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Management of Fracture of Distal End of Femur with Locking Compression Plate

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Abstract:

Context: The fractures of the distal end of femur are one of the commonest fractures found and represent 6-8% of all the femoral fractures treated by orthopedic surgeons. These fractures can be treated by different methods and near anatomical reduction is the most important to obtain near good functional results. The aim of the study was to evaluate the surgical management of fractures of distal end of femur with locking compression plate. **Methods:** A longitudinal clinical study was carried out Department of orthopedics, Shaheed M. Monsur Ali Medical College, Sirajgonj. In this study 50 patients with closed distal femoral fractures (distal fifteen cm of femur) were studied. All the cases were treated between January-2017 and December -2018 at this institution and followed for a minimum of 12 months. Age of the patients was ≥20 yrs. All the fractures in this series were post-traumatic fresh fracture of distal end femur with or without osteoporotic changes and managed surgically by locking compression plate. **Results:** In postoperative complications, 4(8.0%) patients had superficial infection, 8(16.0%) had knee stiffness (which was corrected by vigorous physiotherapy), 1(2.0%) had deep seated infection and 2(4.0%) had delayed union. According to Neer's scoring system, 42(84.0%) patients were excellent, 6(12.0%) were good and 2(4.0%) were poor outcome. **Conclusion:** Locking compression plate is an excellent fixation system for distal end femoral fractures. Device provides good angular stability and helps in early mobilization.

Indexing words: Fracture of distal end of femur, Locking compression plate (LCP)

Introduction:

The fractures of the distal end of femur are one of the commonest fractures found. Incidence of distal end of femur fractures is 37 per 1,00,000 person[1] comprises about 6-8% of all the femoral fractures treated by orthopedic surgeons. The most common high-energy mechanism of injury is a traffic accident (53%) and the most common low-energy mechanism is a fall at home (33%).[2,3] In the past two decades there has emerged another injury group coming out of periprosthetic fractures.[3] Near anatomical reduction is most important in these fractures to obtain near good functional results. A variety of treatment options are proposed for distal femoral fractures of the treatment with distal femoral LCP has yielded good results.[4] There are various options for operative treatment like plating techniques that require compression of the implant to the femoral shaft (blade plate, dynamic condylar screw, non-locking condylar buttress plate), antegrade nailing, retrograde nailing, sub muscular locked internal fixation and external fixation.[5] Locking compression plates with its innumerous advantage is of great use in such circumstances.[5,6] Locking compression plate has the advantage of combination of conventional compression plating and locked plating techniques which enhances the plate osteosynthesis.[5,6,7] Anatomically precontoured built reduces soft tissue problems and acts as internal fixator.[7,8] In addition, a locking compression plate has got distinct advantages of unicortical fixation and least chance of plate back out as the screw gets locked to the plate.[9] The study was undertaken to evaluate the outcome of management of distal femoral fractures using LCP which may be helpful to find the solutions for the age-old problems and complications associated with management of these complex fractures.

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Methodology:

A longitudinal clinical study was carried out Department of Orthopedics, Shaheed M. Monsur Ali Medical College, Sirajgonj. In this study 50 patients with closed distal femoral fractures (distal fifteen cm of femur) were studied. All the cases were treated between January 2017 and December 2018 at our institution and followed for a minimum of 12 months. All the fractures in this series were post-traumatic fracture of distal end femur (distal 15 cms of femur). Patients who were aged ≥20 yrs had fresh distal femoral fractures with or without osteoporotic changes and managed surgically were included in the study. Patients with open distal femoral fractures; children with distal femoral fractures in whom, growth plate is still open; patients lost in follow-up; patients managed conservatively for other medical reasons; distal femoral fractures with neurovascular compromise were excluded from the study. The plate and screws are manufactured from 316L stainless alloy with gun drilling technique. The locking compression plates (4.5 mm precontoured) are available from 8 hole to 12 hole. After following proper surgical preparation, fracture reduction was achieved by traction and counter traction with gentle manipulation during surgery, in few cases Steinmann pin was used for reduction as joystick method. Condyles were fixed with 2 mm Kirschner wires initially along with plate after reduction and fixed with 6.5 mm cancellous screws into the condyles and 4.5 mm locking screws into the shaft. This has been confirmed intraoperatively under image intensifier. Patients post operative care was maintained as per hospital protocol. Patient was mobilized on 3rd or 4th day postoperatively with knee exercises. Non-weight bearing was started after first post-operative week till 6 weeks depending on the fracture pattern. Partial weight and full weight bearing exercises started depending on healing process till fracture union respectively.



Figure 1: Locking compression plate and screws.

