Original Article
Orthopaedics

A PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF DISTAL FEMUR LOCKING COMPRESSION PLATE IN DISTAL FEMUR FRACTURES

R. Balachandran[1], C. Palanikumar[2], M. Vikram[2], M. Manikandan[3]

[1] - Professor, Department of Orthopaedics, Government Royapettah Hospital, Chennai
[2] - Assistant Professor, Department of Orthopaedics, Government Royapettah Hospital, Chennai
[3] - Junior resident, Department of Orthopaedics, Government Royapettah Hospital, Chennai

Corresponding Author
Dr. M. Vikram,
Assistant Professor
Department of Orthopaedics,
Government Royapettah Hospital Chennai.
Phone numbers: 9486825077
E-mail address: vikram.ml@gmail.com

Article submitted on: 03 June 2019
Article Accepted on: 23 June 2019

Abstract

Introduction: Fractures involving the distal femur are more complex injuries and involve about 7% of all femur fractures. It usually occurs following high velocity injury in young patients and low energy trauma in elderly osteoporotic individuals. Fixation with distal femur locking compression plate provides a stable construct by virtue of its locking screws and hence higher pullout strength.

Aim: Aim of this study is to analyse the functional outcome of distal femur locking compression plate fixation in distal femur fractures.

Materials And Methods: Subjects of this study were 21 patients with distal femur fractures based on inclusion and exclusion criteria and treated with distal femur locking compression plate. All fractures were fixed with open reduction except one patient with minimally invasive technique. Bone grafting was done in fractures with metaphyseal comminution. All patients were followed up and analysed using Schatzker and Lambert criteria.

Results: Our study had patients with minimum 8 months and maximum 3 years follow up. 12 out of 21 patients (57%) had excellent or good outcome. Fracture union occurred in 20 patients (95%) while non-union occurred in 1 patient (5%) and 6 patients (29%) had knee stiffness.

Conclusion: Distal Femur locking compression plate is an ideal implant for fixation of extra-articular distal femur fractures and provides a favorable outcome in these fractures. However, in intra-articular fractures inspite of stable fixation, it results in knee stiffness in some patients due to poor compliance during physiotherapy

Keywords: *Distal femur, fractures, locking compression plates.*

Introduction:

The fractures of distal femur are usually the result of high energy trauma. They are often very severe and difficult to treat. The principles of internal fixation must be adhered regardless of the choice of fixation. These include stable internal fixation and early active mobilization. Locking Compression plates (anatomical plate) are useful in achieving this. Our aim is to analyse Distal Femur Fractures managed with Distal Femur Locking Compression Plate fixation and study the functional outcomes using standard criteria.

Materials and Methods:

Prospective study conducted in our institution consisting 21 patients who sustained traumatic fracture of distal femur. The Distal Femur fractures were classified according to Muller classification. We had 11 patients with extraarticular and 10 patients with intraarticular fractures. Out of 11 extra articular fractures, 4 were Muller A1, 5 were A2, 2 were A3 and of the 10 intraarticular fractures,3 were C1,6 were C2 and 1 had C3 fracture. Preoperatively CT scan were taken for those patients with intraarticular extension of the fracture. All study patients were immobilized on either AK slab or Knee spanning External Fixator (for Grade II & III compound injuries) prior to surgery. The average time from admission to surgery was 11.9 days for closed fractures and 23.5 days for open fractures.

Lateral approach to Distal Femur was used for all patients. The lateral approach relies on an atraumatic elevation of the vastus lateralis from the lateral aspect of the distal femur, and a lateral arthrotomy in special circumstances (type C3) where intra articular reduction was done directly visualizing the joint (Swashbuckler approach).Plate length and screw density chosen according to the standard principles of locking plate. Bone grafting done for those fractures with metaphyseal comminution. Post-operative rehabilitation was custom made to each patient depending on the type of fracture and the stability of fixation. All patients were followed up once in 2 weeks for the initial 6 weeks, monthly intervals up to 6 months and once in 3 months after 6 months. In each visit x rays were taken to assess the progression of union, scar examined, range of movements checked and patient advised regarding weight bearing and physiotherapy. Functional outcome of all patients analysed using Schatzker and Lambert Criteria. Mean follow up period was 2 years, ranging from 8 months to 3 years.

Results:

Overall, 6 patients had Excellent outcome, 6 patients had Good outcome, 4 patients had Fair outcome and 5 patients had Poor outcome. One out of 4 patients(25%) with compound injury had favorable outcome. 6 patients had union within 12 weeks, 7 patients had union from 12 – 16 weeks, 5 patients had union from 16 – 20 weeks, 2 patients had union from 20 – 24 weeks, 1 patient had non union. Average time of healing of fractures was 16 weeks. The average knee flexion in our study was 105° (ranging from 60° - 150°). The knee flexion range varied with subtype of fracture. Regarding complications, three patients had infection. Of these patients, 2 of them had Type C2 fractures and 1 patient had Type C1 fracture. Six patients had stiffness of knee, of these patients, 1 patient had type A2 fracture, 1 patient had Type C1 fracture, 3 patients had Type C2 fracture, 1 patient had Type C3 fracture. 5 out of 6 patients (83%) with knee stiffness had intra-articular fractures. One patient with Type A2 fracture had a varus malunion of 12° and also had associated knee stiffness. One patient with Type C2 fracture had infection and developed non-union.

