

Original Article

Outcome of Patients Having Distal End Femur Fracture Treated with Locking Plate

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ABSTRACT

Introduction: Distal femur fractures represent 4-6% of all the femoral fractures and they occur within the 9 terminal centimeters. Most supracondylar fractures are the result of a severe axial load with a varus, valgus or rotational force. Though various treatment options are available for the management of these injuries with their own advantages and disadvantages, experience with use of locking compression plate which combines fixed-angle locking screw technology with the option for conventional screw utilization is still very limited. Locked plating (LP) of distal femoral fractures has become very popular. In this study we study the result of these fractures treated with locking plates and the outcome of these management in terms of regaining early mobility and ability to go to routine activity of daily living. Aim of the study: The aim of the study the efficacy, technical requirements, functional results, radiological results, pitfalls, complications, union rate and Time of Mobilization of locking plate method.

Methods: With prior ethical clearance study was conducted on prospectively 30 Patients, with distal femur fractures (AO classification type A, C) who were treated with distal femur locking compression plate (DF- LCP) at Department of Orthopaedics, SMIMER, Surat with minimum period of follow up with 6 months and with average period of follow up of 9 months. The study sample was 30 patients and all these patients were included with predefined inclusion and exclusion criteria in this study.

Results: We studied different parameters like age of the patients, mode of injury, type of injury according to AO classification, duration of hospitalization, movement of knee after operation, Neer's score results, union or non-union and compared our studies with other studies we find satisfactory results in our study in outcome of the patient.

Conclusion: From our study we concluded that DF-LCP, the "internal fixator" was a safe and reliable implant although careful preoperative planning and case selection were important factors which determine the final outcome.

Key words: Distal femur fracture, locking plate

INTRODUCTION

Throughout the historic evolution of orthopedic surgery the treatment of distal femur fractures has not achieved clinical results with a quality comparable to the rest of the femoral fractures. The presence of thin cortices, osteoporosis, wide medullary canals, and fracture comminution make it difficult to obtain and maintain a stable fixation. The goal of the treatment of these fractures is the anatomic reduction of the articular surface, restoration of the limb length, alignment and rotation, as well as allowing for an early limb mobilization to avoid articular stiffness and the loss of muscle mass.

Distal femur fractures represent 4-6% of all the femoral fractures and they occur within the 9 terminal centimeters. Most supracondylar fractures are the result of a severe axial load with a varus, valgus, or rotational force. In young patients, this amount of force is typically the result of high-energy trauma. In elderly patients, the force from a minor slip and fall on a flexed knee may be sufficient to produce these fractures. Due to high energy trauma distal femoral fractures can be significantly comminuted.

The treatment of distal femoral fractures has evolved nevertheless, these fractures remain difficult to treat and carry an unpredictable prognosis. The fracture characteristics

which make these fractures difficult to treat include, Osteoporosis, Multiplanar articular injury, High degree of comminution, Short distal femoral block in which it is difficult to insert fixation, associated Open wounds, Internal derangement of knee including ligament and meniscal injuries and possible Extensor mechanism injuries. Complications are significant and include Infection, Knee stiffness, Need for bone grafting, non union and Malunion.

Over the years, many different strategies have been used with varying success. There has been an evolution in treatment of distal femoral fractures in past 4 decades with nonoperative methods to biological fixation and evolution of modern implants as well as specific techniques in current times.

Though various treatment options are available for the management of these injuries with their own advantages and disadvantages, experience with use of locking compression plate which combines fixed-angle locking screw technology with the option for conventional screw utilization is still very limited. Locked plating (LP) of distal femoral fractures has become very popular. In this study we study the result of these fractures treated with locking plates and the outcome of these management in terms of regaining early mobility and ability to go to routine activity of daily living.

AIM AND OBJECTIVES

The aim of the study the efficacy, technical requirements, functional results, radiological results, pitfalls, complications, union rate and Time of Mobilization of locking plate method.

