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Original Research Article

Study to Evaluate the Outcome of Open Reduction and Internal Fixation of Distal Femur Fractures by Locking Compression Plate

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Abstract

Aim: The aim of the present study was to evaluate the results of open reduction and internal fixation of distal femur fractures by locking compression plate.

Methods: The present study was conducted in the Department Orthopedics, Government Medical College and Hospital, Bettiah, West Champaran, Bihar, India for 4 months, and study included 50 patients with distal femur fractures.

Results: In this study, 64% of the cases were in the age group of 21-40 years, 24% in the 41-60 years age group, and just 12% in the 61-80 years group. The mean age was 39 years. In our study, 76% of the patients were male, and 24% were female. Sixty percent of the cases were due to road traffic accidents while 40% were due to domestic. AO (Arbeitsgemeinschaft für Osteo synthesefragen) classification was used in this study. There were no A1- type cases. The majority of the fractures belonged to C2 type (40%, 20 cases). C3 accounted for 20% of the cases. A2, A3, and B1 were the least common, accounting for just 4% of the cases each. The majority of the cases did not have any complications, accounting for 84% of the cases. Four cases had stiffness postoperatively, accounting for 8% of the cases, and there were only two cases of non-union and infection each, accounting for 4% of cases, respectively. Out of 50 cases, 24% of cases, i.e. six patients, had excellent outcomes as per Kolmert's and Neer's scores. Twenty-two patients (44%) had good outcomes, eight cases of fair and poor outcomes each, accounting for 16% of total cases, respectively.

Conclusion: LCP proved to be a good implant which could take the challenges like poor bone stock, severe comminution both metaphyseal and articular and prove successful. The locking head screws distally have prevented varus collapse, even in cases of osteoporosis. The Condylar LCP can be used in either an open or a minimally invasive manner.

Keywords: Distal femur fracture, osteosynthesis, internal fixation

Introduction

In the supra and intercondylar fractures of femur particularly with intra-articular extension, patient may develop stiffness of knee, shortening, rotational deformities, internal derangement of knee with instability, varus and valgus deformities which affect patient's routine lifestyle. If these cases were treated with locking compression plate, the results obtained were successful, superior, timesaving providing early ambulation and least disability improving the functional outcome. Comparative study of management of distal femoral fractures managed by DCS and distal femoral LCP (25 cases each) and concluded that results were similar except that distal femur LCP is better in comminuted fractures. [1]

Study on biomechanical analysis of distal femur fracture fixation using LCP versus condylar blade plate concluded that LCP proved stronger than blade plate in both cyclic loading and ultimate strength in biomechanical testing. [2] The overall results of surgical management of distal femoral fractures with DCS are similar to those obtained with condylar blade plate. [3] The DCS group presented significantly better results than the RIMSN group. Blood loss was significantly more in the DCS group. No significant differences between the two groups were seen in terms of cumulative rate of union, range of motion of the knee, overall results, and complications. [4]

Adequate rigid fixation of distal femur fractures with minimal soft tissue damage and preservation of blood supply along with appropriate physiotherapy can attain better clinical outcomes and facilitate earlier weight bearing. [5] Complications associated with this fracture fixation with plating include varus collapse, non-union, arthrofibrosis, restriction of knee range of motion, and infection. [6] Single lateral locking plates would fail in distal femur fractures with gross metaphyseal comminution, medial cortical defects, or bone loss, and in osteoporotic fractures. Such fractures require additional medial plating to buttress the medial column. [7]

The aim of the present study was to evaluate the results of open reduction and internal fixation of distal femur fractures by locking compression plate.

Materials and Methods

The present study was conducted in the Department Orthopedics, Government Medical College and Hospital, Bettiah, West Champaran, Bihar, India for 4 months and study included 50 patients with distal femur fractures.

Inclusion Criteria

1. Patients who have been diagnosed as Closed Type 1, 2 compound distal femur fractures.
2. Age group of 20–80 years of both sexes.

Exclusion Criteria

1. Skeletally immature individuals.
2. Type 3 compound fractures of distal femur.
3. Fractures associated with knee dislocation.
4. Patients with associated ipsilateral tibia and foot fractures.
5. Pathological Fractures.

All the patients were immediately admitted and in detail general examination was done for complete assessment like head injuries, spine, chest, abdomen, pelvis and limbs. In patients with severe blood loss and in hypovolemic shock, it was corrected with intravenous fluids and blood. For simple fractures, antibiotic regimen was started 12 hours before surgery parenterally and continued till 3rd postoperative day, from then till 10th post-operative day oral antibiotics were given.

