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To evaluate the clinical and radiological outcome of internal fixation of distal end of femur fracture using locking compression plate

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Abstract
Introduction: The aim of this study was to evaluate the clinical and radiological outcome of internal fixation of distal end of femur fracture using locking compression plate.
Commonly occurs in elderly patients following a trivial fall or in young adults following a high velocity trauma due to RTA.
Treatment of distal femur fracture has been a great challenge with a variety of treatment modalities available and yet unpredictable outcomes. Surgical treatment has become the favourable choice after improvement in surgical techniques and implants.
Materials and Method: A prospective study on 22 patients was conducted between the year august 2017-Dec 2018 with age group between 20-70 years with a mean age of 50, irrespective of sex.
The patients were treated with internal fixation using locking compression plate and followed up at 6 months post-operatively.
The clinical outcomes were evaluated using Neers scoring system at 6 months post-operatively.
Result and Observation: The result showed that sixteen patients had excellent results, four had Good, one had fair and one failure.
Conclusion: The treatment of distal femur fracture (AO type A, B and C) with a single LCP using direct lateral approach, good to excellent results were achieved in majority of the cases will full weight bearing to start as early as 18.03 weeks (average) and radiological union by 16 weeks (average) and therefore is our current choice for most AO/OTA type A, B and C fractures of distal femur requiring plate Osteosynthesis.

Keywords: Distal femur fracture, locking compression plate, NEER's scoring

Introduction
Fractures of distal end of femur account for 3-6% of total adult femoral fractures and 0.4% of all fractures [1]. Fractures of lower end of femur have a bimodal distribution, usually occurs in old patients with osteoporotic bones following a trivial fall and in young adults following a road traffic accident. In the younger age group males are more commonly involved and females being more commonly involved in the geriatric age group. Treatment of distal end femur fracture has always been a challenge. A delay in surgical treatment more than 2 days may lead to increase in mortality in geriatric patients [2] various treatment modalities are available depending upon the associated co-morbidities, fracture classification and surgeon choice. Traditional methods which were earlier practised include traction [3], closed reduction and external immobilisation in forms of casts. Recent trends in fracture management which have gained importance in the recent past include AO blade plate, ante grade nailing, retrograde nailing, sub muscular locked internal fixation, dynamic condylar screw and locking compression plates and Ex-fix. At times a combined fixation maybe necessary. Locked plating system as well as less invasive surgical approaches are now a common place in the management of distal femoral fractures [4]. Complications following fracture of distal end of femur include infections, malunion, non-union knee stiffness [5],

secondary osteoarthritis of knee joint [6]. These complications can be reduced by using Less Invasive Stabilisation System [7].

Materials and Methods

This study was conducted at Dr. D.Y Patil medical college, hospital and research Centre from year August 2017 to Dec 2018 for a period of 16 months. In this prospective study, 22 patients were included with fracture of lower end of femur treated at Dr. D.Y Patil medical college, hospital and research Centre coming to emergency room they were initially managed according to the ATLS guidelines. All fractures were treated with open or closed reduction and internally fixed with locking compression plate using a Swashbuckler Approach. The patients were followed up at 6 months post-operatively. Inclusion criteria- 1) Age 20-70 years 2) Both sexes 3) Post traumatic 4) Type A, B and C of AO/OTA classification. Exclusion criteria – 1) Patients with poor physical compliance 2) Contraindication to surgery or anesthesia 3) Compound fracture 4) Neurovascular injury 5)Pathological fracture 6)Osteomyelitis or any infection at the fracture site

All patients had to undergo the following before getting operated

1. General and Systemic examination
2. Local examination
3. Associated injuries
4. Neurovascular status of the affected limb
5. Musculoskeletal condition
6. Primary immobilization using long knee brace
7. Mechanism of injury
8. Time interval between trauma and arrival to emergency department.
9. Radiological evaluation -X-ray Anteroposterior and lateral views of the knee joint, distal femur, proximal tibia and pelvis.
10. CT scan with 3D reconstruction was done whenever necessary for better understanding of the fracture anatomy and to plan the management.

All consented patients who were fit to undergo surgical intervention following the above protocol were subjected to open or closed reduction and internal fixation with locking compression plate.

Locking compression plate principle [8, 9].

A compression plate produces a locking force across a fracture site to which it is applied. The effect occurs according to Newton's Third law (action and reaction are equal and opposite).Tension is produced on the plate after attached to bone fragment. As a reaction to this tension compression is produced at the fracture site across which the plate is fixed with screws.

