



Results of Distal Femoral Locking Plates in Distal Femur Fractures

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ABSTRACT

Indications and techniques of locked plate fixation for the treatment of challenging fractures continue to evolve. With advancement of surgical techniques and new upcoming plates for fixation of distal femur fractures had led to a dynamization in fracture fixation in recent world. The locked plating system allows multiple screw fixations in different planes and provides stable and enhanced fracture fixation with early postoperative mobilization. The aim of this observational study was to evaluate clinical and radiographic results in 40 patients with fractures of the distal femur treated, between January 2014 and August 2015, with such a locked plating system using both open and minimal invasive techniques. These cases were followed up until complete fracture healing or for a mean time of 18 months. At the time of last follow-up, 32 of 40 fractures (80 %) progressed to union without complication and radiographic healing occurred at a mean time of 28 weeks. Complications occurred in six fractures that affected the healing that showed delayed union and in two fractures that showed implant breakage. The average American Knee Society Score at the time of final follow-up was 83 for the Knee Score and 71.1 for the Functional Score. In conclusion, there is a high union rate for complex distal femoral fractures associated with a good clinical outcome in this series.

KEYWORDS : Distal femur, Fracture fixation, locked plates

Introduction

Fracture of the distal femur are complex injuries difficult to manage. 55 % of these fractures are intra articular hence CT scan is a must. A bimodal distribution with a peak in young men (in their 30s) and elderly women (in their 70s). Most supracondylar fractures are the result of severe varus, valgus, or rotational force with axial loading leading to shortening, apex posterior angulation and posterior displacement of the distal fragment due to pull of gastrocnemius, hamstrings & quadriceps. In intracondylar fracture there is rotational misalignment due separate attachments of gastrocnemius. The usual context is a high energy trauma in a young patient and a domestic accident in an elderly patient.

Distal femur fractures are much less common than hip fractures and account for about 7% all femur fractures. Various treatment options include external fixation, retrograde intra medullary nailing, simple screw fixation, dynamic compression plates, blade plates, locking compression plates and total knee arthroplasty. In pre era most distal femoral fractures were treated with skeletal traction leading to complications like angular deformity, joint incongruity, knee stiffness and delayed mobilization. In 1970s the AO principals and the use of angle blade plate revolutionized the treatment of these injuries. Over past 30 years, implants and techniques have improved and presently these fractures are treated with distal femoral locking plates with better results.

We did a prospective observational study of 40 patients involving the distal 15cm of femur including the distal femoral metaphysis with comminution and with the articular surface involvement treated using open reduction and internal fixation through lateral approach by distal femur locking plates and evaluated the clinical and radiological results of same during 2014 to 2015.

AO/OTA Classification

Extraarticular

- A1. Simple (two part)
- A2. Metaphyseal wedge
- A3. Metaphyseal complex (comminuted)

Partial articular (unicondylar)

- B1. Lateral condyle (fracture in the sagittal plane)
- B2. Medial condyle (fracture in the sagittal plane)

B3. Frontal (fracture in the coronal plane)

Complete articular (bicondylar)

- C1. Articular simple and metaphyseal simple (a T or Y fracture pattern)
- C2. Articular simple and metaphyseal multifragmentary
- C3. Multifragmentary articular

Materials and Methods:

40 patients with fractures of the distal femur were included in this observational study and treated with open reduction and internal fixation with the Distal Femur Locked Plating System. All clinical and radiological data were recorded from the beginning in a specifically built database. All patients gave their informed consent for surgery. Management included immobilization in above knee slab, wash and dressing of open wounds and skeletal traction.

Inclusion criteria:

All patients with fracture of distal 15 cm of femur including both intra and extra articular fracture according to AO classification.

Exclusion criteria:

- Patients treated conservatively.
- Open fracture with distal neurovascular deficit.
- Pathological/Periprosthetic fractures.

There were 31 males and 9 females. The mean age at the time of the fracture was 40 years (range 16–96). Radiographs and CT scans were obtained to establish the fracture pattern, classification and pre-operative planning. The distal femoral fractures were classified according to the AO system: there were four type 32A1, one type 32A3, two type 32B1, two type 32C1, two type 32C3, five type 33A1, four type 33A2, three type 33A3, one type 33B1, three type 33B2, one type 33B3, two type 33C1, six type 33C2 and four 33C3.

There were 17 closed (42.5 %) and 23 open fractures (57.5 %) Ten type 1, five type 2 and eight type 3 according to Gustilo/Anderson classification. Three patients with closed fractures having poor skin condition and 12 cases of open fractures (one type 1, five type 2, six type 3) were treated with temporary short-term external fixation and revised later. The mean time of delay was 16 days (range 7–25 days). Patients were evaluated by same team of surgeons and were operated through the standard lateral approach with only lateral pillar

implantation. Routine post-operative radiographs to see for union. Malalignment was defined as the presence of more than five degrees of angulation in any plane and more than 2 cm of shortening. Rehabilitation consisted of isometric quadriceps strengthening, continuous passive motion of the knee and ambulation with crutches. Patient was kept nonweight bearing for 8–10 weeks. Follow-up was done at 1,2,3,6,12,18 months to study for infection (superficial and deep), union time, reduction loss, implant failure, Knee stiffness and LLD. Union was defined as bridging of three of the four cortices on the plain radiograph in a patient who was able to bear full weight with no tenderness at fracture site or abnormal mobility. Non union was described as fractures which did not unite 8 months after surgery. Patients were assessed using the American knee society score and functional knee score.

