

## Original Research Article

# A clinical study of surgical management of distal femur fracture using locking compression plate

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### ABSTRACT

**Background:** Fractures of distal femur are common due to increased road traffic accidents and fall from height because of increased construction activities. These fractures are quite disabling hence, these fractures necessitate early stabilization of fractures. Internal fixation with LCP has shown to give one of the best results in terms of recovery, fracture union, and clinical outcome. The aim of the study the clinical outcome of treatment of distal femur fractures using locking compression plates.

**Methods:** A total of n=20 cases of distal femur fractures treated with LCP from December 2013 to June 2015 at NMCH and RC, Raichur. They were admitted and examined according to protocol clinically and radiologically. All patients were followed up for a minimum of 6 months and outcome assessed with Neer's score.

**Results:** All fractures healed with an average duration of 16 weeks which is comparable with other studies. We had two cases of varus collapse one was due to early weight bearing in one case and other case is due to gross comminution. One case had an implant failure (plate breakage) due to early weight bearing. Cases needing hardware revision is comparable to other studies at 10%. Average Neer's knee score was 76.

**Conclusions:** we have found higher Neer's scores in this study. The LCP also prevents compression of periosteal vessels. It may not completely solve the age-old problems associated with any fracture like non-union and malunion, but is a valuable technique in the management of these fractures. But however, in type C fractures the outcome is poorer.

**Keywords:** Locking compression plate, Locked internal fixators, Femoral fractures, Implants

### INTRODUCTION

The rapid urban growth, land development, faster transport, etc. has led to a manifold increase in RTA injuries and construction injuries (fall from height) therefore crippling many young lives. Older patients, especially women, sustain fractures due to osteoporosis. Studies have proved that there is usually a bimodal distribution of supracondylar fractures of the femur in these cases.<sup>1</sup> Fractures of distal femur are complex injuries producing long term disability.<sup>2,3</sup> They account for 6% of all femur fractures and 31% if hip fractures are

excluded. Nearly 50% of distal femur intraarticular fractures are open fractures.<sup>1</sup> Until the 1960s there was a great reluctance towards operative management of fracture due to the high incidence of infection, non-union, mal-union. Watson Jones and John Charnley in the era traditional management were done by skeletal traction, manipulation of fracture, external immobilization, and cast and cast bracing. However, these met with a problem like a deformity shortening, prolonged bed rest, knee stiffness, angulation, malunion, quadriceps wasting, and knee instability and post-traumatic complications. The trend of open reduction and internal fixation has become

evident in the recent years with good results being obtained with AO blade plate, dynamic Condylar screw, intra medullary supracondylar nail and locking compression plate.<sup>2</sup> Elderly patients and Osteoporosis add to the difficulty in articular fractures. Loss of stable fixation is of great concern, so Locking Compression Plate use has an advantage in these groups of patients.<sup>6</sup> Locking compression plate has the advantage of a combination of compression plating, locked plating, and bridge plating. This reduces soft tissue damage and periosteal vessels are preserved. Therefore, it acts as a closed external fixator.<sup>7</sup> Present aim of the study the clinical outcome of treatment of distal femur fractures using locking compression plates.

## METHODS

The present study was done in the Department of Orthopedics, from December 2013 to June 2015 at NMCH and RC, Raichur. Institutional Ethical committee permission was obtained for the study. Written consent was obtained from all the participants of the study. A total of n=20 cases were selected for the study based on the inclusion and exclusion criteria. The inclusion criteria were Patients admitted to NMCH and RC Raichur with fracture lower end of femur fixed with LCP, all skeletal mature patients (>18 years), open distal femur fractures up to type I, II and III A, patients willing to participate in the study. Exclusion criteria were patients with open distal femoral fractures type III B and C, patients with associated tibial plateau fractures, patient with pathological distal femoral other than osteoporosis, distal femoral fractures with neurovascular compromise, patients managed conservatively for other medical reasons. A thorough assessment of the patient to rule out head/chest/abdominal/spinal or pelvic injury was done. Careful assessment of injured limb as regards to neurovascular status. Primary immobilization of the involved limb was done using Thomas splint with a cotton pad below the distal fragment. Radiological assessment: anteroposterior and true lateral views of injured limb including complete knee joint, pelvis and involved femur. Under appropriate anesthesia, we used the standard lateral approach to the distal femur, with the patient in the supine position and a sandbag was kept below the operating knee and one below the ipsilateral hip. Once reduction was satisfactory, the plate may be loaded in tension using articulated tension device. The plate shaft may be fixed with appropriate cortical screws after confirming the final reduction of the fractures. Postoperative rehabilitation was custom made to the patient and the fracture type and is easier, more comfortable and more assured with firm internal fixation. If fracture fixation is stable, then therapy can be started early. The most useful range of motion can be achieved, in the first few weeks of the postoperative period. Most recommend continuous passive motion for 3 hours daily for 2-3 weeks, until the patient achieves more than 100° flexion. Periodic monitoring of knee flexion at end of 1<sup>st</sup>, 2<sup>nd</sup> and the 3<sup>rd</sup> week were done and after completion of

therapy, with concomitant isometric quadriceps exercises and knee mobilization exercises.

