

Original Research Article

Management of intra-articular fracture of distal femur with LCP and Lag screws in adults

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ABSTRACT

Background: Accurate reconstruction of articular surface of distal femur by closed manipulation is not possible. The recent trend for displaced intra-articular fractures of the distal femur is open reduction and stable osteosynthesis with early rehabilitation. The best exposure is achieved through Swashbuckler approach with good results. Purpose of the study was to review the surgical management with LCP and lag screws of complex and most challenging intra-articular fracture of distal femur.

Methods: 30 cases of intra-articular fractures of distal femur were treated with LCP and Lag screws in adults. Regular follow-up with all records was carried out for a period of 36 months. Most of patients were treated with Swashbuckler approach. Final outcome was carried based on Neer's criteria.

Results: Union was achieved in all the cases and mean time was 15 weeks. Patients have more range of motion in C1 and C2 types of fracture as compare to C3 Types. Mean range of motion was 1140. Early physiotherapy has big role to achieve good range of motion.

Conclusions: LCP is better implant in comminuted I/A fractures of distal end of femur and in elderly patients with osteoporotic bone. In spite of the worst fracture anatomy of the comminuted fracture of distal femur and the poor quality of bone in elderly patients, this can provide better post-operative range of knee motion with overall better Knee score, achieving bony union in all the cases with early physiotherapy.

Keywords: Femur, Distal, LCP, Lag Screw

INTRODUCTION

Intra-articular distal femoral fracture occurs at approximately one tenth the rate of proximal femoral fracture and make up 6% of all femur fractures. There is a bimodal distribution of fracture based on age and gender. Most high energy distal femoral fractures occur in males because of road traffic accidents, between 15 and 50 years of age while most low energy fractures occur in osteoporotic women >50 years as a result of falls.¹

Intra-articular fractures of the distal part of the femur are difficult to treat and present considerable challenges in

management. Severe soft tissue damage, comminution, extension of fracture into knee joint and injury to the extensor mechanism lead to unsatisfactory results. Regaining of full knee motion and function is difficult because of intra-articular involvement of knee joint. No single method of management has overcome all of problems associated with these injuries². Thin cortices, a medullary canal, relative osteopenia, intra-articular involvement, comminution make stable internal fixation difficult to achieve.³ Successful treatment of intra articular fracture especially in weight bearing joint requires restoration and maintenance of the congruity of the two articular surfaces.⁴

Treatment challenges are presented by patients with intra-articular involvement, osteoporotic bone, open fractures with significant bone loss, and fractures with short articular segments.⁵ In the 1990s, the success of these indirect reduction techniques for I/A distal femur fractures were reported using conventional implants including the dynamic condylar screw, angled blade plate, and condylar buttress plate.⁶⁻⁸ The next step in the evolution of plating I/A distal femur fractures was the introduction of locking compression plates. Since the LCP can be used as a conventional plate using only dynamic compression, as a pure internal fixator using locking head screws, or as both combined, it provides the surgeon with multiple variations.⁹ Locking plates are fracture fixation devices with threaded screw holes, which allows screws to thread to the plate and function as one construct. These plates may have a mixture of holes that allow placement of locking and traditional non-locking screws (so called combi holes). Distal femoral locking compression plates are anatomically contoured and have multiple locking screw options distally to allow for secure fixation in patients with osteoporosis, fractures with metaphyseal comminution where the medial cortex cannot be restored, or a short articular segment.^{10,11}

Common complication which occurred after I/A fracture of distal femur are malunion, non-union, infection, knee stiffness, hardware problems and post traumatic arthritis. Quadriceps scarring with or without arthrofibrosis of the knee or patella femoral joint is thought to restrict knee movements. These effects are greatly magnified by immobilization after fracture or internal fixation. Immobilization of the knee for period more than 3 weeks usually result in some degree of permanent stiffness.³ The treatment goals are early stable internal fixation of the fracture with meticulous soft tissue handling, early mobilization, rapid fracture union and minimal complications.

METHODS

This was a retrospective interventional study which included 30 consecutively admitted cases having intra-articular (C Type) fracture of distal femur with locking compression plate and lag screws carried out in Department of Orthopaedics, Govt. Medical College, Patiala, Punjab, India from June 2011 to July 2014 after getting the approval from ethical committee and complete informed written consent from all patients participated in our study. AO system of classification was used and all fracture of type C with >15yrs of age and open fracture which were not contaminated. Patients demographics, mechanism of injury, associated injuries, type of fracture, open or closed, time of union, range of motion and complication were recorded. Follow-up was done for period of 36 months.

Maximum stability depends in choosing the implant. The standard for patients who have a fracture of distal femur with intra-articular involvement is open reduction and

internal fixation. Good exposure is necessary with use of atraumatic and aseptic techniques, along with modern principal of internal fixation.