Results:

Out of 40 patients 12 had intrarticular fracture, follow up was done for 18 months. 80% (32 patients) had fracture union without any complications with mean time of 28 weeks(range 12 – 32 weeks). Eight (20%) patients developed postoperative complication five of which had open injury at the time of presentation. One patient developed severe infection due to uncontrolled diabetes requiring plate removal. Two patients developed breakage of implant that underwent revision surgery with bone grafting.

Overall eight patients developed complications of bone healing. One due to deep infection, two fracture near the plates, five with aseptic nonunion.

Postoperative complications:

Complication		Treatment
Non union	5	orif + bonegraft
Hardware breakage	2	Orif + bonegraft
Superficial infection	3	Antibiotic and debridement
Deep infection	1	Debridement + early implant removal



Case1:25/male distal femur type C3 closed fracture.

Age incidence:

AGE	NO. OF PATIENTS	PERCENTAGE
<20 YEARS	4	10%
20-29	8	20%
30-39	11	27.5%
40-49	5	12.5%
50-59	9	22.5%
>60	3	7.5%
TOTAL	40	100%

SEX INCIDENCE:

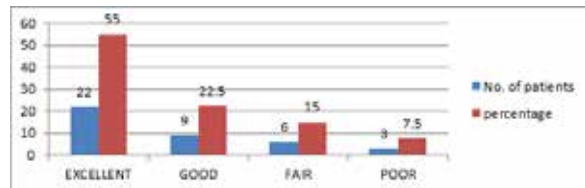
SEX	NUMBER	PERCENTAGES
Male	31	77.5%
Female	09	22.5%
Total	40	100%

NATURE OF INJURY:

NATURE OF INJURY	NUMBER	PERCENTAGE
RTA	36	90%
Fall	4	10%
Total	40	100%

FINAL OUTCOMEAS PER AMERICAN KNEE SOCIETY SCORE:

OUTCOME	NO. OF PATIENTS	PERCENTAGE
Excellent(80-100)	22	55%
Good(70-79)	9	22.5%
Fair(60-69)	6	15%
Poor(<60)	3	7.5%
Total	40	100%



Discussion

Distal femoral fractures are challenging injuries despite improvements of fixation techniques. The primary goal is to restore the axis and rotation of the injured femur along with articular surface. In high-energy injuries to the lower limb a combination of metaphyseal and intra-articular injuries is found frequently. In order to treat these complex injuries, the specific characteristics of the device used are important. Mechanically, it should provide high primary stability and yet enough flexibility to allow dynamic osteosynthesis, it should be applicable in an angular stable mode, and maintain the reduction until union. These mechanical properties should go along with an easy and flexible way of application and the possibility to use minimally invasive techniques. Some authors have demonstrated the ability of locked plates to absorb more energy before failure compared with angled blade plates or retrograde intramedullary nails, thereby having a lower incidence of loss of fixation. Although no agreement exists on management of complex distal femoral fractures, the results reported by several authors suggest modern locking plates represent an advance for fixing different fracture patterns in this region. These include either high-energy fractures with severe bone comminution that may be further complicated through open injury, fractures in older people with poor bone quality and periprosthetic fractures.

This observational study reports the experience with the Locked Plating System for treatment of distal femoral fractures. Intraoperative advantages with variable axis screws include the possibility to reduce the effects of obstacles to adequate periarticular fixation. Such devices allow maximal periarticular fragment fixation through use of multiple screws or by the option to spread screws in a remote segment.

Haidukewych et al. reported a series of 56 periarticular knee fractures (including only 25 in the distal femur) treated by using the Polyaxial plate; fracture healing was achieved in 94 % of the cases with satisfactory clinical outcomes for most of patients.

Limitations of the study includes the small study group, the variability of accidents in our area, different built of our patients and the variability with which the surgery is performed that make determination of factors that influence healing and clinical outcome difficult. There is, in addition, a lack of a control group.

Conclusion

The basic requirement during fixation of a distal femoral fracture having intra articular extension is to achieve appropriate height, proper alignment of the articular fragments and maintain their anatomical relationship with knowledge of weight bearing axis of the femur. This is possible only by proper initial management, planning the time of surgery and the quality of the surgical technique with thorough knowledge of the basic principles of fracture fixation and the ease of using the implants by the surgeon. Mini-invasive treatment seems to provide better results particularly in patient having open injury which decreases the chances of infection in such cases. All types of fractures whether open or closed, extra or intraarticular can be treated with locking plates either through open or minimal invasive techniques.

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