

## Functional Outcome of Locking Compression Plate in Supracondylar Fracture of Distal Femur

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### Abstract

*Background:* Utilization of LCP system in supracondylar fractures of distal femur couples the advantage of conventional plate osteosynthesis together with internal fixator systems. LCP involves use of compression plating and locked internal fixation method into one implant. The study was carried out to clinically explore the practical consequence of LCP in fracture associated with supracondylar region of distal femur on several aspects under investigation. *Materials and methods:* Ninety patients with age more than 18 years, with prolonged comminuted supracondylar fracture of femur were regarded eligible for the investigation. On the contrary, patient exemption criteria for the study included existence of pathological and periprosthetic fracture, patients with existing deformity of same limb or open fracture, or condition of polytrauma. Patients were operated, and the LCP was grafted according to standard surgical procedure. Post-operative follow-up data was collected for 6 months. *Results:* More than 50% patients exhibited outcome score as good, of which most them were above 30 years age. Less than 10% patients exhibited complications in both the cases of open and closed fracture. In patients with open fracture, reunion took place between 20-22 weeks, whereas in closed fractures, 70% patients indicated reunion between 16-18 weeks. Time of union was 16-18 weeks for maximum patients. *Conclusion:* Results reflected that the LCP condylar plate is the treatment of choice in the management of comminuted distal femoral fractures. LCP helped in maintaining limb length and had fewer complications, emphasizing the need to follow basic principles of fracture fixation.

**Keywords:** LCP; Supracondylar; Neer's score; femoral fracture.

### Introduction

The supracondylar area constitutes the distal 9-15 cm of distal femur [1]. Supracondylar fractures of femur have a bimodal age distribution, with a high incidence in young adults from high energy trauma, such as motor vehicle accidents and a second peak in elderly with minor fall [2,3]. Contrary to difficulty in treating and devastating outcomes, the supracondylar fractures constitute only 7% of all femur fractures [1]. They are often unstable and comminuted and tend to occur in elderly or in

patients with multiple injuries following road traffic accidents [4]. Femoral fractures are often associated with fractures of femoral neck, shaft, acetabulum, patella, tibia condyle and shaft. Anatomically, the femoral shaft is oriented 7° of valgus in relation to the knee joint, however maintaining this alignment is critical to the function and durability of the limb. Associated ligament injury of knee has been reported in 20% cases [5].

Earlier, during 1960's, these fractures were mainly treated by traction. Few fractures have been as difficult to treat as the supracondylar fracture

of the femur and few have resulted in as much disability. Stewart and Neer and their colleagues strongly support the concept that supracondylar fractures should be treated conservatively in traction. Stewart felt that the additional trauma and the proximity of the implant to the joint caused excessive reaction and subsequent adhesions [6]. Neer rightly indicated that no method of internal fixation was available which would provide sufficiently rigid fixation to eliminate postoperative splintage and permit early knee motion. In his opinion, this, coupled with the possibility of sepsis, far outweighed any possibility of gain by operative means [7]. Newer advancements include use of implants and various techniques targeting anatomic reduction of articular surface, limb alignment, surgical stabilization and early mobilization [8].

The Locking Compression Plate (LCP) system in supracondylar fractures of distal femur combines the facilities of conventional plate osteosynthesis with those of the internal fixator systems. It combines the two treatment methods (i.e., the compression plating and locked internal fixation methods) into one implant [9]. The aim of the investigation envisaged was to study the results in terms of improvement in functionality of LCP system employed in fractures associated of distal femur.

## Materials and Methods

The investigation was carried out at the Department of Orthopedics, Acharya Vinobha Bhawe Rural Hospital, Sawangi (Meghe) Wardha. The interventional study and the patients follow-up was done for year, from June 2017 to May 2018. The investigation involved 90 patients with comminuted supracondylar fracture of femur admitted in the host department. Clinical examination and interviewing methodology data was collected and subjected to statistical treatment using SPSS software (version 25.0.0.0).

### *Management of patient*

On arrival of the patient in the emergency room, initial emergency management is carried out by maintaining airway, breathing and circulation. Thorough assessment of the patient is then done to rule out head, chest, spinal or pelvic injury. Musculoskeletal examination is done to look for associated fractures. Stabilization of the patient with intravenous fluids, oxygen and blood transfusion

as required. The distal neurovascular status is carefully assessed. Then the fractured extremity is immobilized in a Thomas splint and sent for radiological examination. For open fractures thorough irrigation and lavage, debridement, intravenous antibiotics and delayed wound closure is done. Lower tibia skeletal traction is applied using a Steinmann pin or Denham pin under local anesthesia followed by continuous traction is given using Bohler Braun splint in ward.

### *Pre-operative assessment*

On admission relevant investigations for surgical workup are done in all patients which include hemogram, blood sugar level, renal function test, liver function test, blood grouping, Rh typing, bleeding time, clotting time, retroviral screening, hepatitis B antigen assay, hepatitis C antigen assay.

Fracture is classified according to the AO classification with the help of radiographs. Preoperative planning was done to assess the size of plate and screws to be used. The limb to be operated was prepared. Third generation cephalosporin given early morning on the day of surgery.

*Surgical procedure:* Anesthesia was induced through spinal epidural, or general.

