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Outcome of intra articular distal femur fracture treated with locking compression plate

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Abstract

Background: Distal fractures of the femur especially comminuted, intra-articular distal femoral fractures AO classification 33-C remain challenging fractures for orthopaedic surgeons. Due to soft tissue damage, comminution, articular involvement and extensor mechanism injury functional outcome is poor in fracture distal femur.

Materials and Methods: We have done prospective study of 20 patients of intraarticular distal femur fracture AO classification 33-C treated operatively with locking compressive plate at S.S.G. hospital and medical college, Baroda during January 2014 to March 2016. We have studied functional outcome using neer's score, radiological outcome and complication associated with fracture fixation using LCP.

Result: Out of 20 patients 14 were males and 6 were females. The youngest patient was 18yrs old and the oldest 70 yrs. 4 patients had C1, 10 pt had C2 and 6 pt had C3 type of fracture according to AO classification, 12 patients were operated with extensile lateral approach. 8 patients were operated using Swashbuckler approach. In 3 patients primary bone grafting was done for severely comminuted type C3 fracture. Secondary bone grafting was done in 1 delayed union case at 4 month. Pt shows sign of union at 9 month. 1 Pt develop non-union treated with secondary bone grafting at 9 month with signs of union at 12 month. 1 pt develop infection on 4th post-operative day resolved with surgical debridement and antibiotic. The average duration of weight bearing was 12 weeks. Average time for fracture healing was 20 weeks. Average range of motion of knee was 110 degrees. Among 20 patients there were 9 excellent result, 5 good results, 3 had fair results and 3 had poor results.

Discussion: The LCP acts on the internal fixator principle as screws once locked to the plate do not pull the fracture towards the implant, and hence there is no displacement of the fracture once reduced. Distal femur locking plate provides angular stability and provides multiple options to secure fracture fragments, both metaphyseal and articular. In our study we get better functional outcome using locking compression plate for intraarticular distal femoral fracture. Along with anatomical reduction and rigid fixation, early mobilization and aggressive physiotherapy are key for better functional outcome.

Conclusion: In present study better functional outcome achieved using locking compression plate for intraarticular distal femoral fracture along with aggressive physiotherapy.

Keywords: Intra articular distal femur fracture, Locking compression plate, Neer's criteria

1. Introduction

Distal fractures of the femur especially comminuted, intra-articular distal femoral fractures AO classification 33-C remain challenging fractures for orthopaedic surgeons. Incidence of fracture of distal femur is 7 percent. There is a bimodal distribution of fractures based on age and gender. High-energy distal femur fractures occur in males between 15 and 50 years due to road traffic accident, while low-energy fractures occur in osteoporotic women >50 years due to simple fall [1]. Due to soft tissue damage, comminution, articular involvement and extensor mechanism injury functional outcome is poor in fracture distal femur. In elderly patients, extreme osteoporosis represents a particular problem for anchoring the implant [2]. No single method of management has overcome all of problems associated with these injuries [1]. Thin cortices, short articular segment, osteoporosis, articular involvement, comminution make stable internal fixation difficult to achieve [3].

Various implant evolved over a time for intra articular fracture of distal femur. In the 1990s, the success for distal femur fractures were reported using conventional implants including the dynamic condylar screw, angled blade plate, and condylar buttress plate [4-6]. The next step in the evolution, plating of intra articular distal femur fractures was the introduction of locking

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compression plates. Since the LCP can be used as a conventional plate using only dynamic compression, as a pure internal fixator using locking head screws, or as both combined, it provides the surgeon with multiple variations [7]. Distal femoral locking compression plates are anatomically contoured and have multiple locking screw options distally to allow for secure fixation in patients with osteoporosis, fractures with metaphyseal comminution where the medial cortex cannot be restored, or a short articular segment [8-9].

2. Materials and Methods

We have done prospective study of 20 patients of intraarticular distal femoral fracture AO classification 33-C treated operatively with locking compressive plate at S.S.G. hospital and medical college, Baroda during January 2014 to March 2016. We have studied functional outcome using neer's score, radiological outcome and complication associated with fracture fixation using LCP.

Inclusion criteria

1. All patients of age of 18 years or above both male and female.
2. Close or open grade fracture C1, C2, C3 according to AO classification.

Exclusion criteria

1. Conservatively treated patients.
 - Patients who were bed ridden or non-ambulatory.
 - Patients with severe life threatening medical problems.
2. Pathological fracture
3. Peri-prosthetic fracture
4. Patients with vascular injury.

