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AO type C distal femur fracture: results of operative management in 52 patients

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Abstract

Background: Intraarticular distal femur fractures are severe injuries possess many challenges in management and associated large number of complications like infection, knee stiffness, delayed union, nonunion, instability, and post-traumatic arthritis. The advent of distal femur locking plate has improved the operative outcome of these fractures.

Aim and Objectives: This retrospective study aimed to determine the functional, clinical and radiological outcome of AO type C distal femur fractures treated with distal femur locking plate.

Level and type of study: Level 4, A retrospective study.

Methods: We retrospectively reviewed 52 patients with AO type C distal femur fracture in our hospital between January 2010 to December 2017. Patients were selected according to strict inclusions criteria and operated distal femur locking plate through medial parapatellar or modified swashbuckler approach. The functional and radiological outcome were studied using NEER knee score.

Results: Total 52 patients in which 38 males and 14 females with a mean age of 41.77 years, a mean follow up of 14.56 months were included in our study. According to AO classification, 12 patients of type C1 fracture, 14 of C2 fracture and 26 of type C3 fracture were included. Average time of union was 18.4 weeks and average NEER score at final follow up was 77.68 with 18 patients had excellent, 22 patients had satisfactory results, 7 were had fair results and 5 had poor results. The average range of flexion was 95.86°.

Conclusion: Distal femur locking plate is better to provide angular stability, multiple options to secure fracture fragments both metaphyseal and articular to restore limb length, joint congruity, and varus-valgus alignment. Along with the anatomical reduction of joint surface and rigid fixation, early mobilization and proper physiotherapy are mandatory to get the optimum outcome.

Keywords: AO type C distal femur fracture, distal femur locking plate, NEER knee score

Introduction

Distal femur fractures remain challenging injuries both for the surgeon to treat and for the patient to get full recovery to reach pre-injury state. They account for 7% of all femur fractures^[1], having bimodal distribution within the population. They present in younger patients due to high-energy injuries, such as motor vehicle collisions or falls from height, the incidence of high-velocity trauma causing fracture is increasing now a days^[2, 3]. In elderly patients, these fractures are often due to low-energy trauma such as domestic falls with underlying osteoporosis. According to Muller, this fracture is classified according to their location and pattern in three types, type A (extraarticular), type B (condylar or partial articular), and type C (bicondylar or complete articular)^[4]. Types A and B are less-complicated variety requires less invasive surgery compared to type C, associated with more soft tissue injuries. The management of intraarticular distal femur fractures is always difficult with a wide range of potential complications like delayed union or non-union, mal-union, infection, joint contracture, knee instability, and post-traumatic arthritis.

Previously the trend in the treatment of these fractures leaned towards closed conservative management with traction, casting, or a combination of both. The problems associated with conservative management are the limitation of reduction and difficulty of maintaining reduction. ultimately leading to a large number of complications^[5-9]. Since the 1970s as orthopedic surgery has evolved,

the trend has shifted towards the operative management of these fractures. The AO principle in the operative treatment of intra-articular fractures involves anatomical reduction of the articular surface of the fracture, rigid fixation and early mobilization. Various implants like 95° angled blade plate, dynamic condylar screw plate, condylar buttress plate have been used but the results have been better compared to those with conservative management [10-14]. The advent of Distal femoral management of these challenging fractures. The advent of Distal femoral locking compression plate (DF-LCP) has promised excellent results in the management of these challenging fractures. As a result we have decided to study the treatment of these fractures using distal femoral locking compression plate in patient with supracondylar femur fracture with intraarticular extension in Indian scenario aiming to study functional, radiological and clinical outcomes and find out the answer we are searching for that are we able to find the solution of intraarticular distal femur fracture or not.

Materials and Methods

We retrospective reviewed 52 patients with distal femur fractures with intraarticular extension operated during the period of January 2010 to December 2017 at our institute. All the patients are included according to strict inclusion and exclusion criteria.

Inclusion criteria

- All patients of the age of 18 yrs or above both male and female.
- Close or open grade fractures C-1, C-2 or C-3 type according to AO classification.
- Patients with follow up minimum 12 months.

Exclusion criteria

- All distal femur fractures of type A and B according to AO classification
- Conservatively treated patients
- Patients with vascular injury.
- Pathological fracture
- Peri-prosthetic fracture

All injuries were attended immediately and the patient was hemodynamically stabilized. Distal neurovascular status was assessed and other Injuries like other fractures, abdominal or head injuries are addressed immediately. Distal femur fractures were immobilized with above knee slab or skeletal traction with upper tibial or preferably lower tibial Steinman pins and kept over Bohler frame. The patient was investigated for blood-chemistry, radiologically in form of roentgenograms (AP and lateral views of the involved part plus routine trauma series of X-rays), ultrasound of abdomen or chest and CT Scan of the lower femur with 3D reconstruction. All patients underwent definitive fixation in the form of distal femur locking plate but In certain circumstances like open fractures with significant wound contamination, severe soft-tissue swelling, significant patient co-morbidities temporary, spanning, external fixation was done according to the principle of Damage Control Orthopaedics [15].

