

Functional Outcome Analysis of Fracture distal end femur treated with distal femur LCP - A Prospective Study.

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ABSTRACT

Background: Supra-condylar and inter-condylar fractures of the distal femur historically have been difficult to treat. They account for 7% of all femoral fractures. If hip fractures are excluded, 31% of femoral fractures involve distal portion. Because of the proximity of these fractures to the knee joint, regaining full knee motion and function may be difficult. Many of these fractures are the result of high energy trauma which generates severe soft tissue damage and articular and metaphyseal comminution, the management of which still remains complex and challenging to the orthopedic surgeons. The incidences of mal-union, non-union and infection are relatively high. **Methods:** A total of 25 patients were enrolled for this prospective study and all were treated with locking compression plate. Physical examination and radiographs were performed at regular follow-ups. Functional outcomes were analyzed using Modified Hospital for Special Surgery scoring system. **Results:** Patients were followed up every 2 weeks in the first month, then monthly for 3 months and then once every 3 months. The average range of knee flexion achieved was about 101°. The average knee score was 88.88 rated using Modified Hospital for Special Surgery functional score. The difference in knee range of motion was statistically significant for closed and open fractures but knee score and age was not statistically significant. Intra-articular fractures tend to have poorer results with respect to pain and function, more so because of the nature of the injury rather than the implant used, which limits the movement and causes loss of strength more than instability. **Conclusion:** The outcome seems to correlate with fracture severity, anatomic reduction, etiology, bone quality, length of time elapsed from injury to surgery, concomitant injuries and the exact positioning and fixation of the implant. Furthermore, the initial severe concomitant cartilage damage may predispose to early osteoarthritis although there is no evidence of that. Closed fractures have a higher range of motion as well as a better knee score as compared to open fractures thereby showing that soft tissue compromise also affects range of motion and further rehabilitation of the limb.

Keywords: Distal Femur; Supracondylar Fracture; Locking Compression Plate.

INTRODUCTION

Supra-condylar and inter-condylar fractures of the distal femur historically have been difficult to treat. These fractures often are unstable and comminuted and tend to occur in elderly or multiple injury patients. They account for 7% of all femoral fractures. If hip fractures are excluded, 31% of femoral fractures involve distal portion. The incidence is highest in women older than 75 years

and in adolescent boys and men 15 to 24 years old. Because of the proximity of these fractures to the knee joint, regaining full knee motion and function may be difficult. Although open reduction and internal fixation with plate and screws has become a standard method of treatment for many types of fractures, the management of comminuted, intra-articular distal femoral fractures still remains complex and challenging to the orthopedic surgeons. Many of these fractures are the result of high energy trauma which generates 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.^[1,2]

Aims and Objectives

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- To study the functional outcome of open reduction and locking plate fixation for fractures of distal end offemur.
- To study the preponderance of fractures of distal end of femur in different age groups.
- To evaluate the effectiveness of distal locking plate fixation method of treatment of fractures of distal end offemur.
- To study the complications of locking compression plates for the treatment of fractures of distalfemur.

MATERIALS AND METHODS

In this prospectivestudy, 25 patients withdistal femur fractures treated with Locking Compression Plate fixation were taken into consideration. Patients were selected from among the admissions to the Orthopedics ward in the Department of Orthopedics, LLR and associated hospitals, Ganesh Shankar Vidyarthi Memorial Medical College, Kanpur. All patients above 18 years with closed and compound fractures of supra-condylar & distal femur fractures extending up to 15 cm from distal articular surface were taken into account except Gustillo-Anderson Type IIIC and Muller Type B3 fractures. The standard Swashbuckler approach was used in all the patients.



RESULTS

Patients were followed up every 2 weeks in the first month, then monthly for 3 months and then once every 3 months. The minimum follow up period in our study was 5 months and maximum follow up period was 20 months. Clinically, tenderness at fracture site, knee pain, limb length discrepancy, range of movements, any varus or valgus deformity were assessed at each follow up. 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 scoringsystem. Majority of injured patients were male (80%), indicating that males are involved more in outdoor activities and highest number of patients were in their 3rd decade (38%). Road traffic accident was the most common mode of injury (80%). 9 patients had fracture of both bone leg, 8 of which were on the ipsilateral side. 3 patients had mandibular fracture, 2 patients had ipsilateral fracture of both bone forearm, 2 patients had fracture shaft of femur on the opposite side, 2 had posterior dislocation of hip, 2 had ipsilateral Lisfranc fracture dislocation of foot, 1 patient had fracture of distal humerus, 2 patients had associated pelvic injury, 1 had fracture patella on the ipsilateral side and 1 patient had subtrochanteric fracture on the contralateral side, thereby making a total of 17 patients (68%) with associated fractures. Most of the patients, reported within the first 2 days of injury to this hospital. 12 out of 25 patients (26 knees) had closed fracture. Muller type C2 fracture was the most common fracture type with 14 out of 26 knees (54%). The shortest follow up period was 5 months and the longest follow up period was 20 months. The average range of knee flexion achieved was about 101°. Maximum gain in knee flexion was 145° and minimum flexion achieved was 10°. The average knee score was 88.88 rated using modified Hospital for Special Surgery functional score. Early complications were encountered in 2 patients and these were superficial wound infection and wound gaping. Late complications were observed like mal-union with varus angulation in 1 patient, limb length discrepancy in 2 patients, knee stiffness in 10 patients, 1 patient developed chronic infection with 2 discharging sinuses and 1 patient had continuous pain so implant was removed after union in both of them. 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 2 out of 26 patients. Shortening of less than 1 centimetre was recorded in 6 cases and shortening of 3centimetres and more was recorded in 1 case. All the patients remained painless in the postoperative period, except for 2 cases which had wound infection. Functionally all the patients discarded walking aid by 20 weeks. Out of 5 cases of Type A Muller fractures, 2 had excellent results, 2 had good and 1 had fair result. Implant had to be removed in 1 of the patients after union as the patient had persistent pain. There was a single case of Type B1 fracture which showed good result despite developing post-operative surgical site infection and wound gaping. The

