

**FUNCTIONAL OUTCOME OF SUPRACONDYLAR FRACTURES OF FEMUR MANAGED BY OPEN REDUCTION AND INTERNAL FIXATION WITH LOCKING COMPRESSION PLATE**A. Madhusudhana<sup>1</sup>, Narendra Avalapati<sup>2</sup>, M. Rajesh<sup>3</sup>**HOW TO CITE THIS ARTICLE:**

A. Madhusudhana, Narendra Avalapati, M. Rajesh. "Functional Outcome of Supracondylar Fractures Of Femur Managed By Open Reduction and Internal Fixation with Locking Compression Plate". Journal of Evidence based Medicine and Healthcare; Volume 2, Issue 43, October 26, 2015; Page: 7768-7783, DOI: 10.18410/jebmh/2015/1048

**ABSTRACT: INTRODUCTION:** Incidence of distal femur fractures is approximately 37 per 1,00,000 person-years.<sup>1</sup> Distal femoral fractures has two different injury mechanisms, high energy trauma and low energy trauma. In high-energy trauma, the problem of restoring the function in a destroyed knee joint persists. Complex knee ligament injuries frequently occur additionally to extensive cartilage injuries. In elderly patients, extreme osteoporosis represents a particular problem for anchoring the implant.<sup>2</sup> Supracondylar and inter condylar fractures often are unstable and comminuted and tend to occur in the elderly or those with multiple injuries. Treatment options are many with varied results. The final outcome would depend upon the type of fracture, stabilization of fixation and perhaps patient general condition.<sup>3</sup> The options for operative treatment are traditional plating techniques that require compression of the implant to the femoral shaft (blade plate, Dynamic Condylar Screw, non-locking condylar buttress plate), antegrade nailing fixation, retrograde nailing, sub muscular locked internal fixation and external fixation.<sup>4</sup> However, as the complexity of fractures needing treatment has changed from simple extra-articular supra-condylar types to inter-condylar and metaphyseal comminuted types, these implants may not be ideal. Double plating, and more recently, locked plating techniques have been advocated<sup>5</sup>. However with double plating there is often extensive soft tissue stripping on both sides of the femur, resulting in reduced blood supply and potential non-union and failure of the implants<sup>6</sup>. 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 or pullout resistance as seen in unlocked plates<sup>7,8</sup>. Its unique biomechanical function is based on splinting rather than compression resulting in flexible stabilization, avoidance of stress shielding and induction of callus formation. Further when it is applied via a minimally invasive technique, it allows for prompt healing, lower rates of infection and reduced bone resorption as blood supply is preserved.<sup>9,10</sup> The implant offers multiple points of fixed-angle contact between the plate and screws in the distal part of femur, theoretically reducing the tendency for varus collapse that is seen with traditional lateral plates.<sup>10</sup>

**AIMS & OBJECTIVES:**

1. To study the functional outcome for internal fixation of supracondylar fractures of femur by locking compression plate.
2. To evaluate the complications of supracondylar femur fractures treated with locking compression plate.

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## MATERIALS AND METHODS:

### Design:

Prospective observational case control study

**SUBJECTS:** Patients in S.V.R.R.G.G. Hospital from 01-11-2013 to 01-08-2015 clinically suspected to have supracondylar fractures femur and confirmed radiologically.

### Inclusion Criteria:

- Age more than 20 years
- Both sexes are included
- Fresh and old cases of distal femoral fractures which are of closed type
- Cases will include all supracondylar intercondylar extension of distal femoral fractures

### Exclusion Criteria:

- Age less than 20 years
- Compounded injuries
- Medically co-morbid patients
- Patient not willing for surgery

**SETTINGS:** Orthopaedic units, the department of Orthopaedics, S.V.R.R.G.G. Hospital, Tirupati. S. V. Medical College Tirupati.

**RESULTS:** The present study consists of 21 cases of distal femur fractures treated with an open reduction and internal fixation with locking compression plate in the department of orthopaedics, S.V.R.R.G.G. hospital from December 2013 to april2015.all these cases were followed up to august 2015 for a minimum of 6 months to a maximum duration of 14 months. The following observations were drawn from the compiled data.

