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# Long Term Outcome of Distal Femur Fractures Treated by Plating using Anantomic Locking Compression Plate

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**ABSTRACT**

*Treatment of complex fractures of the distal femur utilizing anatomical locking plates e.g. Less Invasive Stabilisation System is considered to be superior to conventional plating systems.*

*Method: 40 patients with a fracture of the distal femur (AO ASIF 33-A-C) were enrolled in this study from June 2011 to August 2015 at Shree Krishna Hospital, Karamsad. Clinical examination (e.g. range of motion, knee society score) and radiological analysis (e.g. axis deviation, secondary loss of realignment) follow-ups were conducted one and 4 weeks, 3 months,6 months,12 months after the operation.*

*Results: This study comprises data of 40 patients (32 male, 8 female ). Anantomical distal Femur plates provide anatomical reduction and early mobilization and thereby better outcome of treatment.*

*Conclusion: We present the analysis of a prospective study to treatment following complex fractures of the distal femur.*

**KEYWORDS : Distal Femur, Plating, Locking Compression Plate**

## INTRODUCTION:

Distal femur fractures constitute 4–7 % of all femur fractures [1]. The occurrence is bimodal, i.e. most of the younger patients sustain a high energy trauma (e.g. motor vehicle accident), whereas older patients with substantial osteoporosis usually sustain a lower energy trauma [2]. The treatment of complex fractures of the distal femur remains to be a challenge due to displacement, articular involvement, delayed union or osteoporosis. Relevant clinical problems may arise concerning postoperative functioning and integrity [3]. The goals of surgery include anatomic reduction, especially of the articular surface, axis alignment, gentle tissue handling and stable primary fixation in order to ensure rapid fracture healing with an optimal functional outcome [2]

Angle-stable locked plates have been used successfully for distal femoral fractures where the new design imparts a higher degree of stability and provides better protection against primary and secondary losses of reduction [4-12].

Fractures of the distal end of the femur continue to present a challenge to orthopaedic surgeons. Successful management requires a thorough knowledge of the regional anatomy, a comprehensive clinical and radiographic evaluation, an understanding of the "personality" of the fracture, and selection of the appropriate device. Nonsurgical and surgical treatment options exist, but the majority of supracondylar and intercondylar femur fractures are managed surgically. Several surgical options are available for fixation of distal femur fractures, including the fixed-angle blade plate, dynamic condylar screw and side plate, condylar buttress plate, intramedullary nail, distal femur locking plate and external fixator. Protocols for treatment for each patient must be individualized as patient characteristics, fracture patterns, energy imparted and soft tissue integrity vary considerably.

Multiple screws in the distal end allows for hold by multiple locking screws providing a stable osteosynthesis of highly comminuted or osteoporotic fractures.

The aim of this study was to assess the results of a series of distal femur fractures treated at our institution with the Locked Plating System.

## Methods And Material

This study was started after obtaing approval by the ethical committee of Shree Krishna Hospital and Pramukhswami Medical College, Karamsad. 40 patients prospectively with distal femur fractures who were treated and followed at our institute with distal femur plating within period from May 2010 to August 2015 meeting the following criteria:Inclusion Criteria**:**All patients with age >18 years with distal femur fracture. Exclusion Criteria**:** 1. Patients with distal femur fractures treated conservatively or with operative treatment other than distal femur locking plate. 2. Participants, those who have pathological distal femur fractures

The group included 32 male and 8 female patients. The mean age at the time of the fracture was 42 years (range 20–77). Anteroposterior and lateral view radiographs of the knee 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 eight type 33A1, eleven type 33A2, seven type 33A3, two-type 33C1, Ten type 33C2, two type 33C3.

There were 26 closed (65 %) and 14 open fractures (35 %): seven type 1, two type 2 and five type 3 according to Gustilo and Anderson classification.[13]

All patients with fresh trauma were treated in emergency with initial resuscitation followed by examination of local part and then other major/minor trauma. Initial resuscitation includes watch for airway, breathing, circulation and treatment of shock. Then examination of local part for associated injury and examination of distal part of limb for distal neurovascular deficit. In open fractures, thorough wash was given and sterile dressing was kept. Antibiotics were started. In close and open grade I & II fractures, AK slabs were given whereas in open grade III fractures, debridement and external fixation was done

The surgical technique was standardized as far as possible prior to the study. All surgeons were experienced specialists and agreed to the following procedure.

Depending on the fracture classification, a standardized antero-lateral or additional medial approach was used for the reduction of intra-articular fragments. After temporary fixation of articular fragments using screws, K-wires, or clamps, etc., the condyle block was adjusted to the axis of the femur and the whole leg. Therefore, a thorough reduction of the condyle block towards the distal femur was achieved. Then, the locking plate was adjusted and temporarily fixated using

K-wires. After intraoperative fluoroscopy control of the correct plate

position and axis of the femur, the plate was fixed.

