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Original Research Article

Surgical management and functional outcome ofdistal end of femur fractures with locking compression plate

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Abstract
The fractures of the distal end of femur are one of the commonest fractures found and can be treated by different methods. Incidence of distal end of femur fractures-37 per 1,00,000 person. This study was to assess the functional outcome for internal fixation of fractures of the distal end of femur by locking compression plate and to evaluate the effectiveness of distal end of femur fractures treated with locking compression plate. It was a prospective study. In this study, 20 cases of fracture of distal end of femur, meeting the inclusion and exclusion criteria were treated by open reduction/Mippo and internal fixation using Locking Compression Plate. The functional outcome in regards to ROM was on an average of 112 degrees at 24 weeks. All the cases in our study achieved union with a mean value of 5.75 months and in 2 patients bone grafting was done.It is concluded that, Internal Fixation with Locking compression plate & screw remains procedure of choice in the management of fractures of distal end of femur.

Keywords: Distal end of femur fractures, LCP, MULLER's classification, open reduction and internal fixation, neer's scoring system

Introduction

Distal femur fractures occur at approximately one tenth the rate of proximal femur fractures and make up 7% of all femur fractures. There is a bimodal distribution of fractures based on age and gender. Most high-energy distal femur fractures occur in males between 15 and 50 years, while most low-energy fractures occur in osteoporotic women >50 years. 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%)[1,2]. In the past two decades there has emerged another injury group coming out of periprosthetic fractures[2].
Fractures of the distal femur are common, while tibial fractures are rare. Crucial for treatment is to distinguish fractures of the metaphysis above the femoral component. This remains firmly fixed, from those involving the knee joint replacement and component loosening. Distal femur fractures are almost always managed surgically, using methods of osteosynthesis with an angle condylar or dynamic compression plate (DCP), or a short retrograde-inserted supracondylar intramedullary nail. The recent use of implants such as locking compression plates (LCP) with angle-stable screws has offered good prospects[3]. Locking compression plate offers all advantages of angle-stable implants. It is more effective for osteoporotic bone than a Dynamic compression plate implant or a condylar plate, because it provides better fixation stability for the distal fragment[3].

Locking Compression Plate has the advantage of combination of CompressionPlating Locked Plating and Bridge Plating. This reduces soft tissue damage and periosteal vessels are preserved. Therefore, it acts like a closed external fixator[4].

Methodology

Source of data

The study was conducted on patients with distal femur fracture who were treated by ORIF with Locking Compression Plate in department of Orthopaedics, VIMS, Bellari. Krnataka, India.
Sample size was 20.

Method of collection of data

All patients who were admitted to orthopedic wards as above were considered according to inclusion and exclusion criteria.
20 cases of Distal femur fractures treated with locking compression plate were prospectively followed up during 6 months period based on the following inclusion and exclusion criteria.
Patients were admitted and examined according to protocol both clinically and radiologically. They were followed up regularly by clinical examination and evaluated by Neer's Criteria. X rays were taken immediately after the operation, at 6 weeks, 12 weeks and 24 weeks after surgery.

Inclusion criteria

1. Patients of both the sexes aged between 18 to 60 years.
2. Patients with closed distal end femur fractures.
3. Patients fit for surgery.
4. All patients willing to give consent.

Exclusion criteria

1. Open fractures.
2. Patients not fit for surgery, managed conservatively for other medical reasons.
3. Patients <18 years and >60 years.
4. Patients lost in follow up.

Muller's AO classification of distal fracture femur

A) Extra articular fracture

- A1 simple.
- A2 metaphyseal wedge.
- A3 metaphyseal complex.

B) Partial articular fracture (unicondylar)

- B1 lateral condyle, sagittal.
- B2 medial condyle, sagittal.
- B3 frontal-"Hoffa fracture".

C) Complex articular fracture (bicondylar)

- C1 articular simple, metaphyseal simple.
- C2 articular simple, metaphyseal complex.
- C3 articular complex.

A detailed history was collected including the presenting signs and symptoms as per the predesigned proforma. Data so obtained were compiled and analyzed.