METHODS

With prior ethical clearance study was conducted on prospectively 30 Patients, with distal femur fractures (AO classification type A, C) who were treated with distal femur locking compression plate (DF- LCP) at Department of Orthopaedics, SMIMER, Surat with minimum period of follow up with 6 months and with average period of follow up of 9 months. The study sample was 30 patients and all these patients were included with predefined inclusion & exclusion criteria in this study. Patient with Uni-condylar femur fracture, Pediatrics age group and Peri-prosthetic fracture were excluded from the study. All the patients underwent surgical fixation of fracture with DF-LCP with a mean of 5.1 days and duration of hospitalization mean was 2.6 weeks. Records available in the form of admission notes, operative notes and follow up OPD records were analyzed. We considered a fracture united if there were no pain on palpation or attempted motion, no increase in warmth at the fracture site, no discomfort on full weight bearing and serial roentgenograms demonstrated bone trabeculae crossing the fracture site.

The functional and radiographic results were recorded according to NEER'S criteria. Functional grading was made depending on pain, walking capacity, mobility and work. Radiological grading was made based on varus or valgus deformity, shortening, signs of osteoarthritis and union of fracture. The final outcome is compared with the results available from the latest literature.

RESULTS

The fixation of distal femur fractures with Distal Femur locking compression plate (DF-LCP), which combines the principle of fixed-angle locking screw technology with the option for conventional screw utilization. Thirty patients with distal femur fractures were treated with Distal femur Locking compression plating from June 2012 to December 2014 Of this group 10 patients had associated injuries that influenced their course of treatment. We have followed up all patients with NEER'S criteria for assessment of both functional and radiographic results. The following were the observations and results in our study:

The age range was between 21 and 75 years with a mean age of 45.43 years. The youngest in our study was 21 years old and oldest was 75 years of age. The fracture incidences were more common in the age groups between 31-40 years, which was 33.3% and 41-50 years, which was 20%. In present study 70% male were involved. The most common mode of injury was road traffic accident which was 66.66%. Whereas incidence of domestic fall as mode of injury was 23.33%.

In present study most common AO type of fracture was C1 type which was 26%, C2 type was 16.66%, C3 type was 10%, A3 type was 20%, A2 type was 13.33% and A1 type was 13.33%.

Table 1: Age distribution

Age group in years	Patients (n= 30) (%)
21 - 30	4 (13.33%)
31 - 40	10 (33.33%)
41 - 50	6 (20)
51 - 60	4 (13.33)
61 - 70	5 (16.66)
71 - 80	1 (3.33)

Table 2: Type of fracture according to AO classification

AO type of fracture	Patients (n= 30) (%)
A1	4 (13.33)
A2	4 (13.33)
A3	6 (20)
C1	8 (26)
C2	5 (16.66)
C3	3 (10)

Table 3: Duration of Hospitalization

Duration of hospitalization	Patients (n= 30) (%)
1 WK	0 (0)
1 - 2 WKS	12 (40)
2 - 3 WKS	11 (36.66)
3 - 4 WKS	6 (20)
>4 WKS	1 (3.3)

Table 4: Time to Union

Time to union (months)	Patients (n= 30) (%)
2.1 - 3	3 (10)
3.1 - 4	10 (33.33)
4.1 - 5	11 (36.66)
5.1 - 6	3 (10)
6.1 - 7	1 (3.33)
7.1 - 8	2 (6.66)

Table 5: Movement of knee Joint (Flexion in Degrees)

Range of Motion of Knee (Flexion in Degrees)	Patients (n= 30) (%)
>135	2 (6.7)
100 - 135	25 (83.33)
80 - 100	2 (6.67)
60 - 80	1 (3.33)

Table 6: NEER'S Score Result

Results	Patients (n= 30) (%)
Excellent	15 (50)
Satisfactory	13 (43.33)
Unsatisfactory	2 (6.67)
Failure	0 (0)

From our study we observed that intra articular fractures of distal femur were more frequent in occurrence than extra articular fracture. Incidence of intra articular fracture was higher i.e., 16 patients (53.33%) compared to extra articular fracture which was 14 patients (46.66%). From our study we observed that majority of surgeries were per-

formed within 4 TO 7 days of admission which was 46.66%. The average number of days from injury to surgery was 5.4 days (Range 0–15 d). In present study associated injuries were present in 26.66% of patients. In our study 90% of patients were anaesthetized with spinal and 10% were anaesthetized with general anaesthesia.

