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Functional and radiological outcome of surgical fixation of distal femur fractures by DFLCP: A prospective study

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Abstract
Objective: To study the functional and radiological outcome of fracture of distal femur treated by open reduction and internal fixation with locking compression plate.
Design: Prospective study
Methods: data collected for the study is from the patients admitted in orthopedic department in k r hospital, Mysore with distal femur fracture AO 33A, AO 33B and AO33C during the period of august 2016 to September 2018 treated with open reduction and internal fixation with distal femur locking compression plate with 4.5 system. All patients were followed up for an average of 12 months. Outcome was assessed by neer's score.
Results: of 36 patients (14 female & 22males), mean age was 43 years (18 to 62 years) 24 cases were high energy trauma and out of 24, 6 patients had type I compound wound as per gustillio Anderson classification and remaining 12 patients had trivial trauma.
Out of 36 fractures treated, 33 fractures showed radiological signs of union within 6 months, remaining 3 cases showed delayed union which united completely by the end of 12 months.1 patient required bone grafting, 3 patients got infected, 2 implant failure, Mean range of motion of all patients were 110 degree.
Conclusion: open reduction and internal fixation of distal femur fractures with locking compression plate provides the good angular stability, prevents varus collapse and is gratefully helpful in osteoporotic patients. Best results are optioned when standard protocol of locking plate fixation is followed with good soft tissue care, early knee bending exercises and physiotherapy.

Keywords: distal femur, locking plate, osteosynthesis, functional outcome.

Introduction
Distal femoral fractures have a bimodal distribution: in young patients due to road traffic accidents and in elderly due to osteoporotic bone, fracture may occur due to trivial trauma like domestic self-fall, fall from height [1] In old age these fractures are associated with high morbidity and mortality [2]. Distal femoral fracture contributes to 6% of femoral fracture [3] and 29% of non-proximal femoral fractures [4]. Distal femoral fractures is a challenge to orthopedic surgeons [5, 6]. Proper anatomical reduction of articular surface and rigid fixation is required, if not done leads to morbidity like knee pain, decreased range of motion and compromised knee function [7]. variety of implant choices are available for treating distal femoral fracture like dynamic condylar screw (DCS), condyle buttress plate, intramedullary nail, ex–fix, locking condylar plate. Locking plate has become increasingly popular since late 1990s [8]. Locking plate had fixed angle at each screw holes and head is secured to the plate by locking plate mechanism [9-11] and preserve the periosteal blood supply [12, 13] and are very useful in osteoporotic bone as it resists varus collapse [14]. Our purpose in this prospective study was to study functional and radiological outcome of distal femoral fracture treated with distal femoral locking plate by lateral approach. Scoring system used was Neer's Knee Score.

Materials and methods
This prospective study was conducted in K R Hospital Mysore, MMC & RI between august 2016 to September 2018.

ethical committee clearance was taken from our institution and informed consent was taken from all the patients who were included in the study. The classification system used was AO classification which was earlier called as muller's classification.

Inclusion criteria

1. Distal femur fractures type 33A, 33B and 33C
2. age more than 18 years
3. Admitted in KR hosp with distal femoral fracture
4. Closed fracture and guestilo Anderson type I & type II compound
5. Patient willing for treatment and given informed consent

Exclusion criteria

1. age less than 18 years
2. Non willing patients
3. Type III compound fractures
4. Pathological fractures other than osteoporosis
5. Poly trauma patients

In emergency room initial treatment for distal femur fractures was done by splinting the limb with Thomas splint after resuscitating the patient thermodynamically. For type I and type II compound fractures intravenous antibiotics like 3rd generation cephalosporin's and amikacin was given. Routine pre operative investigations was done and anesthesia clearance was taken.

In operating room under spinal anesthesia in supine position, limb was prepared and scrubbed, painted and draped. lateral approach was used in the plane between vastus lateralis and lateral intermuscular septum and to address the intra articular involment lateral para patellar arthrotomy was done by using the swash-buckler approach. Importance was given to the precise reduction of articular fragments and rigid fixation by using 4.5 system distal femoral locking plate, proximal fragment with locking and non-locking screws and distal fragment by locking screws. In cases of fractures with severe communition we used extra partially threaded cancellous screws and for articular fragments we used Herbert screws. Drain was placed. Wound closed in layers, sterile compressive dressing done drain removed after 48 hrs, first dressing was done on 3rd day and knee moments were advised. IV antibiotics was given for 5 to 7 days, patient was mobilized with crutches or walking aids on post op day 5-6, until 6 weeks. Full weight bearing was allowed after 3 to 4 months when radiological evidence was seen. Staples was removed on 12th day and patient was discharged and patient was followed up at 3months, 6months and at the end of 1 year.

Table 1: Age and sex distribution of cases.

Age distribution	Number of cases of male	Number of cases female
18-22	0	1
22-27	1	1
28-32	2	2
33-37	5	3
38-42	3	0
43-47	3	1
48-52	2	1
53-57	2	2
58-62	4	3
Total	22	14

01	High trauma cases	24
02	Low trauma cases	12
03	Type one compound	06

High trauma more common in young and middle age and in male patient, trivial trauma more common in old age especially in females.

Statistical Analysis: Paired t –test used for correlated groups and for unrelated groups means were compared using independent t –test.