Surgical technique

The patient was positioned supine on a radiolucent table that allows fluoroscopic imaging in both planes with knee was placed in slight flexion over a small sandbag or a triangular frame to improve the sagittal plane reduction of the fracture by relaxing the primary deforming force of the gastrocnemius. In all AO type C distal femur fracture we kept midline incision of 15 cm and we took median parapatellar approach or modified swashbuckler's approach according to fracture geometry usually in medial condylar fracture or comminution we took median parapatellar approach After exposing the fracture site, first we fixed medial or lateral condyle Hoffa's fracture with 6 mm or 4.5 mm cannulated cancellous screw followed by intraarticular reduction and fixation with 6mm cannulated cancellous screw. After confirming anatomical intraarticular reduction, final fixation was done by distal femur locking plate of the proper size. The plate is inserted proximally from the wound in the sub-muscular plane and proximal screws are inserted by simple stab incision. We kept an additional 3.5 reconstruction plate or dynamic compression plate over antero medial aspect of the distal femur in large comminution, medial condyle fracture, and a highly unstable fracture to provide extra stability. Surgical wound was closed in layers after confirming proper reduction and fixation in layers with drain. Above knee splint was applied postoperatively and drain removed on the 2nd day, stitches were removed on 15th day postoperatively. Knee bending usually started with in 3 to 4 weeks depending upon bone quality and strength of fixation. Patients were followed up regularly and functional and radiological results were recorded according to NEER score. Functional grading was done according to pain, function, mobility and work while radiological grading was done according to varus/valgus deformity and status of the union. According to fracture union status both clinically and radiologically partial and full weight bearing started.

Results

This is a retrospective study of 52 patients with AO type C distal femur fracture with a mean age of 41.77 years, 38 patients were male and 14 were female, right side(34) is more common than left(18). Most common mechanism of injury was road traffic accident in 39 patients followed by domestic fall in 14 patients. 38 patients had a closed fracture as compared to 14 patients had open fractures. According to AO classification, 12 patient was having type C1 fracture, 14 patients were having type C2 fracture and 26 were having type C3 fracture. In our study 33 patients were operated within 3 days of injury, 12 patients were operated within 7 days and 7 patients were operated after 7 days due to bad local wound and or other co-morbidities polytrauma, abdominal/chest, head injuries etc. The average duration of surgery was 112 minutes (90-210) and blood loss was 278 ml (210-450). Only those patients having followed up of 12 months were considered in our study with the mean follow up 14.56 months (12-56). The average time of union was 18.4 weeks and average NEER score at final follow up was 77.68 with 18 patients was having excellent results, 22 patients were having satisfactory results, 7 were having fair results and 5 had poor results. The average range of flexion was 95.86°(45°-130°).

| Type of Fracture | Number | Excellent | Satisfactory | Unsatisfactory | Poor |
|------------------|--------|-----------|--------------|----------------|------|
| C1 type | 12 | 4 | 5 | 3 | 0 |
| C2 type | 14 | 8 | 5 | 1 | 0 |
| C3 type | 26 | 6 | 12 | 3 | 5 |
| Total | 52 | 18 | 22 | 7 | 5 |

In our study, 2 patients developed superficial skin infection which was treated with antibiotics and regular dressing and healed completely and 2 patients developed deep infection for which serial debridement was done. 1 patient required

removal of implants. 8 patients had extension lag of 10° and 3 patient had 5° extension lag. 4 patients had delayed union and 1 had nonunion and broken implant later on required bone grafting and revision implantation.



Fig 1

Fig 2

Fig 3



Fig 4a

Fig 4b

Fig 4c

Case 1: A 28 yr old male patient having H/O RTA, had # Rt. Supracondylar femur type C-3 treated with DFLP, # united in 4 months, having the range of movement 0°-120°. He is able to squat and do crossed leg sitting also.

Fig 1: Preoperative Xray

Fig 2: Postoperative Xray

Fig 3: 6 month follow up x-ray showing full union

Fig 4: a, b, c: Clinical photos

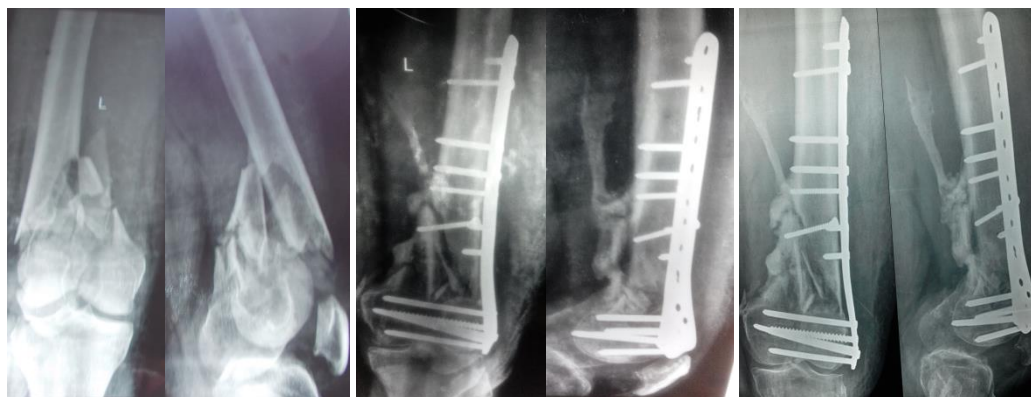


Fig 5

Fig 6

Fig 7



Fig 8a

Fig 8b

Fig 8c

Case-2: A 52 yr old male patient having H/O RTA, had # Lt. Supra-condylar femur type C-2 treated with DFLP, # united in 5 months, having the range of movement 0°-100°.