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Figure 01. Distal Femur LCP

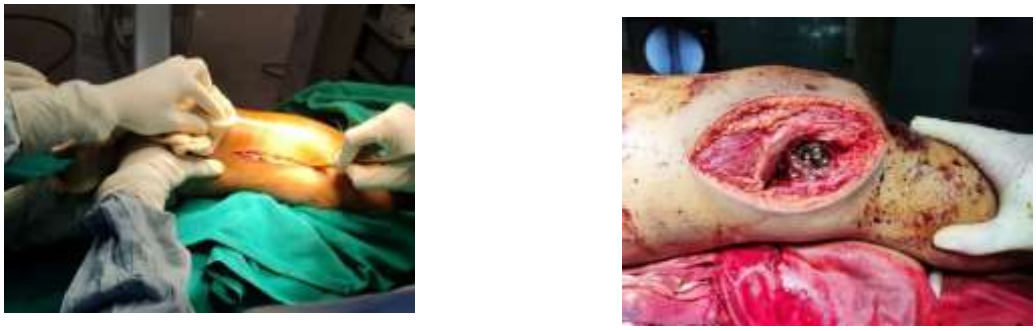

Figure 02. A) open approach-incision; B) plate insertion

Results

In our study, most of the patients presented with C2 & C3 type of fractures.

Table 1: Diagnosis

Diagnosis	No. of patients	%
A1	1	05.0
A3	2	10.0
B2	2	10.0
C1	3	15.0
C2	7	35.0
C3	5	25.0
Total	20	100.0

In out study, open approach was done in 15 patients, MIPPO approach done in 5 patients.

Table 2: Surgical approach

Surgical approach	No. of patients	%
Open	15	75.0
Mippo	5	25.0
Total	20	100.0

In most of the patients, 9-10 holed plate was used in 14 cases & 5-8 holed In 4 cases and >10 holed used in 2 cases.

Table 3: Implant

Implant(no. of holes)	No. of patients	%
5-8	4	20.0
9-10	14	70.0

>10	2	10.0
Total	20	100.0

Mean: 8.70

Bone graft was used in 2 cases in our study.

Table 4: Bone Graft

Bone Graft	No. of patients	%
Negative	18	90.0
Positive	2	10.0
Total	20	100.0

The average ROM achieved at 24 weeks was 112 degrees.

Table 5: ROM

ROM	Active	Passive	6 weeks	12 weeks	24 weeks	% change
<60	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0.0%
61-90	8(40%)	5(25%)	5(25%)	3(15%)	3(15%)	-25.0%
91-120	12(60%)	15(75%)	15(75%)	17(85%)	17(85%)	25.0%
Total	20(100%)	20(100%)	20(100%)	20(100%)	20(100%)	-

Partial weight bearing was started at 12 weeks in 14 cases & at 14 weeks in 6 cases. Complete weight bearing started at 20 weeks in 3 cases, at 22 weeks in 9 cases & at 24 weeks in 8 cases.

Table 6: Weight Bearing

Weight bearing	No. of patients(n=20)	%	Mean
Partial			
12	14	70.0	12.48
14	6	30.0	
Complete			
20	3	15.0	22.24
22	9	45.0	
24	8	40.0	

Table 7: Time of Complete Union

Time of complete union	No. of patients	%
5 months	5	25.0
6 months	15	75.0
Total	20	100.0

Mean: 5.75.

In our study, knee stiffness was present in 10 cases, superficial infectionin 2 cases, wound gaping in 3 cases and bent implant in 1 case.

Table 8: Complications

Complications	No. of patients(n=20)	%
Non union	0	0.0
Superficial infections	2	10.0
Wound gaping	3	15.0

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Knee stiffness	10	50.0
Implant breakage	0	0.0
Bent implant	1	5.0
Screw back out	0	0.0

The outcome in our study was excellent in 7 cases, good in 09 cases, fair in 3 cases & poor in 1 case.

Table 9: Outcome

Outcome	No. of patients	%
Poor	1	5.0
Fair	3	15.0
Good	9	45.0
Excellent	7	35.0
Total	20	100.0

Figure01. Xray of distal end femur fracture

Figure02. United distal end femur fracture 24 weeks of follow up treated with LCP.