### Criteria for Evaluation of the Results

(From Neer Cs, Ii Granthan Sa, And Shelton MI)

Functional (70 points)		Anatomical (30 points)	
a) Pain (20 points)		a) Gross anatomy (15 points)	
• No pain	20	• Thickening only	15
• Intermittent	16	• 5 degree angulation or 0.5 cm shortening	12
• With fatigue	12	• 10 degree angulation or rotation, 2 cm shortening	9
• Limits function	8	• 15 degree angulation or rotation, 3 cm shortening	6
• Constant or at exertion	4-0	• Healed with considerable deformity	3
		• Non-union or chronic infection	0

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b) Walking capacity (20 points)		b) Roentgenogram (15 points)	
• Same as before accident	20		
• Mild restriction	16	• Near normal	15
• Restricted stair side ways	12	• 5 degree angulation or 0.5 cm displacement	12
• Use crutches or other walking aids	4-0	• 10 degree angulation or 1 cm displacement	9
c) Joint movement (20 points)		• 15 degree 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	• Non-union 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	2-0		

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

**Epidemiology:** Sixteen patients were males and five were females. The patients' ages ranged from 18 to 74 years with a mean age of 44 years. Fourteen fractures involved the right side and seven involved the left side.

**Mechanism of injury:** The causes of fractures were motor vehicle accident in sixteen patients and a domestic fall in remaining five. Nineteen of them had acute fresh fractures and two of them were supracondylar fracture non-union with implant failure.

**Classification:** According to Muller's classification of distal femur three were Muller's type A1; seven Muller's type C1; seven Muller's type C2; and four Muller's type C3.

**Peri-operative:**

- All patients were operated within 7 days of injury.
- On 2<sup>nd</sup> post-operative day; wound inspection done, suture removal on 14<sup>th</sup> day.

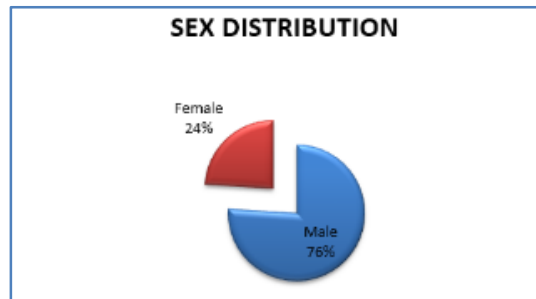
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- Physiotherapy: static quadriceps exercises from day 1, knee range of motion after 2 weeks, partial weight bearing walking after 6 weeks.

Results are summarized in charts and tables below.

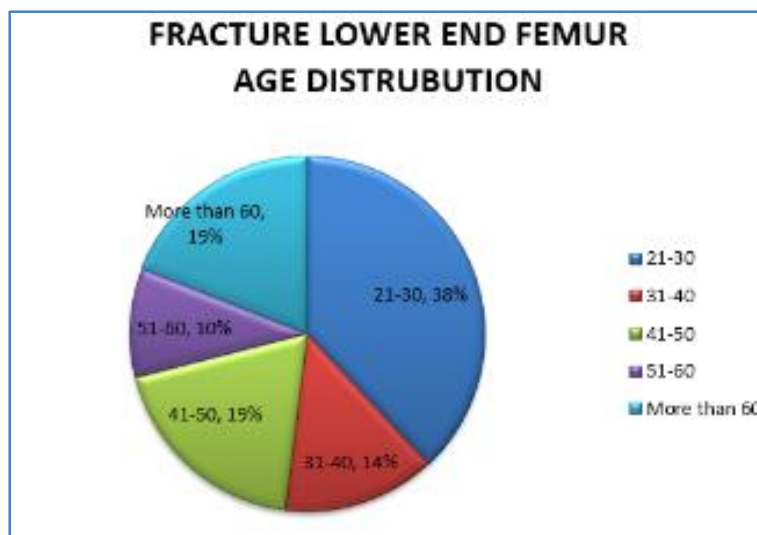
Sex	Lower end femur	Percentage
Male	16	76%
Female	5	24%
<b>Total</b>	<b>21</b>	<b>100%</b>