Fig 5: Preoperative Xray

Fig 6: Postoperative Xray

Fig 7: 6 month follow up x-ray showing full union

Fig 8: a, b, c: Clinical photos

Discussion

Intraarticular supracondylar fracture of the femur is a complex injury that poses various challenges for the orthopedic surgeon starting from management of fracture to a protracted recovery of the patient with a very high potential of long-term disability like joint stiffness and mal union being the major culprits. These fractures have remained an unsolved problem in orthopedic trauma for many years. The most common mechanism of injury for this fracture is road traffic injury, a high-velocity trauma leading to massive soft tissue trauma and metaphyseal comminution being one of the factors for poor outcome. In our study also road traffic accident is the most common mechanism. With advances in industrialization, globalization, acceleration in travel and ignorance of road safety measures, the incidence of a vehicular accident has increased a lot nowadays. Most common fracture seen in our study was type C3 fracture as a result of increasing incidence of vehicular accidents. Not only the primary trauma but surgical trauma is also one of the major cause for the poor outcome in type C fracture as an extensive surgical approach is required to visualize and reduce the articular fragments.

Multiple surgical approaches have been described previously to obtain a good exposure of distal femoral articular surface, including medial parapatellar approach^[16], lateral parapatellar (anterolateral) approach^[17], modified swashbuckler approach^[18], tibial tubercle osteotomy^[19, 20] and combined medial and lateral approaches^[21]. We used medial para patella and modified swashbuckler approach in our study according to the location of comminution, but we had limited our incision in the midline and also in the medial parapatellar approach we had limited our approach to the splitting of quadriceps tendon rather than splitting of quadriceps muscles. We used both of this approach for intraarticular reduction and fixation only, metaphyseal and diaphyseal reduction and fixation done by retrograde plate osteosynthesis by sliding plate in submuscular plane and fixation done by putting small stab incision over the lateral surface of thigh as in MIPPO. Various implants like 95° angled blade plate, dynamic condylar screw plate, condylar buttress plate had been used but the results have been far from satisfactory. The advent of Distal femoral locking compression plate (DF-LCP) has promised excellent results in the management of these challenging fractures. Depending on the desired function Distal Femur Locking Plates (DFLP) can be applied as a conventional dynamic compression plate providing absolute

stability, internal fixator providing relative stability by bridging the fracture zone according to Less Invasive Stabilization System (LISS) principles and in combined fashion where both techniques are employed (combination technique) using conventional lag screws as well as locked screws^[22]. We have also used other reconstruction plate or dynamic compression plate over anteromedial aspect surface in case of large comminution, severe osteoporosis, and highly unstable injury to provide stability and to prevent future varus collapse.

We have compared results of our study with Manohar G, Shibu Andrews Study (2012)^[23] and Siliski' S Study (1989)^[24]. In Manohar G, Shibu Andrews Study 25 cases of supra-condylar and inter-condylar fractures (type C) of femur treated with different implants like Dynamic Condylar Screw (DCS), Locking Compression Plate (LCP) or Condylar Buttress Plate (CBP). Average Knee flexion after the union was 75.6° as compared to 95.86° in our study. Average fracture union time was 22.26 week as compared to 18.4 weeks in our study. In Siliski' S Study (1989), 52 cases of supra-condylar and inter-condylar fractures (type C) of femur treated only by operative means with different implants like condylar blade-plates, condylar buttress plates, and T-plates. Average Knee flexion after union was 107° and union time was 13.17 weeks which is better than our study. In our study average flexion was 95.86° and 8 patients had extension lag might be due to failing to start early mobilization and aggressive physiotherapy due to unavailability of trained physiotherapist in the rural area, lack of understanding of the importance of physiotherapy on part of the patients, osteoporosis, and refusal for further treatment for knee stiffness in the form of manipulation under anesthesia and arthroscopic adhesiolysis.

The strength of our study is an inclusion of only intraarticular distal femur fractures (AO type C) also the good number of patient and the longer period of follow-up. The limitation of our study is its retrospective nature and surgery was performed by different surgeons with different level of skill and experience which would again affect the final outcome.

Conclusion

Management of distal femur fracture with intra-articular extension is always going to be a challenge for the orthopedic fraternity. Anatomical reduction and rigid fixation of the intraarticular fracture, early mobilization, and aggressive

physiotherapy are mandatory for optimum outcome. Distal femur locking plate provides angular stability, multiple options to secure fracture fragments both metaphyseal and articular to restores limb length, joint congruity, and varus-valgus alignment.

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