Results

Out of 36 cases in our study, lowest age of patient 18 years and highest age of the patient 62 year and mean age was 43.3, out of 36 cases female 14(38.8%), male 22 cases(61.2%). high trauma like RTA in 24 cases (66.6%), trivial trauma in 12 cases (33.4%) and type one compound in 6 cases. as per AO classification AO33A fractures in 21 cases,AO33B type fracture in 13 cases and AO33C fracture in 2 cases. in type one compound fracture, immediate through wash with normal saline and IV antibiotics started in emergency room only. out of 36 cases we got ROM>110^0 in 25 cases, ROM 90-110^0 in 9 cases and 70-89^0 in two cases and no case we got less than 70^0 ROM. average range of motion was 110^0. we got good range of motion 33 A fracture than intra articular fracture and no significant deference in ROM between closed and open fracture. post operative complications divided into early and late complications. in our study we come across early post op complications like superficial infection of wound in 2 cases associated risk factor DM and type 1 compound, One deep infection in old age female patient with DM, no neurovascular and thromboembolic complications. In deep infection debridement done in operation theatre and secondary suturing done. Late complications like implant failure in two cases due to short plate like less cortical screws in proximal fragment (less than8 cortexes), stiffness in 3 cases. Out of 36 cases 11 radiological union got in 15-18 weeks and in 22 cases In 19 -22 weeks and remaining three cases got delayed union after 6months, one required bone graft because of bony void. functional outcome was assessed by clinical based outcome neer knee score, it include 6 subscales like pain (20points), function (20 points), motion (20 points), work (10 points), gross anatomy (15points), roentgenogram (15 points) and interpretation of outcome like excellent (86-100 points), satisfactory (70-85), unsatisfactory (55-69), failure (<55 points). Excellent score in 26 patients, 8 patients satisfactory and two patients unsatisfactory results. in our study we got overall good positive results with distal femoral fracture treating with locking plate by open reduction technique and early knee bending exercises.

Table 2: Final range of motion at end of follow up

Type of fracture	Range of motion and number of cases				Total
	>110^0	90-110^0	70-89^0	50-69^0	
33A1	8	1			9
33A2	4	1			5
33A3	6	1			7
33B1	3	1			4
33B2	2	3			5
33B3	2	1	1		4
33C1		1	1		2
Total	25	9	2		36

Post-operative complications

Early

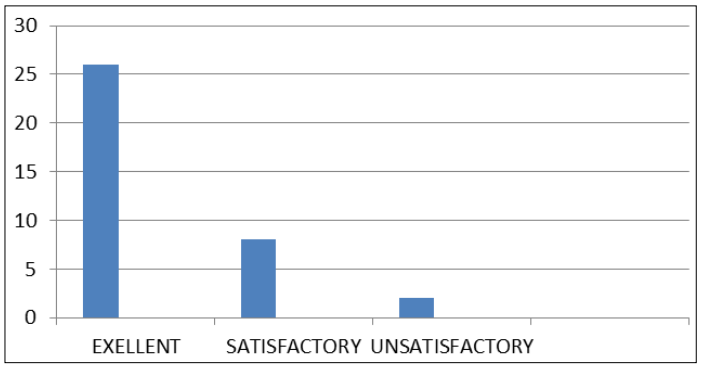
Complications	Number of Cases	%
Thromboembolic Events		
Superfical Infection	2	
Deep Infection	1	
Neurovascular Injury		

Late complications

Complications	Number of Cases	%
Late Infection		
Implant Failure	2	
Malunion		
Stiffness	3	
Delayed Union	3	

Radiological Union	15-18week	19-22 Weeks	After 6months
Number of Cases	11	22	3

Functional outcome



Exellent=26, Satisfactory=8, Unsatisfactory=2

Discussion

We achieved union in all distal femoral fracture cases treating with distal femoral locking plate by open technique and average range of motion at knee joint 110^0, similar results were obtained by rademaker *et al*., in study of 67 patients and one year follow up with mean ROM 111^0. henderson *et al*. [15] reported high rate of non–union (20%) in distal femoral fracture treating with locking plate. advantage of locking plate is by locking mechanism of screw head to plate converts whole implant into single construct. it's especially very useful in osteoporotic and commutated fractures and also useful in peri-prosthetic fractures like THR [16] and TKR. in our study we used in all cases stainless steel we achieved union finally in all cases and good amount of callus. Henderson *et al* found less callus in patient treating with stainless steel compare to titanium plate [17]. we used open technique in all cases showing positive results and many studies also shows positive results treating by less invasive stabilization system (LISS) method [18-21]. in our study we had 2 implant failures due to short plate Ricci *et al*. studying 335 distal femoral fracture treating with distal femoral locking plate identified that diabetes, smoking, open fractures and short plate were risk factors for failure of locking plate [22]. Hoffman *et al*. suggested that at least three bi-cortical screws at each side of fracture [23].

Conclusion

We can get positive results in distal femoral fractures like extraarticular, partial articular and intra articular treating with distal femoral locking plate if we follow all basic principle of fracture fixation and good knee joint physiotherapy in post operative period.

Intraoperative images

Clinical and radiological pictures

Fig 1: Pre and post op xrays

Fig 2: Pre and post op x-rays

Fig 3: Pre and post op x-rays

Fig 4: Pre op and post op x-rays

Clinical follow up

Flextion and extension at knee joint

Three months and one year end follow up xrays

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