Table no. 1: Sex Distribution



Age in years	Lower end femur	Percentage
18 – 30	8	38%
31 – 40	3	14%
41 – 50	4	19%
51 – 60	2	10%
Above 60	4	19%
<b>Total</b>	<b>21</b>	<b>100%</b>

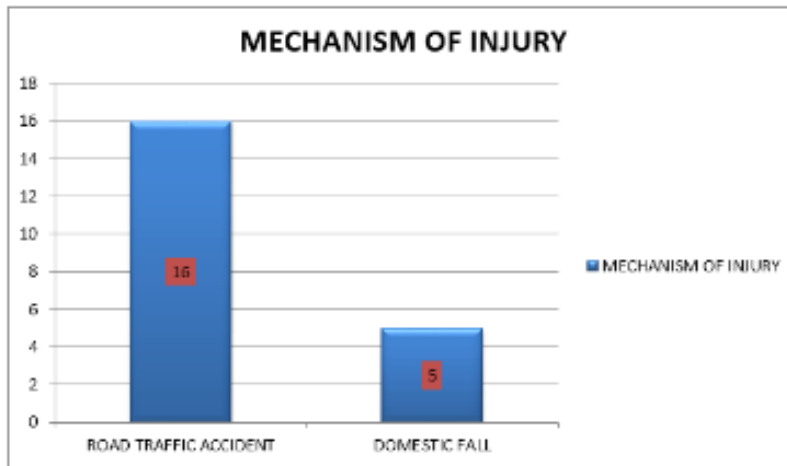
Table no. 2: Age Distribution



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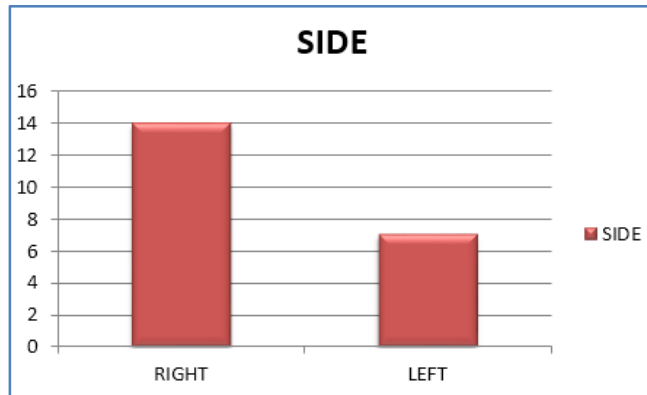
Mechanism	Lower end femur	Percentage
Road traffic accident	16	76%
Domestic fall	05	24%
<b>Total</b>	<b>21</b>	<b>100%</b>