Discussion

The distal femur is defined as the region from the metaphyseal-diaphyseal junction to the articular surface of the knee, involving approximately the distal 15 cm of the femur. The shaft of the femur is a cylindrical shape and extends into two curved condyles at the distal end[5].
Options for open reduction internal fixation include fixed angled blade plate, sliding barrel condylar plate, condylar buttress plate, and locking plate. Indications for open reduction internal fixation include fracture displacement, intra-articular fractures, and fractures that have gone on to nonunion. Goals include anatomic reduction of the articular surface, restoration of limb alignment, length, and rotation with preservation of vascularity. The usual determination of surgical exposure and implant of choice are by fracture configuration and surgeon preference [6].

Locking plates have more recently become the workhorse for open reduction internal fixation. Modern plate designs have various screw fixation options, including unicortical or bicortical screws, cannulated locking and nonlocking screws, solid locking screws, and attachments of radiolucent targeting devices that allow for percutaneous fixation. Locking screws offer advantages because each screw is a fixed-angle device, thus augmenting the stability of the construct by securing the plate at multiple points and eliminating motion at the plate-bone interface. Studies have shown locking plates to be biomechanically superior to blade plates in both cyclic loading and ultimate strength [7].

In our study, most of them were C2 and C3 type of fractures constituting of 7 cases C2(35%)

and C3 5(25%). The duration between the type of fracture, admission & time of surgery was 3-5 day on an average but the range was between 0-14 days. Most of the cases in our study, were operated with an open approach in 15 cases (75%), MIPPO approach done in 5 cases (25%) due to the type of injury since most of them were MULLER'S type wasC2 & C3 (75%). Bone graft was used in 2 cases and Platelet infiltration done in 1 patient due to severe commination. The functional outcome in our study in regards to the range of movements was 112 degrees at 24 weeks since mobilization was started as early as 2nd postoperative day. This is in comparison with Kregor*et al*. [8] of 103 cases, was followed up for 14 months, with a knee range of motion of 1 to 109 degrees & in comparison with Weight and Kollinger study of 21 patients, was followed up for 19 months, with a knee range of motion of5 to 114 degrees.

Partial weight bearing was started at 12 weeks in 14 cases (70%) of A1, & A3 type of fractures and at 14 weeks in 6 cases (30%) as most of them were C2 & C3 type of fractures. Complete weight bearing was done at 20 weeks in 3 cases, at 22 weeks in 9 cases & at 24 weeks in 8 cases. All of the cases in our study united with a mean of 5 months. Most of the cases united by 6 months in 15 patients (75%), by 5 months in 5 patients (25%). Zlowodzki, et al. combined these series (n=327) and evaluated the outcomes as part of a systematic literature review. Average nonunion, fixation failure, deep infection, and secondary surgery rates were 5.5%, 4.9%, 2.1%, and 16.2% respectively [9]. In our study complications like knee stiffness was seen in 10 patients (50%), superficial infection in 2 patients (10%), wound gaping in 3patient (15%) & bent implant in 1 patient (5%). Xing W, et al. showed that 90% of the distal femur fracture fixation had an excellent outcome using a locking compression plate through a posterolateral approach [10]. The outcome in our study was excellent in 7 cases (35%), good in 9 cases (45%), fair in 3 cases (15%) & poor in 1 case (5%). The results were poor in 1 case because it was a compound C3 type of fractures with superficial infection & fair in 3 cases which were compound fractures out of which 2 cases were C3 type and 1 case was B2 type. These cases were operated by open surgical procedure. one patient also had a bent implant due to early full weight bearing.

Conclusion

Locking Compression Plate is a good form of fixation in distal end femur fractures as it ensures good angular stability, intra-articular fracture fixation and aids in early mobilization even in comminuted fractures. provides good construct for fixation in osteoporotic fractures where screw cut through,collapse of fracture and malalignment are common. open/MIPPO technique aids in distal femoral LCP fixation according to the geometry of the fracture. Bone grafting and platelet infiltration will be necessary in communited fractures.

In our study we had excellent results in 7 cases, good in 9 cases which form about 80% and fair & poor in 20% of the cases. These were fair and poor results, as we believe these were compound fractures done by open technique and further enhancing our knowledge of understanding the use of LCP's in distal femur fractures, reducing the technical errors and achieving results in ensuring good outcome.

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