

Original Research Article

Management of intercondylar femur fracture with distal femur locking compression plate: outcome analysis of 72 cases

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ABSTRACT

Background: Supra-condylar and inter-condylar fractures of the distal femur account for 7% of all femoral fractures and have always been difficult to treat and regaining full knee function is often difficult. The purpose of this study is to evaluate the functional outcome, fracture healing, complications of distal femoral intercondylar fractures managed by locking compression plate.

Methods: Total 72 patients of intercondylar femur fracture were operated by ORIF with distal femur-locking compression plate via the standard swashbuckler approach. The functional outcomes were analyzed using modified hospital for special surgery scoring system.

Results: Muller type C2 fracture was the most common fracture type with 50 out of 72 patients. The average range of motion achieved was about $99.03^{\circ} \pm 24.73^{\circ}$ (Closed fractures = $105.83^{\circ} \pm 19.41^{\circ}$ and open fractures = $89.50^{\circ} \pm 28.36^{\circ}$). There was also a significant difference in the duration of operative time, 84.28 ± 18.32 minutes for closed fractures and 98.46 ± 22.47 minutes for open fractures. The average duration for radiological union was 14.52 ± 2.21 weeks for closed and 17.20 ± 2.44 weeks for open fractures. The average knee score was 80.13 ± 13.38 using modified Hospital for Special Surgery score.

Conclusions: Closed fractures have a higher range of motion and a better knee score compared to open fractures, supporting the fact that soft tissue compromise also affects range of motion and post-op rehabilitation of the limb. The outcome seems to correlate with the nature of injury i.e. high vs low velocity, type of fracture, anatomic reduction, associated injuries, time elapsed since injury to fixation and the stability of fixation.

Keywords: Distal femur fracture, Distal femur LCP, Intercondylar femur fracture

INTRODUCTION

Supra-condylar and inter-condylar fractures of the distal femur have always been difficult to treat. These fractures are unstable and comminuted and tend to occur in elderly or multiple injury patients, though cases in younger age groups have been increasing due to increasing number of road traffic accidents. They account for 6-7% of all femoral fractures. If hip fractures are excluded, 31% of

femoral fractures involve distal portion. The incidence is highest in women more than 75 years of age and in adolescent boys and men. The mechanism of injury appears to be axial loading with varus, valgus or rotational forces.¹ As these fractures are in close proximity to the knee joint, regaining full knee motion and function is often difficult. Though ORIF with plate and screws is the standard method of treatment nowadays, the management of comminuted, intra-

articular distal femoral fractures is still challenging to the orthopedic surgeons. Most of these fractures are the result of road traffic accident, which causes severe soft tissue damage and articular and metaphyseal comminution. The incidences of mal-union, non-union and infection are relatively high in many reported series. In older patients, treatment may be complicated by previous joint arthroplasty.² The purpose of this study is to evaluate the functional outcome, fracture healing, complications of distal femoral intercondylar fractures managed by locking compression plate and also to determine whether the type of fracture, i.e. closed or open, has any bearing on the final outcome.

METHODS

The study pattern was prospective with a study sample of 72 patients with intercondylar distal femur fractures treated by Locking Compression Plate fixation. Patients were selected from among the admissions to the Orthopedics ward in the Department of Orthopedics of GSVM Medical College, Kanpur and recruited into the study prospectively from December, 2016 to April, 2019. All patients above 18 years with closed and compound fractures (Grade I, II, IIIa and IIIb) of intercondylar femur (Muller type C1, C2 and C3 fractures) were included. On admission, after adequate haemodynamic stabilization of the patient, detailed examination of the various injuries was carried out. Then standard Antero-Posterior and Lateral view X-rays were taken and the fracture configuration noted. Computerized Tomography was also taken when needed to assess the exact alignment of the fragments. The fracture was classified using the AO/OTA or Muller classification.³

The patients were operated using the standard Swashbuckler approach.^{4,5} Quadriceps strengthening exercises were started on the immediate post-operative day. Suction drain was removed on the 2nd post-operative day at the time of wound inspection and knee bending exercises were started as tolerated in all cases of stable fixation. Knee bending was delayed in some cases where the fixation was not stable.

The data was analysed using SPSS version 2.0.