Fig 1 55/F, MULLER TYPE A3, CLOSED FRACTURE A) & B) Pre Op X rays C) & D) Post Op X rays E) & F) showing Excellent functional outcome

Fig 2 49/M, MULLER TYPE C1, CLOSED FRACTURE A) & B) Pre Op X rays C) & D) Post Op X rays E) & F) showing Excellent functional outcome

Table 1 showing Functional across Extra-articular/ Intra-articular fractures and Closed/Open fractures

TYPE OF FRACTURE		NUMBER OF PATIENTS	FUNCTIONAL OUTCOME (%)
EXTRA-ARTICULAR		11	Excellent & Good – 9 (81.8%) Fair & Poor – 2 (18.2%)
INTRA-ARTICULAR		10	Excellent & Good – 3 (30%) Fair & Poor – 7 (70%)
	CLOSED	6	Excellent & Good – 2 (33.3%) Fair & Poor – 4 (67.7%)
	OPEN	4	Excellent & Good – 1 (25%) Fair & Poor – 3 (75%)

Discussion:

Fractures of the Distal Femur, particularly intra-articular fractures historically have been difficult to treat. The goal of treatment in such cases is to achieve a painless stable joint with normal range of motion. This can be achieved by fixation with such a device which allows rigid fixation of the articular surface, gives respect to soft tissues and allows early weight bearing. The Locking Compression Plate is a single beam (fixed angle) construct where strength of its fixation is equal to the sum of all screw- bone interfaces rather than a single screw's axial stiffness and pull out resistance as in unlocked plates. A locking plate decreases the screw-plate toggle and motion at the bone-screw interface and provides more rigid fixation. The Distal femur locking compression plate can be used as a compression plate in simple fractures providing rigid fixation and absolute stability. It can also be used as a bridge plate in comminuted fractures where it acts as an 'internal fixator' and functions by splinting the fracture rather than compression and hence allows a flexible stabilization, avoidance of stress shielding and induction of callus formation.

In this study the functional outcome of such fractures which were fixed using distal femoral Locking Compression Plate has been assessed. The rates of union and complications are also analysed. The outcome seems to correlate with severity of fracture, anatomic reduction, bone quality, length of time elapsed from injury to surgery, concomitant injuries and proper positioning and fixation of the implant.

Fracture union occurred in 20 patients (95%) while one patient had non-union (5%). The mean time of union was 16 weeks. Closed fractures united early (15.5 weeks) as compared to open fractures (16.5 weeks). Shriharsha RV et al. in their study also observed that closed fractures united early compared to open fractures. Extra-articular fractures united early (15.09 weeks) compared to intra-articular fractures (16.55 weeks). Kiran et al reported 2 cases of non-union out of 46 patients (4.3%).

Cancellous bone grafts were used primarily in 16 patients due to metaphyseal comminution in these fractures. . One patient with Type C2 fracture was done iliac crest strut grafting in addition to cancellous bone grafting to maintain medial cortical continuity. Of these, one patient had non-union due to infection. None of the patients were done secondary bone grafting due to delay in union. The role of delayed bone grafting as a secondary procedure for treatment of cases with delayed union or nonunion was documented in a study presented by Philip et al. They documented that 7% of all fractures eventually failed to heal with secondary procedures including bone grafting. Zlowodzki et al. declared that one of the technical errors that have been reported for fixation failure was waiting too long to bone graft the defects. For a lateral distal femoral plate, plate bending induces more stresses medially leading to increased chances for implant failure. Thus, an intact or restored medial cortex of the femur is an important protector against implant failure.

One of the most common complications of distal femoral fractures is knee stiffness. The average post-operative active range of motion as reported by Seinsheimer et al was 91 degrees. Markmiller et al reported average range of movement of knee joint of 110 degrees. The average knee flexion in our study was 105° (ranging from 60° - 150°). The average knee flexion was 108° in closed fractures compared to 100° in open fractures and 119° in extraarticular fractures compared to 93° in intraarticular fractures. Shriharsha RV et al also observed that closed fractures had a better range of movements compared to open fractures and extra-articular fractures had better range of movements compared to intra-articular fractures. We had 6 patients (28.5%) with knee stiffness. Of these, 4 patients (67%) had closed injury and 2 patients (33%) had open injury and 5 intraarticular (83%) and 1 extraarticular fracture (17%). None of the patients had screw pull-out or implant failure during the course of follow up. Shriharsha RV et al. reported one case (3.8%) of implant failure in their study.

Overall, we had 57% with Excellent and Good outcome and 19% with fair and 24% with poor outcome. Analysing the outcome based on the type of fracture, 82% of patients with extra-articular fractures had excellent and good outcome, 65% of patients with closed fractures had excellent and good outcome. Whereas 30% of patients with intra-articular fractures had excellent and good outcome, 25% of patients with open fractures had excellent and good outcome.

Conclusion:

Distal Femur locking compression plate is an ideal implant for fixation of extra-articular distal femur fractures and provides a favourable outcome in these patients. However, in intra-articular fractures inspite of stable fixation, it results in knee stiffness in some patients due to poor compliance during physiotherapy. Primary bone grafting of comminuted fractures

ensures union in these fractures and strut graft may be used in fractures with medial cortical defects.

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