Neer's scoring system [10].

it has been widely used for evaluation of patients with distal end of femur fracture post-operatively. Consists a total of 100 points (70- functional, 30- anatomical)

Table 1: Show the Excellent Good Fair Poor

Excellent	More than 85
Good	70-85
Fair	55-69
Poor	Less than 55

Table 2: Neer's scoring

Functional (70 points)		Anatomical (30 points)	
a) Pain (20 points)		**a) Gross Anatomy (15 points)**	
• No pain		• Thickening only	15
Intermittent	16	• 5 degrees angulation or 0.5 cm shortening	12
• With fatigue	12	• 10 degrees angulation or rotation, 2 cm shortening	9
• Limits function	8	• 15 degrees angulation or rotation, 3 cm shortening	6
• Constant or at exertion	4-	• Healed with considerable deformity	3
b) Walking Capacity (20 points)		• Nonunion or chronic infection	0
• Same as before accident	20	**b) Roentgenogram (15 points)**	
• Mild restriction	16	• Near normal	15
• Restricted stair side ways	12	• 5 degrees angulation or 0.5 cm displacement	12
• Use crutches or other walking aids	4-0	• 10 degrees angulation or 1 cm displacement	9
c) Joint Movement (20 points)		• 15 degrees angulation or 2 cm displacement	6
• Normal or 135 degrees	20	• Union, but with greater deformity, spreading of condyles and osteoarthritis	3
• Up to 100 degrees	16	• Nonunion or chronic infection	0
• Up to 80 degrees	12		
• Up to 60 degrees	8		
• Up to 40 degrees	4		
• Up to 20 degrees	0		
d) Work Capacity (10 points)			
• Same as before accident	10		
• Regular, but with handicap	8		
• Alter work	6		
• Light work	4		
• No work	2-		

Table 3: Demographic Parameters

1) Age (mean)	47 years
2) Sex -a) Male	13(59.09%)
b) Female	9 (40.90%)
3) Mode of injury	
a) RTA	14(63.63%)
b) Fall	08(36.36%)
4) Side Affected -a) Right	12(54.54%)
b) Left	10(45.45%)

Table 4: Age Distribution

Age in Years	No. of Patients
<20	0
21-30	3
31-40	4
41-50	7
51-60	5
61-70	3
>70	0
Total	22

Table 5: AO/OTA Classification

Type	Number of Patients	Percentage
A1	1	4.54%
A2	3	13.6%
A3	2	9.09%
B1	NIL	0
B2	1	4.54%
B3	NIL	0
C1	5	22.72%
C2	6	27.27%
C3	4	18.18%