Table no.3: Mechanism of injury



Side affected	Right	Left
Lower end of femur	14	7

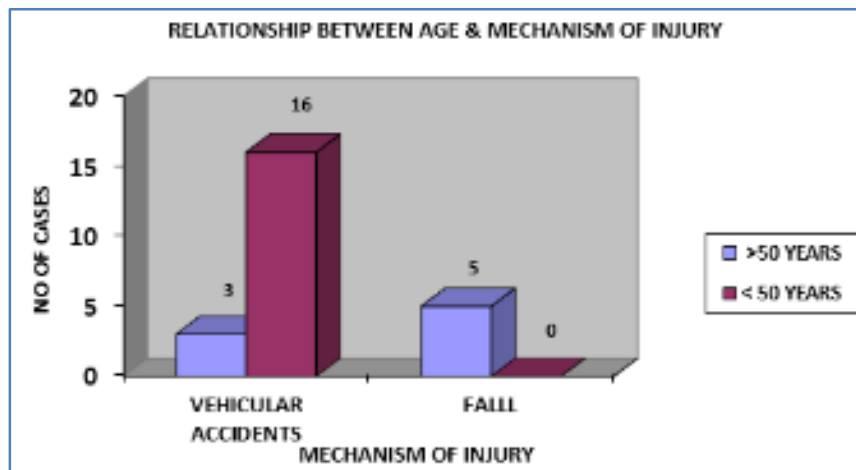
Table no. 4: side affected



Age (years)	Vehicular accidents		Domestic fall	
	No.	Percent	No.	Percent
> 50 years	3	19%	5	100%
< 50 years	13	81%	0	0%
<b>Total</b>	<b>16</b>		<b>5</b>	

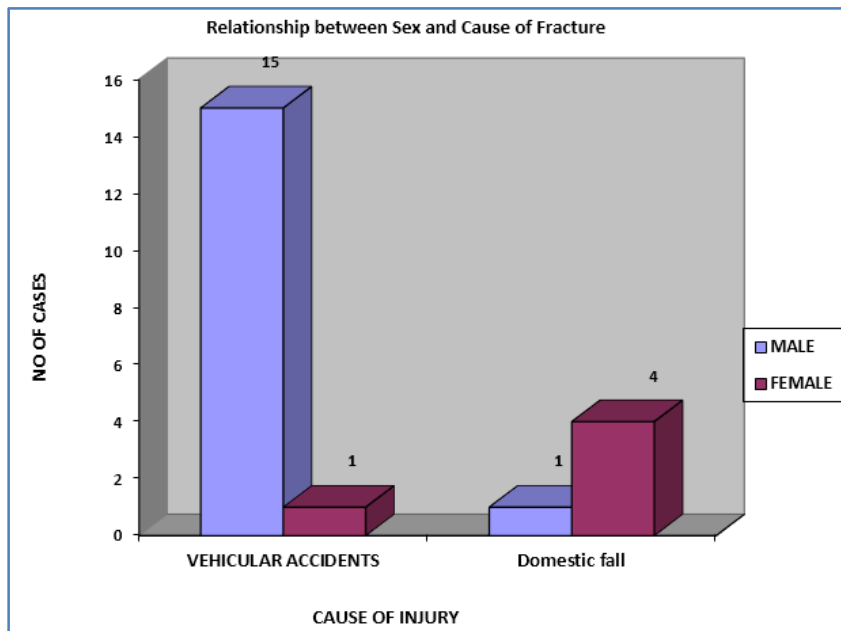
Table No. 5: Relationship Between Age & Mechanism Of Injury

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Sex	Vehicular accidents		Domestic fall	
	No.	Percent	No.	Percent
Male	15	94%	1	20%
Female	1	6%	4	100%
<b>Total</b>	<b>16</b>		<b>5</b>	

Table No.6: Relationship Between Sex And Cause Of Fracture

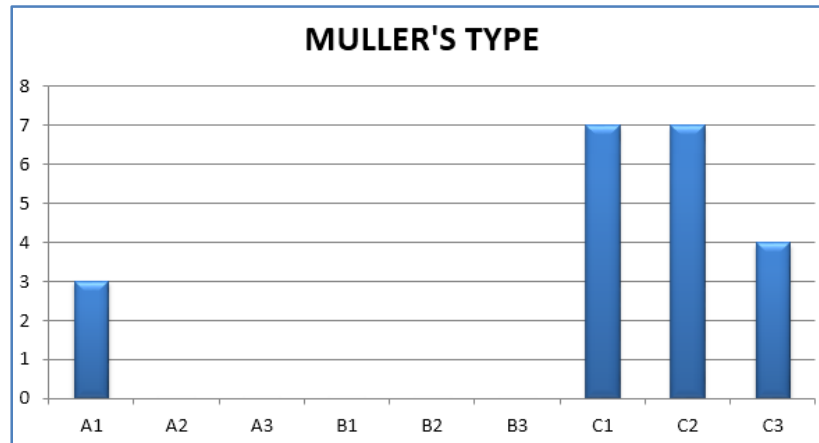


Supracondylar fracture	No of patients	Percent of lower end Of femur fracture
Mullers a1	3	14%
Mullers a2	Nil	Nil
Mullers a3	Nil	Nil