RESULTS

In our study, 72 patients of intercondylar femur fracture were operated with Open Reduction with internal fixation with Distal Femur-Locking Compression. Patients were followed up every 2 weeks in the first month, then every 4 weeks for 3 months and then quarterly for 2 years. The results were analyzed with standard antero-posterior and lateral radiographs. Clinical and radiological signs of union were analyzed at each follow up. The fracture was said to be radiologically united if callus was seen in at least 3 cortices in antero-posterior and lateral views. The functional outcomes were analyzed using modified hospital for special surgery knee scoring system (Figures 1-4).



Figure 1: Pre-op X-ray.



Figure 2: Immediate post-op X-ray.



Figure 3: 3 months follow-up X-ray.



Figure 4: 18 months follow-up X-ray.

Majority of injured patients were males (83.33%), indicating that males are more involved in outdoor activities and highest number of patients were in their 3rd and 4th decade. Mean follow up period was 16.4 months. Road traffic accident was the most common mode of injury (85%). A total of 25 patients (35%) had some kind of associated injury such as fracture of some other bone, blunt trauma abdomen etc. 42 out of 72 patients had closed injury. Muller type C2 fracture was the most common fracture type with 50 out of 72 (69.5%). The average range of motion achieved was about 99.03°±24.73° (Mean ROM for closed fractures was 105.83°±19.41° and mean ROM for open fractures was 89.50°±28.36°). Maximum gain in knee flexion was 145° and minimum was 10°. There was a statistically highly

significant difference in the post-operative range of motion achieved in the closed and open fractures with a p value of <0.01. There was also a significant difference in the duration of operative time which was 84.28±18.32 minutes for closed fractures and 98.46±22.47 minutes in case of open fractures, p value 0.004). The average duration for radiological union was 14.52±2.21 weeks for closed fractures and 17.20±2.44 weeks for open fractures and it was also found to be statistically highly significant with a p value of <0.01. The average knee score was 80.13±13.38 rated using modified Hospital for Special Surgery functional score. The mean knee score for closed fracture was 82.67±10.81 and that for open fracture, it was 76.57±15.84 but it was not found to be significant (p value = 0.074) (Table 1).

Table 1: Patients’ demographic data of the study.

	Overall	Closed fractures	Open fractures
No. of patients	72	42	30
Mean age (years)	36.17±13.52	39.02±13.83	32.17±12.18
Sex distribution	Males - 59	Males - 35	Males - 24
	Females - 13	Females - 7	Females - 6
Type of fracture	C1 - 20	C1 - 13	C1 - 7
	C2 - 50	C2 - 29	C2 - 21
	C3 - 2	C3 - 0	C3 - 2
Operating time (minutes)	90.19±20.05	84.28±18.32	98.46±22.47
Mean ROM (degrees)	99.03±24.73	105.83±19.41	89.50±28.36
Mean union time (weeks)	15.64±2.65	14.52±2.21	17.20±2.44
Mean knee score	80.13±13.38	82.67±10.81	76.67±15.84
Associated injuries	25	13	12
Complications	25/72	13/42	12/30

Early complications were encountered in 7 patients and these were superficial wound infection and wound gaping. Late complications were observed like mal-union with varus angulation in 2 patient, limb length discrepancy in 2 patients, knee stiffness in 10 patients, 4 patient developed chronic infection with discharging sinuses and 1 patient had continuous pain so implant was removed after union in all of them. Shortening less than 1 cm was recorded in 10 cases and shortening of 3cms and more was recorded in 2 cases. Functionally all the patients discarded walking aid by 20 weeks. Postoperative immobilization with slab was advised for severely comminuted fractures, for 3-4 weeks. Autogenous iliac bone graft was harvested based on the bone loss, used in 4 out of 71 patients. Out of 72 patients operated, 20 were Muller Type C1 fractures, 50 were Type C2 fractures and 2 were Type C3. Excellent results were obtained in 35 patients overall (21 closed and 14 open), good results in 22 patients (15 closed and 7 open), fair results were seen in 10 patients (5 each in closed and open fractures) and 5 had poor results (1 closed and 4 open) (Table 2).

Table 2: Results as per modified HSS knee scoring system.