As we can see in the table that majority of patients were hospitalized for duration of 1 – 2 weeks which accounts 40%. Average duration of hospitalization was 2.6 weeks.

Local Complication: In our study local complications were present in 56.67% of our patients and absent in 43.33%. From study we observed that by using locking plate 6 (20%) patients out had extension lag, 4 (13.33%) patients had thigh pain and 2 (6.6%) patients had anterior knee pain.

Time to union or union rate is the time taken for the fracture to unite completely, indicated radiologically by bridging callus across 3 cortices and painless full weight bearing. In our study average time to union was 4.5 months (18 weeks) with a range of 3 – 8 months (12 – 32 weeks). From this we observed that 24/30 (80%) had union in 5 months and 2 patients had delay union and one patient had non-union. Study shows that average time for union was 4.07 months in AO type A fracture and 5 months in AO type C fracture.

From the study we observed that mean range of flexion obtained postoperatively was 116.5° (range of 80°– 100°). Average range of movement was 123.21° AO type A fracture and 110.63° in AO type C fracture.

In our study Neer's score ranged from 59 – 94 and the mean neer's score was 82.4. Final analysis of the Neer's score showed 50% (15 patients) were excellent, 43.33% (13 patients) were satisfactory i.e., in 93.33% results were found to be excellent to satisfactory after using locking plate and 2 patients had unsatisfactory result. In our study average neer's score for AO type A was 81.85, and for AO type C 82.87.

DISCUSSION

In this study, thirty cases of distal femoral fractures with or without intra articular extension treated by distal femur locking compression plates (DF-LCP) at department of orthopaedics, SMIMER were included.

Age / Sex Incidence: In our study of 30 patients the mean age of the patients was 45.43 years and there were 21 males (70%) and 9 females (30%). This is a reflection of the mechanism of injury which was high energy trauma in 66.67% of our patients of which most of patients were of younger age group. The reason being that, in male patients there were more outdoor activities, so they were more prone to vehicular accident and majority females being house wives were less exposed to road traffic accidents.

Valles-Figueroa JFJ et al¹ studied retrospectively clinical data of 52 patients with distal femur fractures treated with locking compression plate and reported higher incidence in males than females and a mean age of 58 years.

In our study most of the injuries were caused by road traffic accidents affecting mostly males. We had 20 (66.66%)

RTA injuries and 7 (23.33%) Falls. There were no sports or industrial accidents.

Type of Fracture According AO Classification: In our study of 30 patients were belonged to AO type A and C of distal femur fractures, 4 patients belonged to A1, 4 to A2, 6 to A3, 8 to C1, 5 to C2 and 3 to C3 type fractures respectively. Majority of fractures belonged to type C fracture which was 53.33% and remaining 46.66% belonged to type A fractures. This indicated that type C fractures occur more commonly than type A. Martin F Hoffmann et al² reported 17 patients of A1, 5 of A2, 22 of A3, 6 of C1, 38 of C2 and 19 of C3 type fractures. These signify that most of the distal femoral fractures were caused by high energy trauma. They were associated with severe comminution and were unstable. Majority of them in our study belonged to type C fracture configuration.

Duration of Hospitalization: In our study average duration of hospitalization was 2.6 weeks (18.2 days), it increased because of other associated injuries and the need for the strict postoperative physiotherapy which affected the course of treatment and rehabilitation. Majority of patients preferred to stay in hospital till the sutures were removed due to social reasons. Yeap et al³ reported average duration of hospitalisation of 17.2 days with a range of 8 to 34 days.

Time of Union / Painless full weight bearing / Union rate: In our study average time to union was 4.5 months (18 weeks) with a range of 3 – 8 months (12 – 32 weeks). Time to union increased with increase in age of the patient ($p = 0.726$, statistically significant). Statistical correlation was significant at 0.00 levels (2 tailed). Time to union in Type C fractures (5 months avg.) generally was found to be longer compared to Type A fractures (4.07 months avg.). There was significant delay in union rate and considerable decrease in post op knee movements if surgery was delayed > 2 weeks. Mongkon Luechoowong⁴ reported average time to union as 17 weeks with a range of 12 – 38 weeks. Kim KJ et al⁵ reported mean time to union at postoperative 15 weeks with a range of 13 – 20 weeks. We concluded that time to union in distal femoral fractures were generally longer than usual fracture union due to high incidence of comminution.