Results:

Majority (42.0%) patients belonged to age 21-30 years. Majority (88.0%) patients were male and 6(12.0%) were female. Majority (90.0%) patients had fracture of right side and 5(10.0%) left side. Majority (92.0%) cases the type of injury was due to RTA and 4(8.0%) cases were due to self fall (Table 1).

Table 1: Demographic characteristics of the study patients

Variables	Number of patients	Percentage
Age (years)		
21-30	21	42.0
31-40	18	36.0
41-50	7	14.0
51-60	4	8.0
Sex		
Male	44	88.0
Female	6	12.0
Side of fracture		
Right	45	90.0
Left	5	10.0
Type of injury		
Road traffic accident	46	92.0
Self fall	4	8.0

Almost one fourth (24.0%) patients were Mullers type A1 followed by 6(12.0%) were A2, 8(16.0%) were A3, 8(16.0%) were B1, 5(10.0%) were B2, 4(8.0%) were C1, 5(10.0%) were C2 and Mullers type C3 (Table 2).

Table 2: Type of fracture lower end of femur of the study patients

Type of fracture	Number of patients	Percentage
A1	12	24.0
A2	6	12.0
A3	8	16.0
B1	8	16.0
B2	5	10.0
C1	4	8.0
C2	5	10.0
C3	2	4.0

Majority (70.0%) patients used 8-12 holed plate and 15(30.0%) used 5-7 holed plate for lower end of femur (Table 3).

Table 3: Plate size of the study patients

Plate size (Holed)	Number of patients	Percentage
8-10	15	30.0
11-12	35	70.0

In postoperative complications, 4(8.0%) patients had superficial infection, 8(16.0%) had knee stiffness (which was corrected by vigorous physiotherapy), 1(2.0%) had deep seated infection and 2(4.0%) had delayed union (Table 4).

Table 4: Post operative complications of the study patients

Post operative complications	Number of patients	Percentage
Superficial infection	4	8.0
Knee stiffness	8	16.0
Deep seated infection	1	2.0
delayed union	2	4.0

The radiological union was found 35(70.0%) patients in 3 month and 15(30.0%) in 6 month (Table 5).

Table 5: Radiological union of the study patients

	Number of patients	Percentage
3 month	35	70.0
6 month	15	30.0

Mean time of partial weight bearing was found 12.4±1.1 weeks and complete weight bearing was found 22.2±1.6 weeks (Table 6).

Table 6: Weight bearing of the study patients

Weight bearing	Mean	±SD
Partial weight bearing (weeks)	12.4	±1.1
Complete weight bearing (weeks)	22.2	±1.6

According to Neer's scoring system, 42(84.0%) patients were excellent, 6(12.0%) were good and 2(4.0%) were poor outcome (Table 7).

Table 7: Functional result (Neer's score) of the study patients

	Number of patients	Percentage
Excellent	42	84.0
Good	6	12.0
Poor	2	4.0



Figure 2: Implant used in fracture of distal femur



Figure 3: (A and B) Follow-up with range of motion and incision site.

Discussion:

In this study it was observed that the majority (42.0%) patients belonged to age 21-30 years. Majority (88.0%) patients were male and 6(12.0%) were female. Majority (90.0%) patients had fracture of right side and 5(10.0%) left side. Majority (92.0%) cases the type of injury was due to RTA and 4(8.0%) cases were due to self fall. Ajaz et al[10] observed similar results where they showed majority (40.0%) patients belonged to age 31-40 years and 12(80.0%) patients were male. Almost three fourth (73.0%) patients had fracture of right side and 14(93.0%) patients the type of injury was due to RTA. Ravish et al[1] also reported out of 25 patients in their study, 17 were male patient (68%) and 8 were female patients (32%). The average age of the patients was between 25-45 years. In 20 (80%) cases the type of injury was due to RTA and 5 (20%) cases were due to self fall. Gupta and Dande[11] reported all cases were fresh, 78 patients were males and 22 patients were females. The median age was 47 years ranging from 20-70 years. 65 of the fractures were caused by road traffic accidents and 25 were due to fall, 10 were due to assault. 60 patients were with fracture on right side and 40 on left side. Vikranth et al[4] reported majority (30.0%) patients belonged to age 20-30 years and 20(66.7%) patients were male. Bhimani et al[12] also reported the patients' ages ranged from 18 to 74 years with a mean age of 44 years. Twenty fractures involved the right side and ten involved the left side. The causes of fractures were motor vehicle accident in nineteen patients and a domestic fall in remaining eleven.