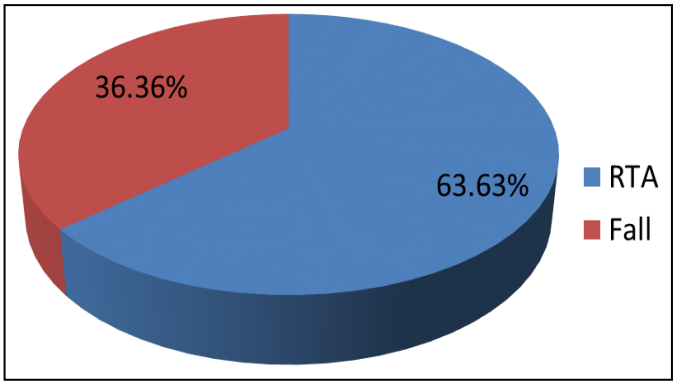

Fig 1: Mode of Injury

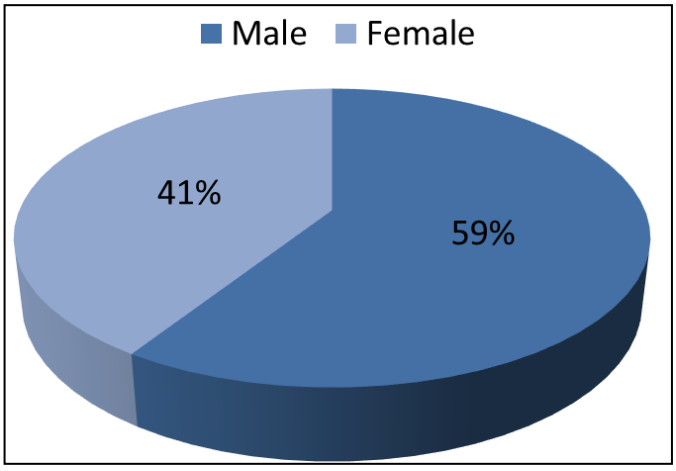

Fig 2: Sex Distribution

Surgical procedure

- All patients were treated using lateral Approach
- Patient were placed in a supine position on a radiolucent table with a bolster under the knee
- The entire limb which was injured was prepared and draped after thorough painting.
- Tourniquet was applied and inflated
- Lateral Incision was made from above the fracture parallel to the shaft of femur to across the patella.
- Incision was extended down to the fascia of quadriceps in line with skin incision
- Sharp dissection of quadriceps fascia off the vastus lateralise muscle was done.
- Iliotibial band was retracted laterally
- By placing a retractor under vastus lateralise and medial is distal femur was exposed and patella was displaced medially.
- Reduction temporarily fixed with help of K wires drilled into lateral surface of femur after checking the plate length axial and rotational misalignment under image intensification.
- Reduction of fracture was assisted with manual traction and bolster placed below the knee.
- Inter-condylar type fractures were converted into a single condylar fracture before LCP fixation.
- Where applicable, Compression screws were used to approximate the plate to femoral shaft

Fig 3: Patient position

Result

Out of 22 patients included in the study, 13 were males and 9 were females. All patients were in the age group of 20 – 70 years and average being 47. Out of 22 patients 14 were due to road traffic accidents and 8 were due to fall. Twelve fractures were of right side and ten were of left side.

Average duration of hospital stay was 15 days.

Our patients were assessed clinically and radio logically by NEER's criteria at 6 months post operatively.
16 patients had excellent result at the end of 6 months (72%)
4 patients had good result at the end of 6 months (16%)
1 patient had fair result (4.54%)
1 patient had poor prognosis (4.54%)
Average time for full weight bearing 18.03 weeks.
Average time for radiological union 16 weeks.
Average Range of motion at knee joint was 0-100 degrees of flexion

Table 6: Neer's Scoring Result

Nears scoring	Number of cases
Excellent	16 (72%)
Good	4 (16%)
Fair	1 (4.54%)
Poor	1 (4.54%)

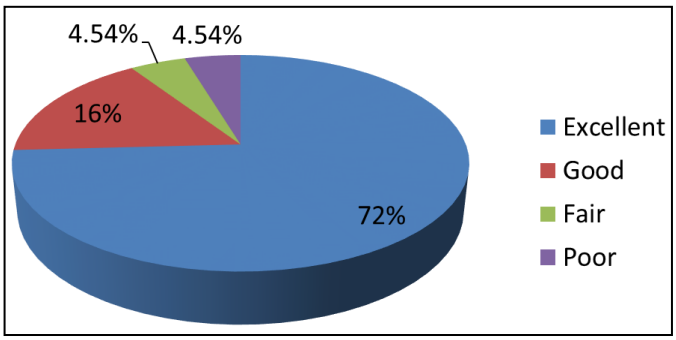

Fig 4: Neer's scoring

Table 7: Other Parameters Observed

Parameter	Average
Radiological union	16 weeks
Time for full weight bearing	18.03 weeks
Range of motion	0-100 degrees

Complications

Knee stiffness was the most common complication that occurred in 11 patients postoperatively which was tackled with good physiotherapy superficial infection developed in 2 patients which was treated was antibiotics based on culture reports and regular dressing and delayed union in 1 patient

Table 8: The no of parameter and cases

PARAMETER	NUMBER OF CASES
Knee stiffness	11(50%)
Superficial infection	2(9.09%)
Delayed union	1(4.54%)