2.1 Surgical techniques

- All Patients were operated under combined spinal and epidural anaesthesia.
- Patients were placed in supine position on operating table slightly elevating the affected side with a sandbag under ipsilateral hip. Knee is placed in slight flexion over a small sand bag or a triangular frame.
- Skin at the operating site was prepared by povidone iodine (10% w/v) solution and spirit and the operating field from the buttock to the knee was draped.
- We have used extensile lateral and Swashbuckler approach for most intra articular distal femoral fracture.
- Swashbuckler approach midline incision from above the fracture laterally to across the patella. Fascia overlying quadriceps is incised longitudinally. Further laterally fascia over quadriceps becomes confluent with iliotibial band. Lateral parapatellar arthrotomy is performed. Proximally arthrotomy incision is made between vastus lateralis muscle and lateral retinaculum of knee using trapezoid shape incision. Proximal release of vastus lateralis fibers from lateral intermuscular septum allow further mobilization of quadriceps.
- Anatomical reduction of articular surface done and provisionally stabilize them with k wires. Articular reduction maintained using lag screw and LCP.
- Proper size of plate selected. After proper placement of plate place the fixation screws in accordance with the biomechanical principal of fixation, placing screws close to and far away from the fracture, Insert minimum 5 screws including lag screws and locking head screws in distal fragment and minimum 4 screws in proximal femoral segment.

- Autologous cancellous bone grafting done for bone loss and severe comminution.
- We closed joint capsule arthrotomy with absorbable suture. Fascia of vastus lateralis and iliotibial band and subcutaneous tissue closed with absorbable suture. The skin wounds were closed over a negative suction drain after thorough washing with copious amount of sterile saline solution and sterile dressings applied over the limb.

2.2 Postoperative Protocol

- Antibiotics was administered as per hospital protocol. Anti-inflammatory, analgesics and other supportive measures were also given as per individual requirements. The suction drain was removed after 48 hrs and check x-ray of the limb was taken.
- Patients were allowed to sit once the drain was removed. Knee range of movements, active quadriceps and hamstring exercises were started, as soon as patient could tolerate pain from immediate post-operative day. Mobilization with Non weight bearing was started from the first post-operative week till 6-8 weeks depending on the fracture pattern and then partial weight bearing after confirmation of beginning of healing process till fracture union.
- Patients were followed up every month until fracture union. Subsequently at 6th month, 9th month and 1 year. During follow up patients were assessed clinically, radiologically and functionally by Neer's criteria.

3. Observations and Results

We have done retrospective study of 20 patients of intraarticular distal femoral fracture AO classification 33-C treated operatively with locking compressive plate at S.S.G. hospital and medical college, Baroda during January 2014 to March 2016. We have studied functional outcome using neer's score, radiological outcome and complication associated with fracture fixation using LCP.

- Out of 20 patients 14(67%) were males and 6(33%) were females, 13 patients had right sided and 7 had left sided fracture
- The youngest patient was 18yrs old and the oldest 70 yrs. About 75% patients had sustained road traffic accidents and 5% had sustained a fall from height.
- 4 patients had C1, 10 pt had C2 and 6 pt had C3 type of fracture according to AO classification
- Average trauma to operative interval was 3 days. 12 patients were operated extensile lateral approach. 8 patients were operated using Swashbuckler approach.
- In 3 patients primary bone grafting was done for severely comminuted type C3 fracture. Secondary bone grafting was done in 1 delayed union case at 4 month. Pt shows sign of union at 9 month. 1 Pt develop non-union treated with secondary bone grafting at 9 month with signs of union at 12 month.
- 1 pt develop infection on 4th post-operative day resolved with surgical debridement and antibiotic.
- 3 pt develop knee stiffness which is a common complication in intraarticular fractures.
- The average duration of weight bearing was 12 weeks. Average time for fracture healing was 20 weeks. Average range of motion of knee was 110 degrees.
- Among 20 patients there were 9(45%) excellent result, 5(25%) good results, 3(10%) fair results and 3(15%) had poor results.