Technique

- Patient is laid supine.
- We used Swashbuckler approach in our most of the cases.

Swashbuckler approach

- Swashbuckler approach midline incision from above the fracture laterally to across the patella. Fascia overlying quadriceps is incised longitudinally and lifted laterally off underlying muscle. Further laterally fascia over quadriceps becomes confluent with illiotibial band. Lateral parapattellar arthrotomy is performed. Proximally arthrotomy incision is made between vastus lateralis muscle and lateral retinaculum of knee. Proximal release of vastus lateralis fibers from lateral intermuscular septum allow further mobilization of quadriceps. Perforating vessels can be controlled with cautry.¹²
- Intra articular comminution temporarily reconstructed with K-wires and then lag screws were used.
- mark the area for insertion of locking compression plate on the lateral aspect of the distal femur. This insertion point is located 1.5 to 2cm proximal to the distal femoral articular surface in the middle third of anterior hail of the lateral femoral condyle.
- Reduce the femoral condyle with the shaft. Reduction is done by taking care of all the factors like rotation, length to achieve the anatomical alignment. After reduction bluntly develop the space between the periosteum and muscle for placement of plate.
- After proper placement of plate to place the fixation screws in accordance with the biomechanical principal of fixation, placing screws close to and far away from the fracture (Figure 1).
- Whenever severe comminution primary bone grafting was done.



Figure 1: Pre-operative and post-operative x rays of Type C3 fracture treated with LCP and 2 lag screws.

Early physiotherapy was started under supervision. Full weight bearing was started depending on clinical and radiological progress of fracture healing, patients were followed up at regular interval until union.¹³ The final results will be assessed according to knee score based on Neer's criteria.¹⁴

RESULTS

In present study of 30 cases mean age of the patient was 45 yrs ranges from 23-65 years of age. Male and female ratio being 5:1. Road traffic accidents were the commonest mode of trauma. Left leg was involved more often than right. 2 cases of C1 type, 14 cases subtype C2 and 14 cases were of subtype C3. 5 patients were found to having osteopenia of grade 5. Most of the cases were operated by using Swashbuckler approach 16 cases were operated by using Swashbuckler approach and 14 cases were operated with anterior approach.^{2,6} In 4 cases primary bone grafting done during surgery having severe comminution (C3 type) and in one case secondary bone grafting done after 4 month a case of delayed union. In our study, all fractures were intra-articular and much comminuted, lag screws were used along with locking compression plates. More lag screws were used in type

C3 as compare to type C1 and C2. Two patients were having early complications in form of superficial infection post operatively, healed up with appropriate antibiotics and antiseptics. One patient was having thromboembolic phenomena in the form of DVT which was treated conservatively. Under guidance of medical and surgical specialist. One patient was having late postoperative complication in form of implant failure. One patient with fracture both bone leg develops pressure sore. Radiological union was seen between 12-19 weeks. Mean time for radiological union was 15 weeks. Most of the C1 and C2 types of fracture have more ROM as compare to C3 type of fractures. Mean range of motion was 114°. Ten cases were excellent, 15 cases satisfactory, 3 cases unsatisfactory and two case graded as poor based on Neer criteria (Table 1 and 2).¹⁴

Table 1: Knee score at follow up.

Total score	Number of patients	%
Excellent (85)	10	33.34
Satisfactory (75-85)	15	50
Unsatisfactory (55-74)	3	10
Poor (55)	2	6.66
Total	30	100

Table 2: Results as per type of fracture

Type	No. of Patients	Excellent	Satisfactory	Unsatisfactory	Poor
C1	2	2 (100%)			
C2	14	8 (57.14%)	5 (35.71%)	1 (7.14%)	
C3	14	1 (7.14%)	7 (50%)	4 (28.57)	2 (14.28)

DISCUSSION

Fracture of distal femur have posed considerable therapeutic challenges throughout the history of fracture treatment. Most of these surgical failures were due to inadequate fixation of fracture fragment.¹⁵ The prognostic factors for distal femur fracture include age, intra-articular involvement and time of joint motion.¹⁴

In present study of 30 cases, mean age was 45 years, ranges between 23-65 years which is comparable with Readmakers et al who reported the mean age of 45 years.

Males are more involved 25 males (83.33%) as compare to females 5 Cases (16.67%) because more outdoor activities as compare to females which corresponds to Ru J et al (2007) study.¹⁶ Most of the patient in present study were of lower socioeconomic status as this study was conducted in government hospital. 21 cases (70%) were literate and 9 cases (30%) were illiterate. Left leg [20 cases (66.67%)] was involved more than right in present study which is comparable with Ru J et al. In present study, out of 30 cases, 29 cases (96.66%) the injury was

due to roadside accidents in 1 case (3.34%) the cause is fall from height. Martinet O et al reported that most common high energy trauma is a traffic accident and most common low energy mechanism is fall at home.¹ 5 patients out of 20 cases had associated medical ailments, 2 diabetes mellitus and 4 hypertension.

