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Original Research Article

Functional Outcomes of Medial Column Augmentation in Comminuted Distal Femur Fractures: A Comparative Study

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Abstract:

Background: Distal femoral fractures, often caused by high-energy incidents, present challenges due to comminution and subsequent complications. Non-union of the femur, resulting from factors like severe open fractures, infections, or implant failures, leads to functional limitations and reduced quality of life. Commonly, open reduction and internal fixation (ORIF) methods are employed, utilizing various devices such as locking plates, condylar screws, blade plates, and intramedullary nails. Deformities arising from distal femur fractures demand anatomical reconstruction.

Aims and Objective: The study aims to evaluate the functional outcomes of comminuted distal femur fractures treated with lateral locking compression plate fixation and medial column augmentation using either the titanium elastic nailing system or a buttress plate.

Materials and Methods: Twenty patients aged 18 and above with comminuted distal femur fractures were included. Preoperative assessment involved clinical examination and radiographs. Surgical procedures comprised lateral plate fixation and medial column augmentation with either the titanium elastic nailing system or a buttress plate. Follow-up evaluations occurred at 4, 12, and 24 weeks to assess knee range of motion and radiological union. Outcome assessment utilized the Lysholme knee scoring system.

Results: Most patients achieved union in under 14 weeks, with an average union time of 15.15 weeks. Knee range of motion varied from <60° to >120°. Outcomes based on the Lysholme knee scoring system revealed 35% of patients achieving excellent results, 45% achieving good results, and limited complications—55% of patients had no complications, while 15% experienced knee stiffness.

Conclusion: The study underscores the efficacy of lateral locking compression plate fixation combined with medial column augmentation in managing complex comminuted distal femur fractures. This approach provides reliable fixation and favorable functional outcomes. Lateral locking compression plate fixation with medial column augmentation proves effective in treating comminuted distal femur fractures, yielding stable fixation and promising functional results.

Keywords: Comminuted Distal Femur Fractures, Medial Column Augmentation, Lateral Locking Plate Fixation, Functional Outcomes.

Introduction

Distal femoral fractures were mostly caused due to high-energy injuries, such as fall from height and road traffic accidents, and fractures were mostly several comminuted. [1]

Non-union of the femur were mostly due to severe open fracture or segmental bone loss, infection or failure of the previous implants. Nonunion of the lower extremities associated with axial malalignment, loss of ambulatory function, decreased range of motion, chronic pain and reduced quality of life. In everyday practice, distal femur fractures are commonly treated with open reduction and internal fixation (ORIF) using locking plates, condylar screws, blade plates or intramedullary nails (IMN). [2]

Deformities that occur from distal femoral fracture principally in course of the preliminary fracture displacement and secondarily with the aid of the pull of the robust musculature. Anatomic reconstruction of the articular surface can only be achieved by the plating group of implants. The stabilization of the fracture in the sagittal plane is generally tougher than in the frontal plane due to rotational deformity of the condyles. Restoration of full knee range of

motion is highly challenging in these type of fracture, as they tend to involve articular surface of knee joint [3].

Main aim of these fracture technique was to achieve near normal anatomical, stable fixation, to avoid varus and valgus angulation and achieve normal range of motion for knee joint. In this study we evaluated functional outcome of comminuted distal femur fracture treated with a locking compression plate laterally and medial column augmentation with either titanium elastic nailing system or with buttress plate.

Material and Method

The present study was done at Gandhi Medical College and associated Hamiaida Hospital, Bhopal after approval from institutional ethical committee. In this study, 20 patients were included above age of 18 years with comminuted distal femur fracture.

The inclusion criteria encompassed individuals with supra-condylar or intra-condylar femur fractures exhibiting extensive medial metaphyseal comminution or bone loss. This encompassed AO type C2 and C3 fracture patterns, medial condyle Hoffa fractures, very distal trans-condylar fractures, supra-condylar femur fractures, and patients aged 18 and above. On the other hand, the exclusion criteria comprised patients with compound Grade 3c injuries accompanied by distal neurovascular deficits, those under 18 years of age, cases of pathological fractures, and individuals with systemic conditions such as osteoarthritis, malignancy, or compromised immune states.