Routine post-operative radiographs were performed and analysed. Malalignment was defined as the presence of more than five degrees of angulation in any plane. Post-operative rehabilitation consisted of isometric quadriceps strengthening, continuous passive motion of the knee and ambulation with crutches and no weight bearing for 8–10 weeks. Then, gradual weight bearing was allowed when there was evidence of progressing union on X-rays. All patients were routinely followed in the outpatient clinic; radiological and clinical examinations (1, 2, 3,6 months after surgery and then 6 monthly) were conducted and the following noted: time to union, loss of reduction, hardware failure (loosening or breakage) and local or systemic complications. Union was defined as bridging of three of the four cortices and disappearance of the fracture line on the plain radiographs for a patient who was able to bear full weight [14]. There are several published definitions of non-union, but none is universally accepted. According to Rodriguez- Merchan [15], we define non-union as a fracture that did not heal within 8 months and required second surgery. To assess loss of reduction and hardware failure, the radiographs at the latest follow-up were compared with the first post-operative ones. Patients were assessed using the Knee Society clinical rating system subdivided into a Knee Score (AKSS) based on three main clinical parameters (pain, joint stability and range of movement) and a Functional Scores (AKFS) based on the patient's perception of general knee function in specific activities (walking ability and ascending/descending stairs) [16]. This dual rating system eliminates the problem of declining Knee Scores associated with increasing age or other medical conditions. A score between 85 and 100 points is considered excellent; 70–84, good; 60–69, fair; and<60, poor.

## RESULTS

40 Patients were included in this report. They were followed up until complete fracture healing and for a minimum of 24 weeks (range 24–240) with mean follow-up of 62 weeks. At the time of last follow-up, 26 fractures (65 %) united without complication : radiographic healing occurred at a mean time of 20 weeks (range 10–40 weeks).

Six patients who reported pain and tissue irritation after fracture union underwent hardware removal with a corresponding decrease in symptoms.

Ten fractures (25 %) developed complications of bone healing : Four deep infection, Six aseptic non-union. The patients with deep infection long term IV antibiotics and debridement of wound. Two patients required implant removal and were treated with Aboe Knee slab for 6 weeks. Two patients showed signs of healing with IV antibiotics and subsequently united, although delayed as compaired to other patients.

Six patients were treated with cancellous autograft 4 weeks after the first surgery. These cases healed at about 2.5 months after second surgery.The mean Knee Score at the time of the latest follow-up was 75.5 points

(range 50–100) at a mean follow up of 62 weeks.

## Discussion

Distal femoral fractures are challenging injuries despite improvements of fixation techniques and plate designs. Some authors [17,18] 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 [4,5,7-9,11,19] 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.

Average fracture union time was 5.2 months with a range from 3 to 8 months. This is longer when compared to 4.5 months of the Yeap study [20] which was mainly because they were either open, comminuted or associated with infection.

Delayed union was reported in 6 (15%) cases. Retrospectively all were reduced by open technique, had metaphyseal comminution and 50% of them were open. These were detected on 1 month post operative x-rays by absence of callus &/or presence of void in bone at medial aspect of distal femur. All united following bone grafting which was done to hasten the healing process. Only 1 needed medial plating due to medial void in distal femur. All cases treated by MIPPO technique united without need for bone grafting suggesting more biological fixation. We had no non unions due to our protocol of bone grafting at one month post operatively. Schultz et al study [21] had 15% and Yeap et al study [20] had 10% non union rates.

Average knee ROM in our study was 97°. It was 93° in Kanabar et al study [22] and 107.7° in Yeap et al study [20]. In study done by Frankhauser et al [23] it was 113° possibly because of non inclusion of open fractures in their series.

Knee stiffness (<100 degrees flexion) occurred in 20 (50%) patients. Of these 5 had delayed union & were immobilized for prolonged period (>2 months). 4 had infection & had undergone debridement. Imperfect reduction especially intra-articular was present in all patients with knee stiffness. Knee stiffness in Kanabar et al study[22] was 62.5% and in Yeap et al study [20] was 27%.Average final knee ROM for extra articular fractures was 106.3° whereas that of intra articular fractures was 79.6°.

External fixator was used as a temporary fixation device in open grade III fractures and was replaced by distal femur locking plate as soon as soft tissue condition & general condition of the patient allowed. In this series it was done within 2 weeks. None had pin tract infection. 2 got late infections, 1 was superficial & the other was deep.4 (10%) cases had infection. 2 were open IIIA and external fixator was used for temporary stabilization. These got infected, both detected at one month post op; one was superficial and other was deep. Other 2 patients had diabetes. Hence proper debridement, early conversion of external fixator to plate and sugar control are important to prevent infection. This is similar to infection rates of Readmakers et al (10%) [24]. 8 (20%) cases had impinging screw tips at medial aspect of knee. Shape of the distal femur is trapezoidal, narrow anteriorly and wider posteriorly. So screws which appear bicortical under IITV were actually long.

Distal femur locking plates are load bearing implants. Hence weight bearing should be started after some signs of union (clinical/ radiological). In this series, partial weight bearing was started at clinical union at an average of 14 weeks and full weight bearing was allowed after radiological union at an average of 20 weeks. In Yeap et al study[20] full weight bearing walking was started at 22 weeks when there was complete bridging callus in three cortices, together with painless full weight bearing. In our study, one patient developed plate bending of 8 degrees on partial weight bearing.

Average Knee society knee score was 148.8; 80.55 (pain) and 68.25 (function), which was better than 131 of the Fankhauser et al study [23]. The scores were poor for open and intra articular fractures. Extra articular fractures had better scores than intra articular fractures. Average score for closed & open grade I fractures for Type A was 165.91 (pain 90.26 and function 75.65) and for Type C was 146.8 (pain 79.3 and function 67.5).

## CONCLUSION

Anatomical articular reduction is of utmost importance for better functional outcome though may not be possible in all cases particularly comminuted fracture patterns and those associated with bone loss. Fixation with distal femur locking plates provides reliable fixation and thus knee mobilisation can be started early post-operatively giving better final ROM & better final scores.

Ethical clearance form Human Resource Ethical Committee of the Pramukh Swami Medical College was obtained before start of the study. Written informed consent has been obtained of all the subjects before start of study.

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