Table 1: AO classification of fracture with Neer's score

AO classification	No of patients	Percentage	Excellent	Good	Fair	Poor
C1	4	20	4	0	0	0
C2	10	50	4	3	2	1
C3	6	30	1	2	1	2
Total	20	-	9	5	3	3

Table 2 - Neer's score			Table 3 - Complications		
NEER'S Score	No of patients	percentage	Complications	No of patients	Percentage
Excellent(>85)	9	45	Infection	1	5
Good(70-84)	5	25	Non union	1	5
Fair(50-69)	3	15	Knee stiffness	3	15
Poor(<50)	3	15	Delayed union	1	5

Table 4- Knee ROM			Table 5 – Extension lag	
Knee flexion	No of patients	Percentage	Extension lag	No of Patients
<90	6	30	NO	17
90-110	5	25	5 degree	2
>110	9	45	10 degree	1



Image 1: Preoperative x ray and CT scan of AO type C3 distal femur fracture



Image 2: Immediate post-operative X rays



Image 3: 8 Month follow up X rays

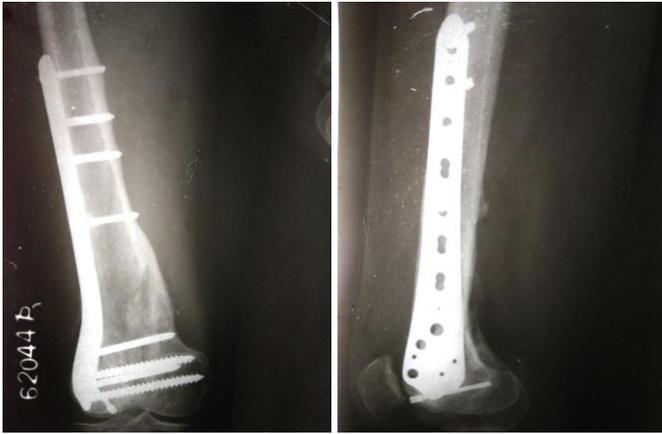


Image 4: 15 month follow up X rays



Image 6: Follow up full ROM of knee



Image 7: Squatting by patient on follow up

4. Discussion

Incidence of comminuted complex fractures are increasing due to high velocity RTA. Improved healthcare results in a longer lifespan and subsequently presents us with more osteoporotic fractures which were previously treated using conservative methods. Due to soft tissue damage, comminution, articular involvement and extensor mechanism injury functional outcome is poor in intra-articular distal femur fracture. The prognostic factors for distal femur fracture include age, intra-articular involvement and time of joint motion [10].

Various implant evolved over a time for intra articular fracture of distal femur. In 1960s, non-operative treatment, traction and cast bracing, produced better results because of the lack of adequate internal fixation devices. The blade plate

was one of the first plate and screw devices. The blade plate requires accurate insertion in three plane and technically demanding. Dynamic condylar screw allows freedom in flexion and extension plane. A minimum of 4 cm of uncomminuted bone required in femoral condyle for DCS and blade plate insertion. Disadvantage of DCS is condylar lag screw require removal of large amount of bone which make revision surgery difficult if required. Later in evolution is condylar buttress plate which allow multiple screws in comminuted fragments. Disadvantage of condylar buttress plate is, it does not provide rigid fixation such as blade plate and DCS. Fractures with a comminuted medial column, segmental bone loss, very low trans condylar fracture may angulate into varus because of movement at the screw-plate interface.

The LCP is a single beam construct where the 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 in unlocked plates. Its unique biomechanical function is based on splinting rather than compression resulting in flexible stabilisation, avoidance of stress shielding and induction of callus formation. The LCP acts on the internal fixator principle as screws once locked to the plate do not pull the fracture towards the implant, and hence there is no displacement of the fracture once reduced [9]. Distal femur locking plate provides angular stability and provides multiple options to secure fracture fragments, both metaphyseal and articular.

In present study we treated 20 patients of intra-articular distal femur fracture using locking compression plate. AO classification were used. 45% excellent, 25% good, 15% fair and 15% had poor result using neer's criteria., Average time for fracture healing was 20 weeks. Average range of motion of knee was 110 degrees. Infection, non-union, delayed union and knee stiffness are complication associated with operative treatment. In our study we get better functional outcome using locking compression plate for intra-articular distal femur fracture.

Along with anatomical reduction and rigid fixation, early mobilization and aggressive physiotherapy are key for better functional outcome.

5. Conclusion

Good planning and execution of surgery in these complex fractures results in better functional outcomes on par with other means of fixation even in these intra-articular injuries. If we do a proper anatomical restoration and alignment in these fractures functional outcome is better. LCP is better implant in comminuted I/A fractures of distal end of femur and in elderly patients with osteoporotic bone. The device provides good angular stability by its triangular reconstruction principle and thus helps in early mobilization, even in comminuted fractures where other modes of fixation often tend to delay the process of mobilization because of lack of stability. Perhaps one of its greatest applications is in osteoporotic fractures where it may provide a solution to the age old 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. In present study better functional outcome achieved using locking compression plate for intra-articular distal femur fracture along with aggressive physiotherapy.

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