Protocol

On admission, thorough history, general examination, systemic examination, and vitals were recorded in order to rule out any co-morbidities and to establish the nature and mode of injury. All patients were assessed and resuscitated as per Advanced Trauma Life Support® (ATLS®) protocol. Plain radiographs were obtained of the knee and femur of the affected side as well as routine trauma series radiographs, which included pelvis with both hips, cervical, and lumbar radiographs.

Above knee slab was applied to immobilize the affected limb with adequate elevation and cold compression. Preoperative investigations including blood investigations, chest radiographs, and electro-cardiograph as per requirements for surgical fitness for anesthesia were done. CT was done in order to classify the fracture, determine the nature of fragments, plan the surgical approach, determine the choice of implant, and strategies the technique of reduction and fixation. Patients were posted immediately after surgical fitness from anesthesia. Written and informed consents for the surgical procedure were taken. Injection cefuroxime 1.5 g was given half an hour prior to induction. Xylocaine sensitivity was done on the morning of surgery. Patients who had closed fractures were taken up for surgery within three to four days after admission.

Patients with open fractures were primarily treated for the open wound and a knee-spanning external fixator. A 6L saline wash was given followed by debridement, when needed, and primary suturing was done on admission. The patients were given a course of injectable cephalosporin, metrogyl, and aminoglycosides for five days. Routine betadine sterile dressings were done and the patients were taken up for surgery as soon as the wound condition improved. Patients were kept in a supine position over a radiolucent operating table, with knee frame utilised to facilitate flexion of the knee during fracture fixation. An image intensifier was positioned on the opposite side of the injured limb. A bolster was utilized under the hip of the affected side when access was needed to the posterolateral aspect of the femur. A high tourniquet was utilized. Painting and draping were done. The surgeon and assistant staff occupied the side of the affected limb. The Swashbuckler approach is used to access the distal femur. With the patient in supine, an antero-medial incision is given over the knee. Dissection is continued through the quadriceps fascia, iliotibial band is retracted. Lateral intermuscular septum is detached from vastus lateralis, and quadriceps is pulled medially, and the patella is dislocated

medially, allowing adequate access to the distal femur. [8]

Reconstructing the articular section to anatomical reduction is done using reduction clamps, Kirschner wires, and then fixed using inter-fragmentary screws. Osteochondral fragments can be fixed using headless screws if larger than 5 mm; fragments lesser than 5 mm can be excised. After articular reconstruction, the articular block is fixed with the metaphysis using a distal femur lateral locking plate. Bridge plating is done if there is comminution in the metaphysis, and the gap is filled with bone graft. Alignment and length are carefully restored. Medial plating is done through the same incision using a T buttress plate or reconstruction plate, depending on the fracture fragment. After wound closure, the range of motion of the knee is reassessed and helps in releasing any soft tissue that may have been impinged during the reduction and fixation of fracture fragments. Intra-operative C-arm images are obtained to confirm the reduction of fragments. Postoperative radiograph of the knee in anteroposterior and lateral views.

A robust postoperative protocol is essential for a better clinical and functional outcome. Intravenous antibiotic cover, consisting of cefuroxime 1.5 g with amikacin 750 mg, along with analgesia, and deep venous thrombosis (DVT) prophylaxis was given. Rehabilitation was tailored to suit individual cases and depends primarily on fixation stability. Drain, if used, is removed 48 hours postoperatively. Isometric exercises (static quadriceps and hamstring exercises) are started on the first day, and passive knee range of motion is initiated on the second day. Up to 45 degrees of flexion within the first seven days and gradually increased to around 90-110 degrees by 8-12 weeks. Sutures were removed by the 14th to 18th postoperative day. Plain radiographs were taken of the operated knee, anteroposterior and lateral views, immediately after surgery. Patients were followed up regularly after discharge on day 10, six weeks, and three months to assess the functional outcome, complications, and radiological union.

Patients would be made to bear 50% weight on the operated limb by the sixth week postoperatively, with aid, and unassisted 100% weight bearing by the 9th-10th week postoperatively. Postoperative knee stiffness was defined by a decrease in range of motion, which would decrease walking capacity to the extent that the patient would require aid to do so. [9,10] Fracture union was defined clinically when the patient was able to weight bear without walking aids, and radiologically union when there is progressive callous formation across two cortices in both views. The follow-up of patients was done by assessing clinically and functionally by Neer's criteria [11] after surgery along with Kolmert scoring [12] three months postoperatively.