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Mullers b1	Nil	Nil
Mullers b2	Nil	Nil
Mullers b3	Nil	Nil
Mullers c1	7	34%
Mullers c2	7	34%
Mullers c3	4	18%

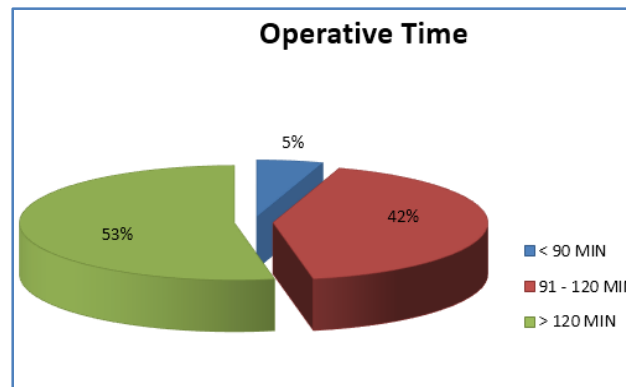
**Table no. 7: Type of Fracture Lower end of Fumer**



Maximum number of cases was of MULLERS Type C – 86%

Operative time (minutes)	No. of cases	Percentage
< 90 min	1	5%
91 – 120 min	9	42%
> 120 min	11	53%
<b>Total</b>	<b>21</b>	<b>100%</b>

**Table no. 8: Duration of surgery**

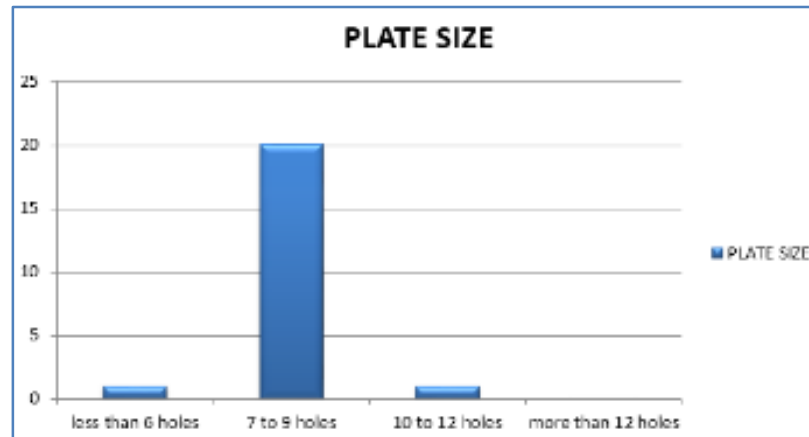


Average operative time was 140 min. Out of 11 patients who had surgical time more than 120 min, 5 patients underwent ORIF for other fractures, 2 patients underwent implant removal, freshening & bone grafting for supracondylar non-union.

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Plate size	Femur lower End	Percentage
4 – 6 holed	1	5%
7 – 9 holed	19	90%
10 – 12 holed	1	5%
>12 holed	Nil	Nil
<b>Total</b>	<b>21</b>	<b>100%</b>

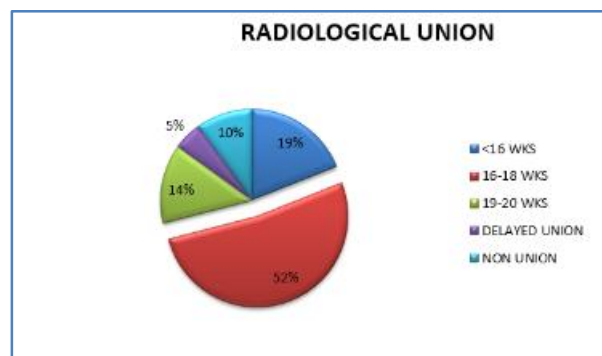
Table no. 9: size of plate used



The size of plate was selected based on the type of fracture. 7 and 9 holed plates were used most commonly.