## RESULTS

In our study of the 20 patients, 12 (60%) were Males, 08 (40%) were Females. The mode of injury was road traffic accident in 11 patients (55%), fall from height/stairs in 9 patients (45%). 17 patients were operated within one week after injury, 2 patients had been admitted in another hospital earlier and presented after about 8 days after injury. For 1 patient surgery had been delayed due to medical conditions. Meticulous clinical examination was made in all patients and associated injuries were treated with proper documentation. Open fractures included in this study were of Grade II and Grade IIIA according to (Gustilo - Anderson's classification) males were majority in number when compared with females highest number of patients was in their 3rd decade (35%) road traffic accident was the most common mode of injury (55%) There was not a single case with bilateral fractures. 1 patient had associated facial injuries, 2 patients had ipsilateral metatarsal and phalangeal bones fracture and one patient had an ipsilateral radius and ulna fracture making a total of 4 patients (20%) with associated fractures.

**Table 1: Age wise distribution of cases.**

Age group (in years)	No. of patients	Percentage (%)
19-30	7	35
31-40	4	20
41-50	5	25
51-60	3	15
61-70	1	05

Most of the patients reported within 1st week of injury to the hospital. 19 out of 20 patients had closed injury type A1 Muller's fracture was the most common fracture type 7 out of 20 patients (35%). The shortest follow-up period was 6 months and the longest follow-up period was 18 months. The average range of knee flexion achieved was about 91°. Maximum gain in knee flexion was 110° and minimum gain about 70°. The average knee score of 80 points was rated using the Neer functional score. (Max 100) Neer's scores consist of Functional (70 units) and Anatomic (30 units). The Neer's pain score, functional score, knee flexion score, score of gross anatomy was used to assess the outcome of surgery, for adult distal femoral fractures (Table 2).

In our observation, n=2 out of n=20 patients had no pain (10%), n=15 patients had intermittent pain due to knee stiffness (75%), 3 patient had pain with fatigue (15%). In this study, n=2 out of n=20 (10%) patients were able to return to their function as before the injury. The mild restriction was noted in the rest of n=13 (65%) patients, restriction with stair climbing in n=5 (25%) patients. In

our observation, n=10 out of 20 (50%) patients gained knee flexion of 100° or more, n=09 (45%) patients gained up to 80° and remaining n=1 patient regained a knee flexion of 70°. 5 (25%) patients worked as before the injury, 14 (70%) patients with mild handicap and n=1 (05%) patients shifted to alter work. In our study, n=2 (10%) patients developed mild varus angulation of 10° and another 7 (35%) patients had 5 mm shortening, and the remaining 11 (55%) patients had thickening only. Out of n=20, n=15 patients (75%) had near normal radiographs, n=4 (20%) had 10 degrees angulation and another n=1 (05%) patient had 5 mm displacement. Overall results were excellent in n=6 (30%) out of 20 cases and were satisfactory in n=13 (65%) cases and one had an unsatisfactory result. The overall average knee score in our study was 80% we can observe that all the excellent results were from type A fracture and satisfactory results were seen in type A, B, C.



**Figure 1: AP and lateral view of distal femur fracture.**

**Table 2: Neer's scores at follow up.**

<b>Neer's scores</b>			
<b>Neer's pain score</b>			
Scores	Pain score 5	Pain score 4	Pain score 3
No. of patients	2	15	3
<b>Neer's function scores</b>			
Scores	Function score 5	Function score 4	Function score 3
No. of patients	2	13	5
<b>Neer's knee flexion score</b>			
Scores	Knee flexion score 4	Knee flexion score 3	Knee flexion score 2
No. of patients	10	9	1
<b>Neer's work score</b>			
Scores	Knee work score 5	Knee work score 4	Knee work score 3
No. of patients	5	14	1
<b>Neer's score of gross anatomy</b>			
Scores	Roentgenogram score 5	Roentgenogram score 4	Roentgenogram score 3
No. of patients	15	4	1

