Original Research Article

Functional Outcome Of OTA Type-C Distal Femur Fracture Fixed With Locking Compression Plate

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Abstract

Background:A distal femur fracture is a very complex injury constituting about seven percent of all femur fractures and a huge surgical challenge to restore function. The aim of this study is to access the functional outcome and the complication of distal Orthopaedic Trauma Association type C femur fracture using a locking compression plate.**Material and Methods:**A total of 35 cases was recruited as per inclusion and exclusion criteria. All the distal femoral fractures were treated with a distal femoral locking compression plate. The patients were followed up at 1, 3, 6, and 12 months respectively. There were 27 males and 8 females with a mean age of 48.5 years (range 25–94). The greater part of the cases was of type C2 (AO classification) and was due to high energy trauma. The functional outcome was assessed using the NEER's criteria. **Results:**In this study, the average time of the union of fracture was 16 weeks (14-22weeks). In 26 cases (75%) we obtained satisfactory to excellent results. Post-operative complications associated with the fracture were knee stiffness six (17.1%), varus deformity in three (8.5%), shortening in five (14.2%), and two (5.7%) superficial wound infections. **Conclusion:**LCP plate is an effective method in distal femur fractures. It gives excellent stability and helps to maintain the length and alignment of the limb preventing metaphyseal collapse. It is also effective in osteoporotic fractures and reduces compression of periosteal vessels.

Keywords: Distal Femur, OTA Type C, Locking compression Plate

Introduction

Distal femur fracture incorporates the fractures of the supracondylar and intercondylar region of the femur bone. These are common injuries and constitute about seven percent of femoral fractures with a bimodal distribution. [1] Due to variation in the age group, a different group of fractures have to been managed separately as functional demand varies with the different age group. In young adults, these are mostly associated with high-velocity injuries like RTA or fall from a height so are more commonly associated with other fractures whereas these constitute fragility fractures due to osteoporosis in the geriatric population and may occur due to trivial trauma. [2]

Treatment of distal femur fractures has been challenging as the functional outcome is variable, there are many deforming forces around the knee which imposes major challenges to restore anatomy without injuring them [3] .The involvement of the knee joint is a very important aspect of treating distal femur fracture. In osteoporotic elderly patients with relatively weak bone quality, it is very difficult and challenging [4]. Maintaining the reduction and nature of bone with bone loss, so locking compression plate use has an advantage. The distal femur fracture requires absolute anatomical reduction of the articular surface, restoration of limb length, alignment, and early mobilization for better functional results [3].There have been many devices which have come up for the treatment of Distal femur Fractures like Angle Blade Plate, Dynamic Condylar screw, Condylar buttress plate, Flexible Nails, Intramedullary Nail, External fixators and Even total Knee Replacement[3] . With the advancement in technology still, osteosynthesis has a greater advantage. Current distal femoral locking compression plate has multiple advantages over older ones, as they are anatomically contoured and forms a better construct with the bone, the dual advantage with a combination of conventional compression and locked plating technique [5] . It also reduces soft tissue problems and acts as an internal-external fixator to provide more stable fixation which is a key factor in the successful treatment of these fractures. The placement of the plate is such that there is no contact with bone directly which helps in the preservation of periosteal blood supply. They can be used in metaphyseal comminution. It also provides a useful choice for extra-articular fracture of the distal femur. Also, it does unicortical fixation and there are least chances of the plate back out as the screw gets locked to the plate. The pull-out strength of the locking screw is higher than the conventional screw and is particularly useful in osteoporotic bone. These plates are designed to apply in a minimally invasive fashion to preserve local biology and avoid problems with fracture healing and infection. [5] .Disadvantages to these plates include not being a fixed-angle device and thereby relying on the friction of the bone-plate interface. Due to the eccentric mechanical

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axis of the femur, screw loosening can occur, causing the typical varus deformity [5].Fracture healing is the most important aspect so we opted for a LCP for fixation of distal femur fracture with the advantage of Easy insertion, multiple screw holes, easy to contour, useful features for multifragmentary fractures but may require medial support [3] . We assessed the distal femur outcome using NEER's Questionnaire criteria [6] accessed the clinical and radiological parameters of OTA Type 3 C fractures.