Union (Weeks)	No. of cases	Percentage
<16	4	19%
16 – 18	11	52%
19 – 20	3	14%
21 – 22	NIL	NIL
Delayed Union	1	5%
Non-Union	2	10%

Table no. 10: Radiological union



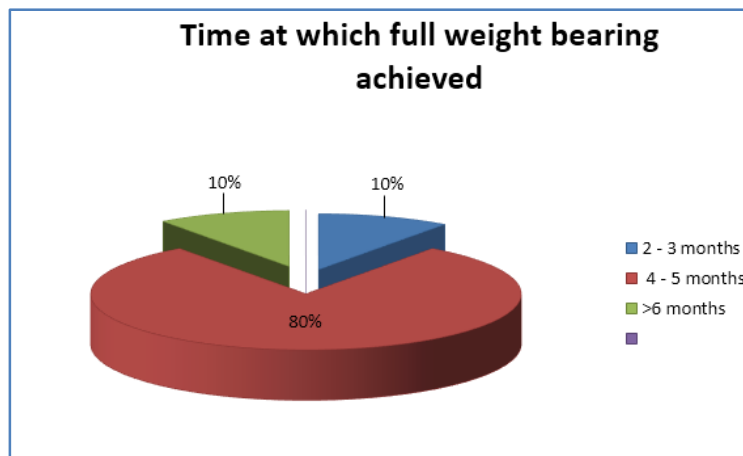


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Radiological union was defined as presence of bridging callus across three cortices. Average time for union was 16 weeks. 1 patient operated for supracondylar fracture non-union with implant failure had delayed union.

Achieved time (Months)	No. of cases	Percentage
2 – 3 months	2	10%
4 - 5 months	17	80%
> 6 months	2	10%
<b>Total</b>	<b>21</b>	<b>100%</b>

**Table No. 11: Time at which Weight Bearing Achieved**



### TABLE NO. 12: KNEE FLEXION

Normal knee flexion is 140 degree. Laubethal has demonstrated that average motion required for:

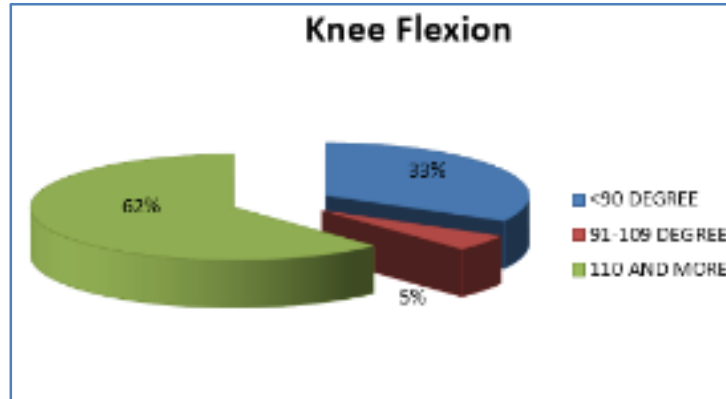
- Normal sitting 93 degree.
- Stair climbing 100 degree.
- Squatting 117 degree.

Thus, acceptable knee flexion compatible with daily activity would be 110 degree.

Knee Flexion (Degrees)	No. of cases	Percentage
< 90	7	33%
91 – 109	1	5
110 and MORE	13	62%