	Overall	Closed fractures	Open fractures
Excellent	35	21	14
Good	22	15	7
Fair	10	5	5
Poor	5	1	4

*Excellent-85 to 100, Good-70 to 84, Fair-60 to 69, Poor <60

One of the patients with poor results presented late after 4 days with an already infected wound and bone loss. Plating with bone grafting was done once infection subsided but he developed varus angulation and impending implant failure and a limb length discrepancy of 3 centimeters, most probably because of early weight bearing despite instructions. The other patient with poor result had associated ipsilateral posterior fracture dislocation of hip with foot drop which was also treated by plating resulting in prolonged immobilization and thereby knee stiffness.

DISCUSSION

In our study, sample size is 72 which is comparable to study of Locking Compression Plate by Siliski et al and Kregor et al as opposed to 103 in Kregor et al, 109 in Gaines et al and 112 in Schutz et al and several other studies with smaller case series.⁶⁻¹⁰ Out of the 72 patients in our study, 30 were open constituting about 42% of total which was slightly less than that of the studies of Fankhauser et al (50%) and Vallier et al (54%) and much more than other studies like 29% in Schutz et al, 31.6% in Syed et al, 34% in Kregor et al, 26% in Kayali et al thereby reconfirming that this is the result of increasing number of high energy trauma these days.^{8,10-14}

In our study, 83.33% were male and 16.67% were female which is comparable to that of Borthakur B et al, Rauf A et al and more recently Konuganti SR et al which is quite a change from earlier studies like Schutz et al, Syed et al, Fankhauser et al and Wong et al, all of which had a female preponderance and the age was also higher suggesting that most of them were in the elderly female mainly due to osteoporosis and weakened bones.^{10,11,13,15-18}

The mean age in our study was 39 years (range 18-65 years). Mode of injury was road traffic accident in 85% of cases thereby signaling a shift from domestic fall in elderly to high energy trauma i.e. road traffic accident in mainly the younger age group. We found a right sided preponderance in our study with 66.67% right sided, 33.33% left sided, most probably because India is a country with left-hand drive and 2-laned roads. The average range of motion achieved was about 99° which is lower than other studies such as 115 in Vallier et al, 117 in Kayali et al and 113 in Fankhauser et al.^{11,12,14} This is largely because our study included only Muller Type C fractures.

We had 2 cases of varus collapse due to gross comminution. The same cases had implant failure (plate bending) due to early weight bearing and needed re-fixation with realignment of knee joint with bone grafting. The average time for radiological union was 15.64 weeks which was comparable to 15 weeks in study for locking compression plate by Kayali et al and 16.34 weeks in Sahoo BS et al.^{14,19}

The rate of infection in our study was high at 15 % which was more than that of several other studies such as 3% in Kregor et al, 3.5% in Schutz et al, 4% in Syed et al and 3% in Sahoo BS et al.^{7,10,13,19} The reason may be because of higher incidence of open fractures in our study. The mean knee score as calculated by modified Hospital for Special Surgery scoring system was 82.67 for closed fractures and 76.57 for open cases. The difference in the duration of operation, knee range of motion and time for radiological union was statistically significant for closed and open fractures though the knee score was not. There was a significant relationship (p value 0.033) between

open fractures and incidence of post-operative infection with 8 out of 30 open fractures (Odds ratio – 4.727, 95% CI - 1.1357 to 19.6776) showing some kind of infection, either acute or chronic, in the post-operative period, thereby increasing the duration of hospital stay, readmission and increased cost of treatment to the patient. There was increased incidence of complications overall in open fractures as compared to closed fractures (p value 0.428, Odds ratio-1.487, 95% CI-0.5578 to 3.9648).

We routinely did primary closure of the wound (unless contraindicated) under drainage after taking swab from the wound for culture and sensitivity and starting broad-spectrum intravenous antibiotics prophylactically, effectively converting an open wound into a closed one thereby reducing the chances of post-operative complications such as wound infection and wound dehiscence.

The limitations of our study are a relatively shorter period of follow up and no comparison with other modalities of treatment. The strength of our study is that our study has a greater number of patients than most of the other studies in this regard.¹⁵

CONCLUSION

Though our follow-up period is short, several studies have pointed out that the long-term outcome is comparable to early functional gain. Locking compression plate appears to be technically an ideal implant for comminuted distal femoral fractures which along with proper physiotherapy produces excellent results. From our study, we have concluded that Locking Compression Plate has better outcome in Type C comminuted intra articular distal femur fractures. Closed fractures have a higher range of motion and a better knee score when compared to open fractures, supporting the fact that soft tissue compromise also affects range of motion and post-op rehabilitation of the limb.

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