Classification

AO classification [7] has been well accepted all the over world and has standardized the treatment protocol for fracture management. The AO/OTA system broadly classifies the fracture into 3 Types i.e. A (Extra-articular), B (Partial-articular), and C (Intra-articular). Further, it is sub-classified on the degree of comminution and fracture pattern. Type C fractures are divided into C1 (simple articular, simple metaphyseal), C2 (simple articular, multi-fragmentary metaphyseal), and C3 (multi-fragmentary). (Figure 1)

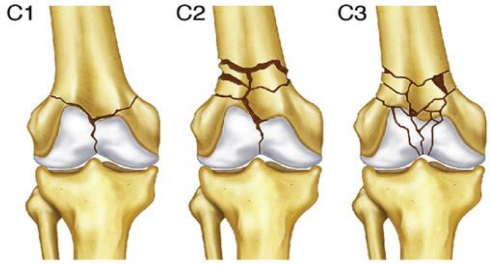

Fig 1: Classification

Materials and Method

After the local ethic committee approval and proper consent from patient, we conducted our study. It was a prospective observational study done for a period of over 2 years September 2018- September 2020. All the distal femur fracture treated with anatomical locking compression plates were included in the study. Inclusion criteria were 1. Patients above 18 years of age. 2. Closed distal femur fracture Type C1, C2, C3. Exclusion criteria were 1. Any other ipsilateral long bone fracture. 2. Any pathological fracture. 3. Patients with compound fractures , 4. associated ligamentous injury, 5. Delayed and neglected cases.

Surgical Technique

All the patients were operated on with Subvastus approach to distal femur (Figure). The fracture reduction was done under fluoroscopic guidance or direct vision as per the fracture pattern. The Intra-articular reduction of fracture ends was obtained and fixed temporarily with multiple K wires. Indirect reduction of the articular surface with femoral diaphysis was done under fluoroscopic guidance. Plate Length was determined intraoperatively after fracture reduction. Usually, we prefer the length of the plate which is three times the fracture comminution segment. For proximal fixation four bicortical screws were used percutaneously. A minimum of five locking screws was used for distal fixation. One or more partially threaded cancellous screws were used in the intercondylar region whenever required to achieve compression and articular reduction. The position of the plate was confirmed under fluoroscopic guidance in both Anteroposterior and lateral views. No screws violated the intercondylar notch area.

Fig 2: Sub vastus Approach

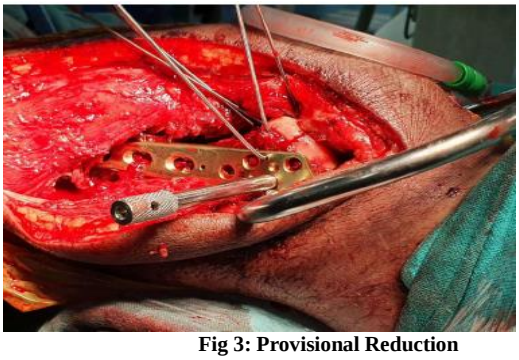

Fig 3: Provisional Reduction

Outcome Assessment.

All patients were followed up at regular intervals at 1, 3, 6, and 12 months. The clinical and radiological evaluation was done to assess fracture healing. Three cortex union i.e. in anteroposterior and lateral radiographs showing the callus were considered a fracture union. NEER's Criteria were used for functional and anatomical outcomes. Clinical signs of loss of tenderness at the fracture site, joint line tenderness or suprapatellar knee pain, limb length disparity, knee range of movements, and coronal plane deformity was assessed at each follow-up.