**Table 3: Fracture type and outcome.**

<b>Fracture type</b>	<b>Outcome</b>		
	<b>Excellent</b>	<b>Satisfactory</b>	<b>Unsatisfactory</b>
<b>Fracture type A</b>	6	7	0
<b>Fracture type B</b>	0	1	0
<b>Fracture type C</b>	0	5	1

**Table 4: Early and late complications in the patients.**

<b>S. no.</b>	<b>Complications</b>	<b>No. of patients</b>
<b>1</b>	Superficial wound infection	1
<b>2</b>	Delayed wound healing	1
<b>3</b>	Tibial Pin tract infection	1
<b>4</b>	Malunion with varus	2
<b>5</b>	Plate breakage	1
<b>6</b>	Knee stiffness	1



**Figure 2: Post treatment AP and lateral view of locking compression plate.**

Early complications were encountered in n=3 patients. One patient developed superficial wound infection in 1st week and was promptly treated with appropriate antibiotics, wound care and secondary suturing. One diabetic patient had delayed wound healing but was otherwise uneventful. One patient developed a tibial pin tract infection. Late complications included knee stiffness in the n=1 patient, in one of whom it was observed that the patient was not cooperative for physiotherapy and also had a low threshold for pain. She was counselled for regular physiotherapy using C.P.M. machines, which improved her knee flexion from 40° to 70°. One patient presented with broken plate in the condylar region, in his 2nd month and subsequently developed pain. He has operated again and showed a good functional outcome. Two patients were noticed to have varus collapse of about 10° with malunion.

## DISCUSSION

The LCP condylar plate is the treatment of choice in the management of comminuted distal femoral fractures especially type A fractures in this study we have found higher Neer's scores. The added advantage of LCP is it also prevents compression of periosteal vessels. It may not completely solve the age old problems associated with any fracture like non-union and mal-union, but is a valuable technique in management of these fractures. However, we found that LCP in type C fractures the outcome was poorer. But still LCP remains the implant of choice since their results are generally superior than the dynamic condylar screws and angle blades for type C fractures also, though there are complications like knee stiffness and extensor lag were encountered in a few cases.<sup>8,9</sup>

The good outcome seen in our study can be attributed to more number of patients with type A fractures, which usually show favorable results. We had only 5% of open

fractures, which are much higher in other case series.<sup>10</sup> Also the small sample size can be used only as level III evidence in evidence based medicine. We in this study had two cases of varus collapse one was due to early weight bearing in one case and other case is due to gross comminution. One case had an implant failure (plate breakage) due to early weight bearing. Cases needing hardware revision is comparable to other studies at 13%. Earlier, fixation of these fractures with a lateral plate alone has historically been associated with non-union and/or malunion with varus collapse. Prior to advent of locking plates, these problems were addressed with dual plating methods.<sup>11</sup> Though this prevented varus collapse, extensive soft tissue stripping and medial incision increased the chance of extensor lag.

With the introduction of plates with option of locked screws, the results are encouraging, as it increases the rigidity of fixation in osteoporotic bone and in presence of periarticular or juxta-articular comminution.<sup>7</sup> The LCP condylar plates provide multiple points of fixed plate to screws contact, generating greater stability and thereby reducing the tendency of varus collapse.<sup>12</sup> LISS plating allows minimally invasive approach by submuscular insertion of plates and thereby preservation of vascularity to the lateral cortex.

In our study, radiological union was seen at an average of 16 weeks which is comparable to study of LCP by Kayali et al that averages 15 weeks.<sup>13</sup> Overall results were excellent in 6 out of 20 cases and were satisfactory in remaining cases except one. The overall average knee score in our study was 80, as opposed to 67.7 by Schandelmaier et al.<sup>10</sup> We had 95% good to excellent outcome as per Neer score in our study, compared to Hann et al (86%).<sup>14</sup> The problems in fixing distal femoral fractures with osteoporosis, extensive comminution and revision surgeries following failed implant can be addressed effectively using locking condylar plate.<sup>14,15</sup> We believe that locking plates represent a valuable advancement in fracture treatment. However, the limitations of this new technology and indications for its use have not been completely elucidated and the long-term results are awaited. The locking plates can fail when physiological loads are outside plate-design parameters.<sup>16</sup> The locked screws can disengage from the plate secondary to failure of the screw to seat into the plate properly, as a result of cross threading or when insufficient screw torque is used to engage the screw threads into the plate threads.<sup>16</sup>

## CONCLUSION

Within the limitations of the present study, we have found higher Neer's scores in this study. The LCP also prevents compression of periosteal vessels. It may not completely solve the age-old problems associated with any fracture like non-union and malunion, but is a valuable technique in the management of these fractures. But however, in type C fractures the outcome is poorer.

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