Results

Table 1: Demographic data

	N	%
Age Group		
21-40	32	64%
41-60	12	24%
61-80	3	12%
Sex		
Male	38	76%
Female	12	24%
Injury Mechanism		
RTA	30	60%
Domestic Fall	20	40%
AO Fracture Classification		
A1	0	0%
A2	2	4%
A3	2	4%
B1	2	4%
B2	4	8%
B3	6	12%
C1	4	8%
C2	20	40%
C3	10	20%

In this study, 64% of the cases were in the age group of 21-40 years, 24% in the 41-60 years age group, and just 12% in the 61-80 years group. The mean age was 39 years. In our study, 76% of the patients were male, and 24% were female. Sixty percent of the cases were due to road traffic accidents while 40% were due to domestic. AO (Arbeit gemeinschaft für Osteo synthesefragen) classification was used in this study. There were no A1- type cases. The majority of the fractures belonged to C2 type (40%, 20 cases). C3 accounted for 20% of the cases. A2, A3, and B1 were the least common, accounting for just 4% of the cases each.

Table 2: Complications

Complication	Number of Cases	Percentage
Stiffness	4	8%
Non-union	2	4%
Infection	2	4%
None	42	84%

The majority of the cases did not have any complications, accounting for 84% of the cases. Four cases had stiffness postoperatively, accounting for 8% of the cases, and there were only two cases of non-union and infection each, accounting for 4% of cases, respectively.

Table 3: Distribution of cases based on Kolmert and Neer's score

Outcome	Number of cases as per Kolmert Score	Number of cases as per Neer's Score	Percentage
Excellent	12	12	24%
Good	22	22	44%
Fair	8	8	16%
Poor	8	8	16%

Out of 50 cases, 24% of cases, i.e. six patients, had excellent outcomes as per Kolmert's and Neer's scores. Twenty-two patients (44%) had good outcomes, eight cases of fair and poor outcomes each, accounting for 16% of total cases, respectively.

Discussion

Fractures of distal femur are rare, accounting for less than 0.5% of total fractures and contributing 3-6% of all femoral fractures with a bimodal pattern distribution of with peak in frequencies found in elderly females in their late 70s and young males in their 30s, with males having a history of high-velocity impact trauma and the females having lower energy trauma with osteoporosis. [13,14] Distal femur fractures were traditionally managed utilizing the principle of Watson Jones and John Charnley, which included skeletal traction, closed reduction of the fracture, and casting. [15,16] Poor outcomes of conservative management led to the need for surgical intervention, which comprised using various modalities of fixation such as condylar buttress plates, dynamic condylar screw fixation, locking compression plates, fixed angle condylar blade plates, and retrograde interlocking nails. [17]

In this study, 64% of the cases were in the age group of 21-40 years, 24% in the 41-60 years age group, and just 12% in the 61-80 years group. The mean age was 39 years. In our study, 76% of the patients were male, and 24% were female. Sixty percent of the cases were due to road traffic accidents while 40% were due to domestic. The average age documented in the study by Kregor et al [18] was 49, while in the study by Yeap et al [19] it was 44. RTA accounted for 60% of the total cases, therefore contributing to the majority of the cases, while falls contributed to the remaining 40% of the cases. In the study by Rekha et al [20], 73% of the cases were due to RTA and 27% were due to domestic falls. AO (Arbeit gemeinschaft für Osteo synthesefragen) classification was used in this study. There were no A1- type cases. The majority of the fractures belonged to C2 type (40%, 20 cases). C3 accounted for 20% of the cases. A2, A3, and B1 were the least common, accounting for just 4% of the cases each. Hence, 68% of our cases were of AO type C fracture pattern, while Kregor et al[18] noted 50% of their cases were AO type C. In the study by Rekha et al [20], 46.7% of their cases were AO type C.

The majority of the cases did not have any complications, accounting for 84% of the cases. Four cases had stiffness postoperatively, accounting for 8% of the cases, and there were only two cases of non-union and infection each, accounting for 4% of cases, respectively. Out of 50 cases, 24% of cases, i.e. six patients, had excellent outcomes as per Kolmert's and Neer's scores. Twenty-two patients (44%) had good outcomes, eight cases of fair and poor outcomes each, accounting for 16% of total cases, respectively. In the study by Garg et al [21], 50% of cases had excellent outcomes as per Neer's criteria, 30% had good outcomes, while fair and poor outcomes were 10% each. In this study, 72% of

cases had shortening of affected limbs less than 1 cm postoperatively, while only 16% of cases had more than 1.6 cm shortening. In the study by Rekha et al [20], 10% of cases had a shortening of more than 1.5 cm. Eighty-four percent of cases had postoperative fracture displacement of less than 1.5 cm, which can be co-related with the better outcome of walking. Sixteen percent of cases had displacement of more than 1.6 cm. Park et al [22], in their study, reported a postoperative mean displacement of 5.6 mm.

Conclusion

LCP proved to be a good implant which could take the challenges like poor bone stock, severe comminution both metaphyseal and articular and prove successful. The locking head screws distally have prevented varus collapse, even in cases of osteoporosis. The Condylar LCP can be used in either an open or a minimally invasive manner.

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