In preoperative planning, Clinical examination - Palpation revealed abnormal mobility and crepitus. Distal vascularity was assessed by anterior & posterior tibial artery pulsations, capillary filling, pallor and paresthesia at tip of toes. Radiograph – x-ray thigh with knee AP, lateral & oblique views, CT femur with knee with 3D reconstruction. The fractures were classified on the basis of Muller classification. Basic investigation included complete haemogram, blood grouping and viral markers. Informed written consent was taken for surgery and for bone grafting was obtained from all patients

Operative procedure: The patient was placed supine on a radiolucent table. About 30 flexion was maintained at hip and knee. A sand bag was placed under the ipsilateral buttock to avoid excessive external rotation of the lower limb. A tourniquet was used.

Lateral Plate Fixation: Skin incision- incision started from Gerdy's tubercle and curved proximally over lateral femoral condyle. Iliotibial band was divided in line of skin incision, in line of muscle fiber orientation and should be divided in one precise incision. Muscle fascia of vastus lateralis incised just anterior to lateral intermuscular septum, muscle dissected from distal to proximally. Vastus lateralis was retracted antero-medially. Perforating vessels of profunda-femoris artery and vein were ligated. To exposed intra articular surface joint capsule arthrotomy was done, joint capsule was incised over the anterior third of femoral condyle, arthrotomy was done up to lateral meniscus. Fracture sites were opened and hematoma drained, fracture fragments were cleaned and freshened. Medial and lateral condyle were reduced and reduction maintained with help of temporary k-wires and bone clamps. Distal femoral lateral compression plate was placed in position along the lateral aspect of femur. Plate was reduced to bone with help of cortical screws. 2 screws per placed proximally and 2 screws placed distally. After application of medial column augmentation by plate or nail rest of remaining screws were placed.

Medial fixation: Medial column fixation with plate- an anteromedial incision was given from anterior margin of pes unserious and followed upto the adductor canal, then the fascia enveloping around the vastus medialis incised along its posterior margin of muscle. Blunt dissection was done to elevate the muscle off the periosteum and from the intermuscular septum, from adductor tubercle to intact proximal femur shaft. Distally vastus medialis tendinous insertion was incised 3 cm wide into the medial capsule. Plate was reduced to bone with help of cortical screws, and screws were place.

Medial column fixation with tens nail: By using C-arm guidance, a 3 cm incision was given over medial aspect of distal femur over medial epicondyle. Entry portal was made with the help of curved Awl about 2cm proximal from the articular surface and at mid-point antero-laterally. First entry of bone awl was perpendicular to bone and then advance at an angle of 45 degrees to femur. Appropriate size TENS nail was pre-curved and then fixed from medial condyle into the medullary canal of the femur up to lesser trochanter. After checking final position under C-arm guidance and remaining screws were put to fix the lateral plate. The wound was then closed in layers, drain and antiseptic dressing was applied.

Result

In this study there were 5% patients were younger than 20 ,25% belong to 2nd decade ,45% patients were from 3rd decade and 10% and 15% patients were from 4th and 5th decade respectively. Mean age was 35.25 years with standard deviation of 10.1 years.

Right side was more commonly involved than left side.65% times right distal femur was involved and only 35% times left femur was involved, 5 patient had injury due to fall from height and all of them belong to age group >45 years, while 15 patient had trauma due to road traffic accident and belongs to younger age groups. In our study 40% patient came

with Muller type C3 fracture, 35% patients came with type C2 fracture, 15% came with type C1 rest 10% had A3 type fracture.

In our study out of 20 patients, in 11 patient titanium elastic nailing system was used for medial column augmentation along with distal femur locking compression plate for lateral fixation. That accounts 55% of patients. Whereas in 9 patients buttress plate was used for medial column augmentation, accounts for 45% of patient involved in our study. 3 patient presented with head injury along with distal femur fracture, 4 patients had patella fracture of same side while one had tibia fracture of same side along with distal femur fracture. In 6 patients (30%) partial weight wearing was achieved within 8 weeks. In remaining patients 14(60%) partial eight bearing was achieved in 13 weeks. In our study mostly patients achieved union in less than 14 weeks. In our study average time of union was 15.15 weeks. only 2 patient had union time of more than 20 weeks. Standard deviation was 2.92 weeks. In our study, we used Lysholme knee scoring system to evaluate patient under gone treatment. We found that 7 patients (35%) of patients had excellent result while 9 patients (45%) had good result while 3 had fair result and 1 patient (5%) had poor result. 45% of patient achieved flexion of more than 120°, 30% of patient had knee flexion in range of 91-120°, while 20% of patient had knee flexion from 61 to 90°, while 5% had knee flexion less than 60°. Patient was followed up at 4, 12 and 24 weeks for determination of knee range of motion achieved. During follow up, x-rays were done to assess radiological union.

