification AO des Fractures*. New York: Springer-Verlag, 1987.
3. Yeap EJ, Ortho MS, Deepak AS, Ortho MS. Distal Femoral Locking Compression Plate Fixation in Distal Femoral Fractures : Early Results. *Malaysian Orthop J*. 2007; 1(1):12-7.
4. Zlowodzki M, Williamson S, Cole PA, Zardiackas LD, Kregor PJ. Biomechanical evaluation of the less invasive stabilization system, angled blade plate, and retrograde intramedullary nail for the internal fixation of distal femur fractures. *J Orthop Trauma*. 2004; 18(8):494-502.
5. Markmiller M, Konrad G, Sudkamp N. Femur-LISS and distal femoral nail for fixation of distal femoral fractures: are there differences in outcome and complications? *Clin Orthop Relat Res*. 2004; (426):252-7.
6. Vallier HA, Hennessey TA, Sontich JK, Patterson BN. Failure of LCP Condylar Plate Fixation in the Distal Part of the Femur: A Report of six cases. *J Bone J t Surg*. 2006; 88(4):846-53.
7. Higgins TF, Pittman G, Hines J, Bachus KN. Biomechanical analysis of distal femur fracture fixation: fixed-angle screw-plate construct versus condylar blade plate. *J Orthop Trauma*. 2007; 21(1):43-6.