wound was thoroughly debrided and split skin grafting was done after the infection subsided and bed was prepared. Out of 25 patients (26 knees), 20 were Muller Type C fractures and 19 of them were treated by Locking Compression Plate and 1 patient was treated with Dynamic Condylar Screw. Out of the 19, 9 had excellent results, 5 had good results, 3 had fair results and 2 had poor results. The patient treated with Dynamic Condylar Screw had good result. 1 patient developed chronic infection with discharging sinuses and so the plate was removed after union of the fracture. 1 of the patients 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. The other patient with poor result presented late after 4 days with an already infected wound and bone loss. Plating was done once infection subsided along with bone grafting but patient developed varus angulation and implant failure and a limb length discrepancy of 3 centimetres. This patient was re-operated with correction of varus angulation, bone grafting and plating.



Pre-Operative Immediate Post-Op 3 Months Post- Op



1 YEAR POST-OP RADIOLOGICALLY AND CLINICALLY

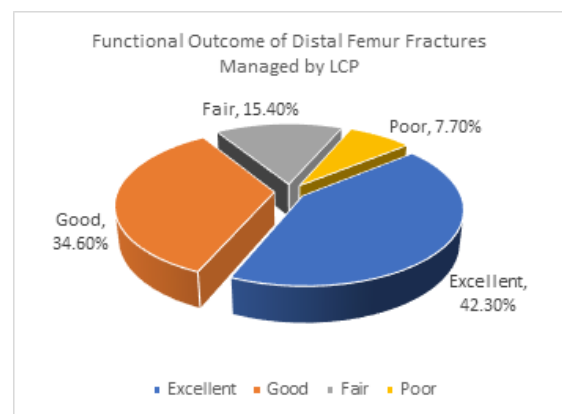
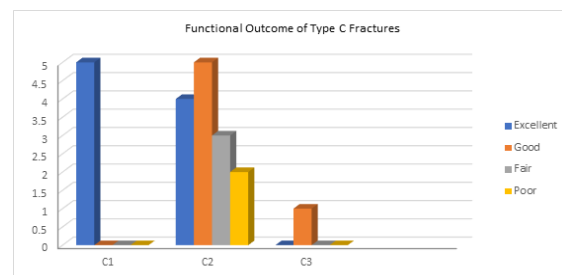
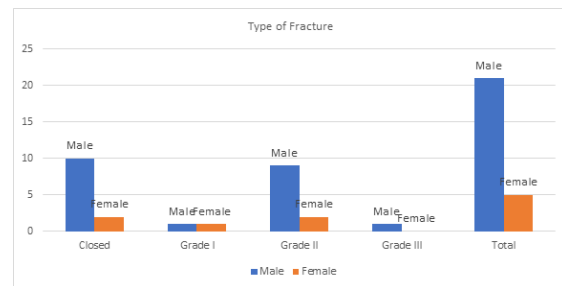
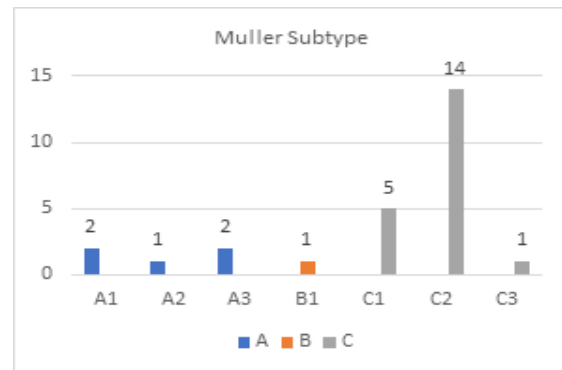
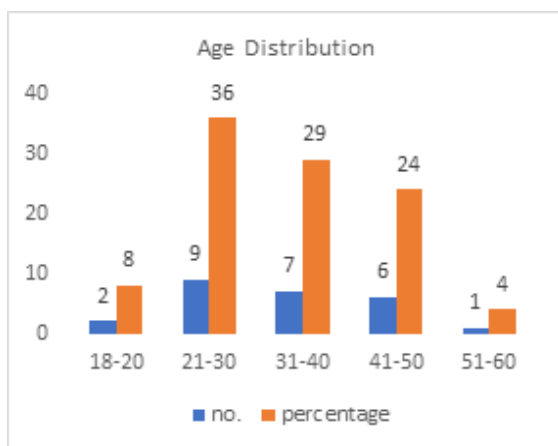