Results

A total of 35 cases of fractures of the distal femur (Type -C) were included in our study. Among all type C fractures most common was OTA TYPE C2 15 (42.85%) followed by C1 12 (34.28%) and C3 Eight (22.85%). The mean age group was 48.5 years with the oldest being aged 94 years and the youngest being aged 25 years. High-velocity injury i.e. RTA was the most common cause of the fracture and constitutes about 26 (74.28%) followed by trivial fall nine (25.72%) of these all were among the age group of more than 50 years. Male are more prone to isolated femur fractures in proportion to females i.e. 77.14% to 22.86%. Laterality of injury was more on Right than Left 65.7% to 34.3%. (Table 1)

Table 1: Demographic Data

Total Number of Patients	N = 35
Sex	Male = 27 (77.14 %) Female = 8 (22.86%)
Age	18-50 = 22 >50 = 13
Laterality	Right = 23 Left = 12
Mode of Injury	RTA = 26 (74.28%) Fall = 9 (25.71%)
Fracture Subtype	C1 = 12 (34.28 %) C2 = 15 (42.85 %) C3 = 08 (22.85 %)

Table 2: Outcome Data

Bone loss	6
Union	16 weeks (14-22)
Neurovascular Injury	0
Deep Infection	0
Superficial Infection	2
Loss of Reduction	0
Shortening	5 (0.5- 1cm)
VarusMalalignment	3 (2-6º)
Knee stiffness	6

Primary Bone grafting was done in Six (17.14% cases) of which Five (14.2%) were in the age group of more than 50 and one (2.8%) in the age group of <50. The radiological union was achieved at an average of 16 weeks with a minimum-till 14 weeks and a maximum of 22 weeks. Early complications were Superficial Skin infection in 2 cases which resolved with regular dressing and IV antibiotics, there were no cases of deep infection or neurovascular injury. Late complications were knee stiffness in six (17.1%), varus deformity in three (8.5%) and shortening in five (14.2%) patients. (Table 2).The functional and anatomical outcome was measured with NEER's criteria as scoring was done and classified as per the scoring system. Excellent >85, Satisfactory 70-85, Unsatisfactory 55-70 and Failure <55. In our study excellent results found in 9 cases, satisfactory results in 17 cases, unsatisfactory results in 6 cases and failure results in 3 cases. In our study 3 cases had function (walking capacity) as before surgery, 10 cases had mild restriction while walking, 16 cases had a restriction on stairs, 5 cases had severe walking restriction and 1 case had crutch walking. In our study 4 patients had >135º of knee flexion, 17 patients had 100º of knee flexion, 9 patients had up to 80º of flexion, 2 patients had up to 60º, 2 patients had 40º of knee flexion and 1 patient had no movement at the knee with knee stiffness at 10º of knee flexion. In our study 4 patients had the same work capacity as they had before the injury. 16 patients doing their work regularly but handicapped, 11 patients had altered work capacity postoperatively and 4 patients had a light work capacity.

Fig 4: Preoperative

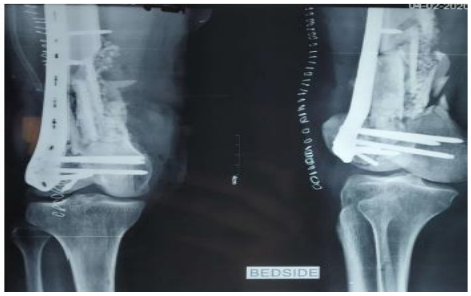

Fig 5: Postoperative

Fig 6: 1 Year followup full knee bending

Fig 7: FFD of 20'