In our study evaluation according to Neer's score showed a mean Neer's score of 82.13 with a range of 59 to 94.

The outcome of the surgery was evaluated on the following parameters:

1. Knee range of motion.
2. Time to union.
3. Pain in the knee
4. Walking status
5. Limb shortening.

Out of our 30 patients in the study, fifteen patients (50%) had excellent results, 13 (43.33%) satisfactory, 2 (6.67%) had unsatisfactory and ZERO (0%) failure case. Excellent and satisfactory results accounted for 93.33% of cases and remaining 6.67% included unsatisfactory and failure cases. Younger aged patients had better results than older age. The time to union increased with increase in age ($p=0.00$, significant). There were 16 type C fractures of which 15 (93.75%) showed excellent to satisfactory results and 1 (6.25%) had unsatisfactory results. Out of 14 type A frac-

tures 13 (92.86%) showed excellent to satisfactory results except one (7.69%) which was a failure. Type C fractures took longer time to unite than Type A fractures. The mean range of movement i.e., knee flexion was 116.5° with a range of $80^{\circ} - 160^{\circ}$. The average knee flexion in Type C fractures was 110.63° compared to 123.21° in Type A fractures, which shows that intra-articular fractures lead to intra-articular stiffness and decreased range of motion. 10 patients had absolutely no pain postoperatively in their knees. Out of remaining 20 patients 17 had intermittent/ occasional pain and 3 had pain with fatigue. Along with post operative intermittent pain 4 patients had associated osteoarthritis, which was present prior to surgery. All patients with pain were managed conservatively with analgesics. All patients used walking frame during immediate post-operative non weight bearing mobilization and continued the same during partial weight bearing till complete union of fracture/ painless full weight bearing. Limb shortening was present in 6 of our patients. 4 patients belonged to AO Type C fractures and 2 was AO type A. In our study 3 patients had 1 cms shortening

postoperatively and rest 3 patients had 0.5 cms shortening. Shortening was corrected by appropriate heel raise in all patients.

Yeap and Deepak, using Schatzker scoring system reported four excellent results, four good, two fair and one failure. Kim KJ et al reported mean Neer's score of 74.2 with a range of 58 to 97 of which 3 were excellent, 5 satisfactory and 7 unsatisfactory. Yang Teng-heng et al ⁶ reported excellent results in 23 cases, good in 9 cases, moderate in 3 cases according to Merchant standard, which showed that the excellent and good rate was 91.4%. the results of our study was comparable with study done by WANG Ya-quan et al ⁷ and k.kolb et al ⁸.

Results of Valles-Figueroa JFJ et al and our study was compared.

From study we were concluded that locking plate provide more excellent to satisfactory result compare to other modality of treatment in management of distal femur fracture because of its mechanical properties.

Table 7: comparison of present study with result of Valles- Figueroa et al ¹

Outcome	Present group	Comparison group	
	Locking Plate	Condylar Compression Screws	Less Invasive Stabilization System
Excellent	50%	61.30%	71.42%
Satisfactory	43.33%	19.35%	9.52%
Unsatisfactory	6.67%	9.67%	14.28%
Failure	0%	9.67%	4.76%

CONCLUSION

From our study we concluded that DF-LCP, the "internal fixator" was a safe and reliable implant although careful preoperative planning and case selection were important factors which determine the final outcome.

The new fixation system offers many fixation possibilities and had proven its worth in complex fracture situations especially in extensive comminution of femoral condyles with intra-articular involvement and osteoporosis where other fixation devices were incompetent. The DF-LCP had shown excellent to satisfactory results in majority of intra articular fractures (AO type C). It may substitute a conventional plate and screw system (compression method) in treatment of complex distal femoral fractures especially in osteoporotic bone. DF-LCP may prevent varus collapse in selected cases by using maximum number of screws into the distal fragment of the fracture, which had to be assessed by the surgeon during operation. Time to union was found to increase with increase in age ($p = 0.00$, statistically significant) and can be improved by early adequate fixation, primary bone grafting and immediate postoperative mobilization. Further randomised controlled studies are required in different situations to know the usefulness of this implant.

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