In the current study showed that almost one fourth (24.0%) patients were Mullers type A1 followed by 6(12.0%) were A2, 8(16.0%) were

A3, 8(16.0%) were B1, 5(10.0%) were B2, 4(8.0%) were C1, 5(10.0%) were C2 and Mullers type C3. Ajaz et al[10] observed that majority (60.0%) patients were Mullers type C2, 3(20.0%) were A1 and 3(20.0%) were C3. Gupta and Dande[11] reported 5 cases were Mullers type A1; 25 was Mullers type A2; 20 were Mullers type A3; 10 was Mullers type C1 20 were type C2 and remaining 20 were Mullers type C3. Bhimani et al.[12] observed according to Muller's classification of distal femur five were Muller's type A1; nine Muller's type C1; ten Muller's type C2 and six Muller's type C3.

In the present study, in majority (70.0%) patients 8-10 holed plate was used and in 15(30.0%) 4-7 holed plate was used for lower end of femur. Bhimani et al[12] reported the size of the plate used for fixation varied from 4 holed to 12 holed depending on fracture pattern. But commonly used size was 7-9 holed plates. Ajaz et al[10] in more than two third (67.0%) patients used 8-10 holed plate. Gupta and Dande[11] reported the size of plate was selected based on the type of fracture. 6 and 8 holed plates were used more commonly for lower end of femur.

In the present study, postoperative complications were occurred in some patients. Among them 4(8.0%) patients had superficial infection, 8(16.0%) had knee stiffness (which was corrected by vigorous physiotherapy), 1(2.0%) had deep seated infection and 2 (4.0%) had delayed union. Agarwal et al[13] found that late postoperative complications included chronic infection (10%), knee stiffness (10%), malalignment (10%). Ajaz et al[10] reported 6(40.0%) patients had superficial infection and 1(7.0%) had delay union. Ravish et al[1] reported 2 patients had superficial infection, 3 patients had wound gaping, 12 patients had knee stiffness and bent implant was seen in 1 patient. In study of Gupta and Dande[11], very few patients had significant varus/valgus malalignment with 5 patients had superficial infection which was treated with debridement and antibiotics. Implant failure occurred in 2 patients, delayed union in 2 patients. Bhimani et al[12] two patients (7%) had superficial infection which was managed conservatively with intravenous antibiotics. They observed one patient each with varus and valgus malalignment.

In the present study, the radiological union was found in 35(70.0%) patients in 3 month and 15(30.0%) in 6 month. Agarwal et al[13] reported the radiological union was noted in 46.67% patients each at three months and six months. Ajaz et al[10] two third (66.66%) patients were found <16 weeks of radiological union. Ravish et al[1] reported the average time taken for radiological union was between 20-24 weeks. Gupta and Dande[11] observed 73 Patients (73%) showed radiological union within 18 weeks. In Vikranth et al[4] study 22 patients showed radiological union within 16 weeks and 7 cases united within 24 weeks. Bhimani et al[12] also reported 26 (87%) showed radiological union within 20 weeks. Mean time for Radiological union was 16 weeks.

In the present study, the mean time of partial weight bearing was found 12.4±1.1 weeks and complete weight bearing was found 22.2±1.6 weeks. Ravish et al[1] reported time of partial weight bearing was 12 weeks and full weight bearing was 22 weeks. In Bhimani et al[12] partial weight bearing was started at an average 6-8 weeks after surgery when there were early signs of callus formation. Full weight bearing was started on an average 12-14 weeks after surgery as per union seen on roentogram and patient's tolerance.

In this study observed that according to Neer's scoring system, 42(84.0%) patients were excellent, 6(12.0%) were good and 2(4.0%) were poor outcome. Agarwall et al[13] reported all types of fractures had excellent outcome except type C1 and C2 where 55.56% and 66.66% of patients had excellent outcome respectively. Ajaz et al[10] reported 3(20.0%) patients were excellent, 9(60.0%) were good and 3(20.0%) were poor outcome. Ravish et al[1] stated according to Neer's scoring system, 7(28%) cases were excellent, 14(56%) were good, 3(12%) were fair, 1(4%) were poor. In Gupta and Dande[11] study on 100 fractures around knee, 65 patients showed excellent result. 20 patients showed good outcome, 10 patients showed fair outcome and 5 patient showed poor outcome. Vikranth et al[4] reported restoration of anatomy was excellent in 18 patients (60%), good in 8 patients (26.6%), fair in 2 patients (6.7%) and poor outcome in 2 patients (6.7%). Bhimani et al[12] reported Neer's scoring system as excellent in 19(64%), good in 6(20%), fair in 4(13%) and poor in 1(3%).

Conclusion:

Locking compression plate is an excellent fixation system for distal end femoral fractures. Device provides good angular stability and helps in early mobilization.

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