Discussion

Intercondylar fracture of femur management is challenging as it is associated with a lot of complications and failure. [2] Most of the surgical failures are due to inadequate fixation of the fracture fragments.With the improvement in implants and surgical techniques, there have been good to excellent results in their injuries. [3] Early surgical stabilization can facilitate the care of the soft tissue, permit early mobility and reduces the complexity of nursing care.[3] Many implants have been designed for distal femur like condylar buttress plate, LCP Condylar plate. LCP decreases the screw-plate toggle and motion at the bone screw interface and provides more rigid fixation. Rigid fixation is felt to be one key to the successful treatment of these fractures. The conventional plates are associated with their own demerits such as screw pull out, implant failure and unstable fixation needing postoperative immobilization. Delay in postoperative mobilization results in stiffness of the knee which is an indicator of poor outcome. Fixation in osteoporotic and comminuted fractures which was difficult previously now can be addressed with the evolution of LCP condylar buttress plate for distal femoral fractures especially for the comminuted intraarticular fractures many of the older demerits could be addressed which includes the increased stability due to locking compression plating principle, multiple screw options in the distal fragment providing an option for fixing the multiple fragments restoring the anatomical congruity and providing stable fixation of the distal fragment with the proximal fragment with resulting increased stability allowing for early mobilization. [3]Our study showed a majority of injured patients were males (77.14%) indicates that males are more involved in outdoor activities and highest number of patients were in their 4th decade about 25.71% with Road traffic accident being the most common mode of injury 74.28%. The average time of union of fracture was 16 weeks. SILISKI et al. [8] reported union at 13.6 weeks, GILES et al [9] obtained union at 16 weeks, Olerud et al [10] obtained in 18.2 weeks, Mize et al [11] and Stewart et al [12] found union in 20 and 17.6 weeks respectively. Postoperative assessment showed a Low VAS score but few patient had persistent pain Post surgery which is about %. There was there was only two cases of superficial infection which were treated with systematic and local antibiotics and were uneventful postoperatively. There was no cases of deep infection in our study. With compared to others Kregor et al [13] had three deep infections. In a series of 35 cases reported by Stewart [12] five patients had an infection. Out of the four patients had a superficial infection, while one patient had osteomyelitis. Return to the activity of daily living was achieved only by three patients, 10 had mild restriction in walking, 16 had difficulty on stairs and one patient persisted with walking with a crutch. 4 patients had >135o of knee flexion, 17 patients had 100o of knee flexion, 9 patients had up to 80o of flexion, two patients had up to 60o, two patients had 40o of knee flexion and 1 patient had no movement at the knee with knee stiffness at 10o of knee flexion. 4 patients had the same work capacity as they had before the injury.16 patients doing their work regularly but handicapped, 11 patients had altered work capacity postoperatively and four patients had a light work capacity. In this case series, 27 cases had good anatomical restoration and 5 patients had shortened and 2 patients had varus deformity. One patient had shortening with varus deformity, five patients had knee stiffness and one patient had a wound gap. Kim K J et al [16] reported two cases of postoperative infection and shortening respectively which were treated with antibiotics and Shoe raise postoperatively. In our case, the shortening was about the range of 0.5- 1cm, and no intervention was done for Limb Length discrepancy. No implant failure occurred in our study which is similar to the study by Rajaiah et al [17]. Yeap and Deepak et al [18] reported one case of implant failure.We had 75% good to the excellent outcomes as per NEER'S score in our study. Compared to Ketterel et al [14] they found 90% good to excellent outcome in their study and Hann et al [15] found 86% good to excellent outcome. Yeap and Deepak et al [16] reported one case of implant failure.

Conclusion

LCP acts as an extramedullary load-bearing device, stabilizing fracture fragments and ensuring early bony union. The LCP has shown excellent to satisfactory results in the majority of intra-articular fractures(AO type C) with the restoration of good functional outcomes as this implant prevents the metaphyseal collapse,maintain the limb length in severely communited fractures. It also prevents the compression of periosteal blood vessels. . One of its greatest applications is in osteoporotic fractures where it may provide a solution to the problems of screw pull out, late collapse, and malalignment since the stability of the construct does not entirely depend on the quality of the bone.

Limitations

Longer duration of study would help to understand the long term outcome and complications associated to fracture and management. Larger study group would help to understand different variables associated with the fracture.

Conflict of Interest: Nil Source of support:Nil

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