AO system of classification was used in present study. In present study of 30 cases all fractures are intra-articular and as per AO classification all are C types and out of 30, 2 cases (6.66%) were of subtype C1, 14 cases (46.67%) were of subtype C2 and 14 Cases (46.67%) were of subtype C3. 11 patients were having associated fractures like fracture of proximal femur of same site, 4 cases with fracture both bone legs and 2 were having fracture distal end of radius of opposite side and fracture ulna of same side, 3 cases (10%) were having fracture patella of same side. Fractures distal end of radius were treated on same day with application of cast. Other associated fractures treated on same sitting along with internal fixation. 5 patients were formed to be osteopenic as per radiological finding based on Singh index. Based on Singh index criteria 5 patients 3 women and 2 men were having

osteopenia of grade 5. Presence of osteopenia play important role in delayed union. Most of cases were operated within 24 hours by using Swashbuckler approach because in this approach tissue damage is less and quadriceps remains intact. But when comminution is more especially on medial side anterior approach is preferred. Literature shows LISS application will give better result. Two cases were operated by this technique. As this study was conducted in Government hospital and most of patients were of lower socioeconomic status. So LISS technique could not be used more frequently. Out of 30 cases, bone grafting was done in 5 cases. Most of cases were osteoporotic and severely comminuted fractures.

In present study, all fracture was intra articular and highly comminuted, joint congruity is most important before reduction of fracture fragment. Reconstruction of articular area was done initially by using 2 or 3 lag screws. C1 fracture were fixed with one lag screw.

2 cases (6.66%) in present study associated with superficial infections. One case had late complication after 4 months in form of delayed union which was treated with secondary bone grafting and union was achieved. One patient having type C3 fracture reported after 2 months of surgery as case of implant failure. Patient was illiterate and started early weight bearing. Pt was advised to revise surgery. P Kanaber et al noticed superficial infection in 2 cases which was comparable to our study.¹⁷ By using the locking compression plate and maintaining the joint congruancy, early physiotherapy was started and chances of thromboembolic phenomena were reduced and only one case of DVT was found in present study.

Radiological union was achieved in all the cases. Union was seen between 12-19 weeks in most of cases. Mean time for radiological union was 15 weeks. When the callous formation started, patient was advised to start partial weight bearing. P Kanabar et al study shows union ranges between 12-19 weeks which resembles our study.¹⁷



Figure 2: Follow up at 9 months showing flexion of knee >100 degrees.

Out of 30 patients, 9 patients (30%) were achieved full flexion >130 degree (Figure 2) out of which 2 patients

were of C1 type and 7 cases were of C2 type. 19 patients (63.34%) were achieved flexion 100-129 degree out of which 7 patients were of C2 type and 12 cases were of C3 type and two cases achieved up to 90 both are of C3 type. In present study mean range of motion at the knee joint was 116 degree. Present study shows range of ROM is more in C1 and C2 types of fracture of distal femur as compare to the C3 fractures. Early physiotherapy and better articular reconstruction will play important role to get the more ROM. Regular follow-up of the patients is very important. 3 cases of type C3 were having angulation of 5 degree, reason was found to be more metaphyseal comminution along with intra-articular involvement. Rademaker M et al obtained in study of 67 patients found to mean range of motion was 118 degree based on Neer criteria.¹⁸

Knee score was calculated based on Neer criteria, out of 30 cases 10 cases (33.34%) were having Neer score more than 85 and graded to be excellent, 15 cases (50%) were having Neer score 75-85 and graded as satisfactory, 3 cases (10%) were having Neer score 55-74 and graded as unsatisfactory and two case (6.66%) was having Neer score 55 and graded as poor. Rademaker MV et al obtained in study of 67 patients found 84% satisfactory to excellent result.⁵⁴ In present study it was found that 83.34% found to be satisfactory to excellent result.

CONCLUSION

LCP is better implant in comminuted I/A fractures of distal end of femur and in elderly patients with osteoporotic bone. The screw head gets locked to the plate and it acts as one construct, thus increasing the holding power of the implant, making it an implant of choice in osteoporotic bone and in comminuted fractures with little bone stock. In spite of the worst fracture anatomy of the comminuted fracture of distal femur and the poor quality of bone in elderly patients, this can provide better post-operative range of knee motion with overall better Knee score, achieving bony union in all the cases. In present study it was found physiotherapy had very important role to get the good range of motion.¹⁸

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