**Table no. 12: Knee Flexion**

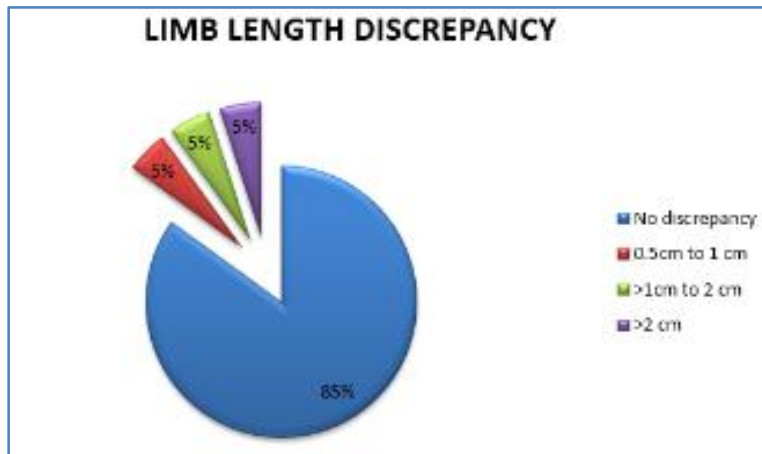
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Average flexion in this study was 115 degree with more than 62% patients having knee range of motion more than 110°.

Shortening (cms)	No. of cases	Percentage
No limb length discrepancy	18	86%
0.5 – 1 cm	1	5%
1-2 cm	1	5%
>2 cm	1	5%
<b>Total</b>	<b>21</b>	<b>100%</b>

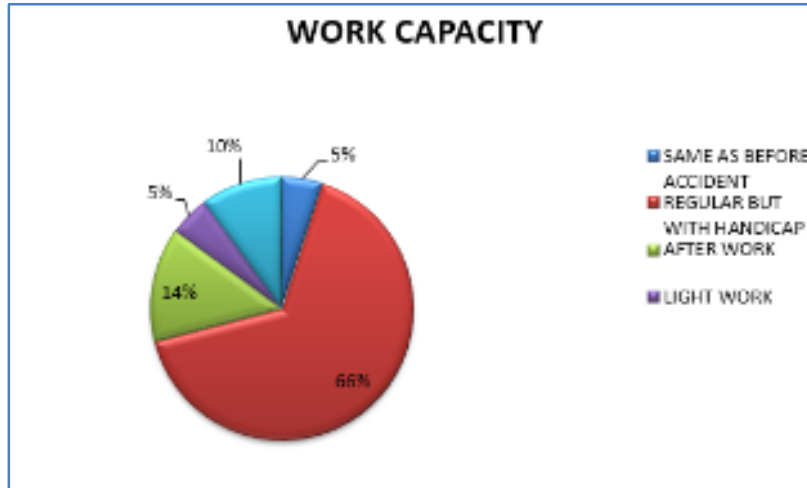
Table No. 13: Limb Length Discrepancy



Work capacity	No. of cases	Percentage
Same as before accident	1	5%
Regular but with handicap	14	66%
Alter work	3	14%
Light work	1	5%
No work	2	10%

Table No.14: Work Capacity

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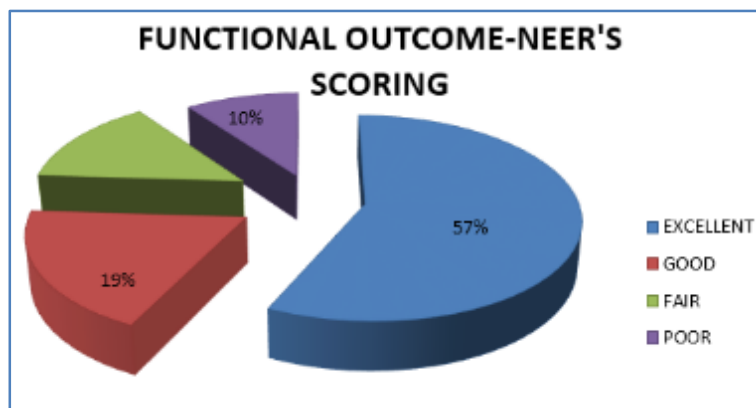


Complications	No. of cases	Percentage
Superficial infection	1	5%
Delayed union	1	5%
Plate back- out	0	0%
Deep infection	0	0%
Non-union	2	10%
Implant failure- screw/plate breakage	0	0%
Varusmalalignment	0	0%
Valgus malalignment	0	0%

Table No. 15: Complications

Grade	No. of cases	Percentage
Excellent	12	57%
Good	4	19%
Fair	3	14%
Poor	2	10%

Table No.16: Functional Results



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**DISCUSSION:** Supracondylar-intercondylar fracture of femur, historically have been difficult to treat. These fractures often are unstable and comminuted and have a potential for long term disability. The literature review shows various different implants and techniques in the management of these fractures, the use of these devices requires a certain amount of bone stock present, which limits their use in some fracture types.