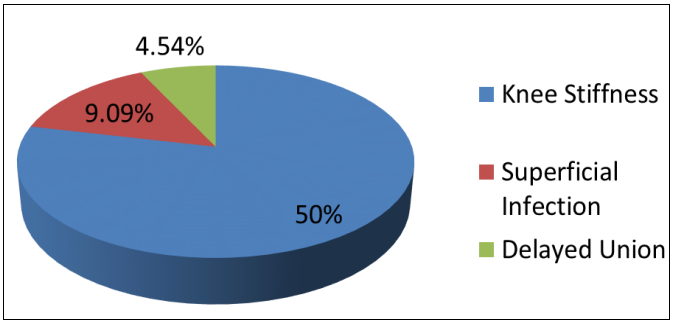

Fig 5: Complications

Discussion

Distal end of femur fractures are challenging studies and require an extensive exposure of the fracture site. Following injury and post-operative phase, injury to soft tissue is very common due to the high velocity injury and this interferes with the post-operative rehabilitation programme. Hence, the overall outcome of fractures of distal end of femur remains unpredictable and are likely to result in complications such as stiffness, secondary arthritis, malunion and non-union [11] Multiple surgical approaches have been described to obtain a good exposure of distal end of femur including the articular surface, lateral par patellar approach (anterolateral) [12], medial par patellar approach and combined medial and lateral approaches. Starr. *et al.* [13] described a modified anterior (Swashbuckler) approach to distal end of femur which facilitated complete exposure of the distal end including the articular surface. Starr *et al.* in their original report, had avoided the use of tourniquet, citing that "it can prevent medial retraction of quadriceps muscle" [1] 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 screws axial stiffness pull-out resistance in unlocked plates [14] In our study 22 patients with distal end of femur fracture were treated. Overall outcome of the surgical management of fracture distal end of femur using locking compression plate was assessed by using NEER's Score. Out of 22 patients, 13 were males and 9 were females. The average age group was 47 years ranging from 20-70 years. Out of 22 fractures, 14 were due to Road traffic accident and 8 were due to fall. 12 patients were with fracture on right side and 10 on left side.

In a study performed by Schutz M, Muller M *et al.* [15]. Internal fixation using the LISS was performed at an average of 5 days after injury. 48 fractures were operated within the first 24 hours. The study showed clearly that when working with LISS, primary cancellous bone grafting is not necessary. The total follow up rate was 93%, 5% non-union was observed. The DLF-LCP is a further development from the LISS. The main difference between the LISS and DLF-LCP is that the LISS utilises an outrigger devise for shaft holes, functioning essentially as a locked guide jig, which is attached to the distal end of plate and guides the placement of proximal locking screws [16, 17] In our study, cefuroxime 1.5gms was administered intravenously 30 minutes before the incision and for 3 days post-operatively. The average injury to surgery interval was 5 days. The average number of locking screws used in proximal articular segment was 4 and the mean number of screws used in distal segment was 5.The average duration of hospital stay was 15 days with a range of 10-20 day. Similar result was observed in the study by Vishwanath C [18] In our study on 22 patients with distal end femur fracture, 16 patients showed excellent result(85-100) i.e. 72% 4 patients showed good(70-84) i.e. 18% 1 patient showed fair(55 -69) outcome i.e4.54% and 1 patient showed poor(less than 55) outcome i.e. 4.54%.Similar results were observed in study by Umanski Stewart Mj% [19] in which 70% showed excellent result and 16% showed good result. Average time for radiological union was 16 weeks which was similar to Dr Rajesh *et al.* [20] in which average time for union was 16.8 weeks. *Time for full weight bearing* was 17-21weeks in most of the patients. For AO type a fractures, average time for full weight wearing was 18.03 weeks and for AO type B fractures was 19.04 weeks. Similar results were observed in study by Dr Somil *et al.* [21] in which the average time for full weight bearing was 18.06 weeks. The average knee flexion in this

study was 100 degree with more than 75% patients having knee range of motion more than 100 degree. Similar result was observed in study by Shriharsha R.V *et al.* [3] in which average knee flexion was 99 degree. *The most common complication* following the surgery was Knee stiffness which was observed in about 8patients (36%) and was managed with physiotherapy. Similar result was observed in study by Vishwanath C [19] in which 30% cases had knee stiffness at final follow-up. Superficial infection was observed in 2 patients which were treated with antibiotics and regular dressing. Similar result was observed in study by Gyanendra Kumar Jha *et al.* [22] in which 2 patients developed superficial infection and were treated with dressing.

Fig 6: Pre-operative radiological image

Fig 7: Intraoperative images

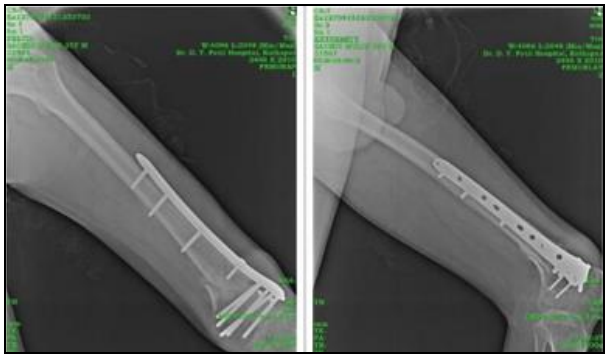

Table 8: 6 Months post-operative images

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