Case 1:

Pre Op | **Immediate Post Op**

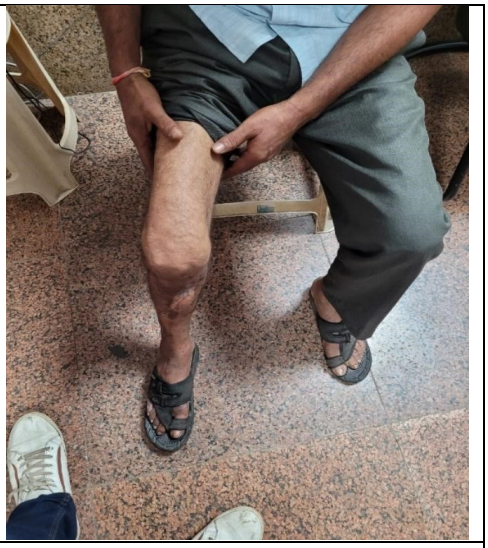
Follow-up 6 months

Figure 1:

Case 2:

Pre Op

Immediate Post Op



Follow-up 6 months

Discussion

The present study shows about management of comminuted distal femur fractures with medial column augmentation in 20 patients. The outcome of study was evaluated on the basis of Lysholme knee scoring system. [4]

Complications of distal femoral fracture included mal-union, nonunion, varus angulation. Limb length discrepancy as well as secondary osteoarthritis of knee joint leading to stiffness of knee joint. The principal of treatment in these fracture include restoration if bony congruity maintenance of good reduction and good range of motion. [5] Different type of fixation devices was used for distal femur fractures, which include angle blade plate (schatzker 1979), enders nail (kolmert 1986) and zinkel devices. Tens nail is a type of nonlocked intramedullary device which provides relative stability, while buttress plate provide more rigidity to fixation. In our study, 20 patients were selected with comminuted distal femur fracture for our study, sample size was comparable to Holzman et al. [6] and Metwaly and Zakariya [7], they have studied 22, 23 patients respectively. In current study we had patients with age group between 18-60 years, mean age was 35.25 years as compared to Anchul et al.[8], their mean age was 39.08 years. There were comparable to Anchul et al [8] where 91.3% patient had met road traffic accident while only 8.7 % had history of fall. Weight et al. reported incidence of road traffic accident in 82% of patient and rest 18% have history of fall. Patients 65% of patient had right sided injury and 35% times left side was involved in trauma. these are comparable to study done by Anchul et al [8] and Anil at al. [9] (55% have injury on right side while 45% sustained injury on left side). In current study we had augmented medial column with either plate or nail. For augmentation with plate separate medial incision was used, same

as in Sanders et al. [10] (separate medial approach), He et al. [11] (medial separate approach for medial plate). For augmentation with nail, T.E.N.S nail was used for entry 2 cm approx. skin incision was given over medial condyle and tens nail was progressed up to lesser trochanter, comparable to technique used by Anchul et al. [8]

In this study out of 20 patients, in [11] patient titanium elastic nailing system was used for medial column augmentation along with distal femur locking compression plate for lateral fixation. That accounts 55% of patients. Whereas in 9 patients buttress plate was used for medial column augmentation, accounts for 45% of patient involved in our study.

In 6 patients (30%) partial weight wearing was achieved within 8 weeks. In remaining patients 14(60%) partial eight bearing was achieved in 13 weeks. In our study mostly patients achieved union in less than 14 weeks. In our study average time of union was 15.15 weeks. only 2 patients had union time of more than 20weeks. Standard deviation was 2.92 weeks. Out of 20 patients 6 patients (30%) have range of motion between 90-120 degrees, while 9 (45%) patients had range of motion more than 120 degrees.

We used Lysholme knee scoring system to evaluate patient under gone treatment. We found that 7 patients (35%) of patients had excellent result while 9 patients (45%) had good result while 3 had fair result and 1 patient (5%) had poor result. 8 patients with C3 type fracture. among which 50% of patient achieved either excellent or good result while 1 patient with C3 type fracture had poor result that accounts for 12.5% of total C3 fracture pattern involved in study. 7 patients had C2 type fracture out of which 57 % of patient had excellent result while 43 % patient had good result no patient had poor result among these fracture. 11 patients had no complication of any type, they constitute of 55% of patient included in study, while 25% of patient present with knee pain in follow up period, and 3 patient had knee stiffness, these patients constitute 15% of total patients included in study, and only 1 patient had superficial infection.

Conclusion

Locking compression plate with medial column augmentation in comminuted distal femur fractures provides good fixation with excellent results.

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