Table 1: Comparative Results of Closed And Open Fractures

	Knee Range Of Motion	Knee Score	Age
±	2.89	1.32	0.79
p value	< 0.05	>0.05	>0.05
Inference	Significant	Non-significant	Non-significant

DISCUSSION

In our study, sample size is 25 which is comparable to study of Locking Compression Plate by Markmiller et al,2004,^[3] Weight et al 2004,^[4] and

Kayali et al 2007,^[5] as opposed to 103 in Kregor et al, 2004,^[6] 109 in Gaines et al,2008,^[7] and 112 in Schutz et al,2001.^[8] Out of the 26 fractures in our study, 14 were open constituting about 54% of total which was comparable to 50% in Fankhauser et al,2004,^[9] and 54% in Vallier et al,2006,^[10] and much more than other studies like 29% in Schutz et al,2001,^[8] 31.6% in Syed et al,2004,^[11] 34% in Kregor et al,2004,^[6] 26% in Kayali et al, 2007,^[5] thereby reaffirming that this is the result of increasing number of high energy trauma. In our study, 80% were male and 20% were female which is comparable to that of Borthakur B et al,2016,^[12] Rauf A et al, 2017,^[13] and more recently Konuganti SR et al,2018,^[14] which is quite a change from earlier studies like Schutz et al,2001,^[8] Syed et al,2004,^[11] Fankhauser et al, 2004,^[9] and Wong et al,2005,^[15] 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. The mean age in our study was 33.72 years (range 18-55 years). Mode of injury was road traffic accident in 80% 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 60% right sided, 36% left sided and 4% bilateral involvement. The average range of flexion achieved was about 101° which is lower than other studies such as 115° in Vallier et al, 2006,^[10] 117° in Kayali et al,2007,^[5] and 113° in Fankhauser et al, 2004.^[9] This is mainly due to more number of intra-articular fractures in our study.

We had one case of varus collapse due to gross comminution. The same case had an implant failure (Plate bending) due to early weight bearing and needed re-fixation with realignment of knee joint with bone grafting. The need for hardware revision is 4% in our study which is comparable to Kayali et al 2007,^[5] at 4%. The mean follow up in our study was 13.12 months. The average time for radiological reunion was 16.2 weeks which was comparable to 15 weeks in study for locking compression plate by Kayali et al 2007,^[5] and 16.34 weeks in Sahoo BS et al 2017.^[16] The rate of infection in our study was 4% which was almost similar to that of several other studies such as 3% in Kregor et al 2001,^[6] 3.5% in Schutz et al 2001,^[8] 4% in Syed et al 2004,^[11] and 3% in Sahoo BS et al 2016.^[16] The mean knee range of motion in our study was 120.83° in closed fractures while it was 91.15° in open cases and the overall range of motion was 101°. The mean knee score as calculated by modified Hospital for Special Surgery scoring system was 85.16 for closed fractures and 77.84 for open cases. The difference in knee range of motion was statistically significant for closed and open fractures but knee score and

age was not statistically significant. Intra-articular fractures tend to have poorer results with respect to pain and function, more so because of the nature of the injury rather than the implant used, which limits the movement and causes loss of strength more than instability. Despite such large number of open and comminuted fractures, serious complications such as deep seated infections, vascular lesions and deep vein thrombosis were not a major problem. This was because the therapy included thorough toiletting and debridement of the wound along with primary closure of the wound under drainage after taking swab from the wound for culture and sensitivity and starting broad-spectrum intravenous antibiotics prophylactically. This effectively converts an open wound into a closed one thereby reducing the chances of post-operative complications such as wound infection and wound dehiscence.

CONCLUSION

Although the follow-up period of our series was short, several studies have shown that early function is comparable to final long-term outcome. The outcome seems to correlate with fracture severity, anatomic reduction, etiology, bone quality, length of time elapsed from injury to surgery, concomitant injuries and the exact positioning and fixation of the implant. Furthermore, the initial severe concomitant cartilage damage may predispose to early osteoarthritis although there is no evidence of that. Fractures of distal femur are more common in high velocity injuries and fall from height, occurring in middle aged men and older age women. Most fractures were comminuted. Locking compression plate appears to be technically an ideal implant for comminuted distal femoral fractures with proper physiotherapy producing excellent results.

- In Type C comminuted intra articular distal femur fractures, Locking Compression Plate is superior in functional outcome.
- Knee stiffness was the most common complication we encountered in our series. Mal- alignment is also one of the common complications.
- Closed fractures have a higher range of motion as well as a better knee score as compared to open fractures thereby showing that soft tissue compromise also affects range of motion and further rehabilitation of the limb.

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