Advance in mechanization and acceleration of travel have resulted in increased incidence of such comminuted, unstable open fractures.

The LCP is a single beam (fixed angle) construct where 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 as in unlocked plates. It acts as an 'internal fixator' and functions by splinting the fracture rather than compression and hence allows a flexible stabilization, avoidance of stress shielding and induction of callus formation.

Our study comprised of twenty one patients with distal femur fractures who were treated by locking compression plate. Overall final outcome was assessed in terms of regaining the lost knee function using NEER'S Score.

In our study 16 patients were males and 5 patients were females. The median age was 44 years ranging from 18 to 72 years. 16 of the fractures were caused by road traffic accidents and 5 were due to domestic fall. Road traffic accident has mechanism of injury was observed more common in younger males and domestic fall more common in elderly females. 14 patients were with fracture on right side and 7 on left side. The Epidemiology of group is consistent with previous review of literature.

The average union time was 16 weeks. 10 % non-union,. We had one case of delayed union.

At a mean follow-up of 12 months, the mean knee range of motion in this cohort was 0 to 115 degrees. Functional outcome at the end of one year was asessed using Neer's scoring system. Results were excellent in 12 patients (57%), good in 4 (19%), fair in 3(14%) and poor in 2(10%). In our studies functional results are close to the functional results achieved in other studies so are the rate of complications. Long term follow up is needed to assess the arthritic changes in intraarticular fractures.

**CONCLUSION:** The present study was undertaken to assess the functional outcome of open reduction and internal fixation of supracondylar factures femur by locking compression plate and the following conclusions were drawn.

1. The introduction of locking compression plates with option of locked screws has provided the means to increase the rigidity of fixation in osteoporotic bone or in the prtence of periarticular fractures.
2. Operative time is certainly reduced when working with Locking Compression Plate since surgical dissection is kept to a minimum. Surgical time further reduces if LISS, MIPPO technique is used this may be initially difficult and has a learning curve.
3. The device provides good angular stability by its triangular reconstruction principle and thus helps in early mobilization, even in communitied fractures where other modes of fixation often tend to delay the process of mobilization because of lack of stability.

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4. Perhaps one of its greatest applications is in osteoporotic fractures where it may provide a solution to the age old problems of screw cut out, late collapse, and malalignment since the stability of the construct does not entirely depend on the quality of the bone.
5. In contrast to other studies where LCP was used, our study used the plate through open reduction technique. However, when compared with other techniques of plating through open reduction technique the soft tissue damage is considerably less, since periosteal stripping and soft tissue exposure can be kept to a minimum. Use of Locking Compression Plate through Less Invasive Stabilisation System and Minimally Invasive Percutaneous Plate Osteosyntheses would probably further decrease the amount of soft tissue trauma.
6. It must be remembered that careful intraoperative attention should be given to restoring alignment in all planes. Restoration both medial and lateral column necessary to prevent complication.
7. Potential reasons for implant failures include technical errors in plate placement and early weight-bearing in the presence of delayed fracture union.
8. In our practice we use bicortical, non-locked screws in the proximal portion of the LCP which may improve pull-out strength compared with that provided by the unicortical locked screws of the LISS.
9. Earlier studies involving LISS did not recommend primary bone grafting. Our opinion is possible that judicious use of bone graft or bone-graft substitutes would enhance the healing response and decrease the potential mechanical failure and varus collapse.
10. In our institution we also have experience in supracondylar femur fracture nailing, which has difficulty in correcting rotation, varus and valgus malalignment. With advent of locking compression plate this difficulty has been overcome.



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