Patient positioned supine on the operating table with a pillow below the knee to flex the knee. A pneumatic tourniquet is applied in the upper thigh. Tibial pin is then removed, the limb is scrubbed with povidone iodine. Ipsilateral iliac crest and contralateral leg is also prepared.

Lateral standard approach is mostly used. A lateral incision parallel to the shaft of femur, extending across the midpoint of lateral femoral condyle, anterior to fibular collateral ligament, across the knee and gently curved anteriorly to end distal and lateral to tibial tubercle. The Vastus lateralis is elevated from the lateral intermuscular septum and retracted anteriorly and medially exposing the distal femur.

The condyles are reduced and stabilized temporarily by K-wires and fixed with cancellous screws. Fibular strut graft is harvested from the ipsilateral side and inserted in the medullary cavity of the proximal femur and into the distal femur maintaining axial and coronal alignment. Supracondylar part is reduced, and distal femoral LCP placed. Cancellous bone graft from the iliac crest is placed to fill the gap. Wound is closed in layers after attaining hemostasis over suction drain.

*Post-operative period*

Vitals of the patients are monitored. Blood transfusion was given if postoperative hemoglobin is below 9 g/dl. Intravenous antibiotics are continued in the postoperative period for 5 days and oral antibiotics till suture removal. Analgesics are given as per patient's compliance. Sutures removal done on the 14<sup>th</sup> postoperative day. Patients are discharged once the surgical wound is healed and the general condition is stable.

Follow up: All patients were followed up at monthly for 6 months. At every visit patient is assessed both clinically (Table 1) using Neer's functional criteria and using radiographs (Fig. 1).

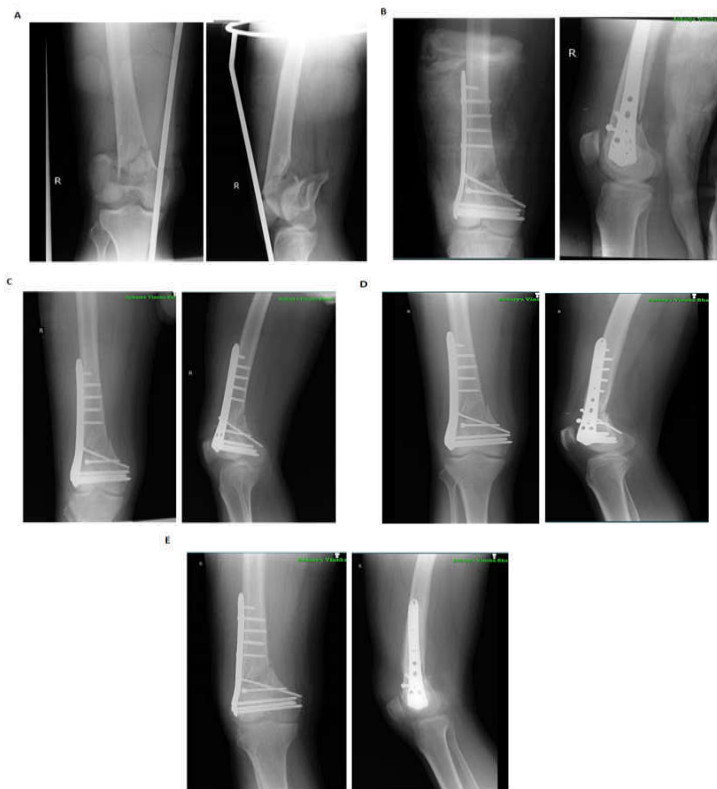
**Results and Analysis**

In our study, incidence of fracture is high in young patients and elderly (Fig. 3). In the study, both sides were affected equally (Fig. 4). In the study, 02 (2.22%) patients sustained fracture due to assault, 24 (26.67%) patients by fall, and 64 (71.1%) patients by RTA. (Fig. 5).

Prevalence of closed fractures was higher in comparison to closed ones (Fig. 6). The final outcome score was higher in good and excellent

**Table 1:** Neer's score chart

<b>Functional (70 points)</b>	
<i>A) Pain [20 points]</i>	
No pain	20
Intermittent	16
With fatigue	12
Limits function	8
Constant or at exertion	4
<i>B) Walking capacity [20 points]</i>	
Same as before accident	20
Mild restriction	16
Restriction stair sideways	12
Severe/cane	8
Crutches/ brace	4
<i>C) Movement - flexion [20 points]</i>	
Normal or 135°	20
Upto 100°	16
Upto 80°	12
Upto 60°	8
Upto 40°	4
Upto 20°	0
<i>D) Wok capacity [10 points]</i>	
As before	10
Regular with handicap	8
Alter work	6
Light work	4
No work	2



**Fig. 1:** Radiographs of supracondylar fracture of distal femur region and (A) pre-operative, (B) post-operative, (C) post-operative after one month, (D) post-operative after two months, (E) post-operative after six months.

category, as interviewed by the patients (Fig. 7). Complications, such as infection, knee stiffness, malunion and shortening, were less dominant, and almost equally distributed among all patients, whereas the rest had no complication (Fig. 8). After LCP plating, around 63% patients exhibited 16-

18 weeks as time taken for reunion (Fig. 9). Data collected from patients to elucidate the score at the follow-up from time to time, reflected higher mean score values in patients with progression of time (Fig. 10).

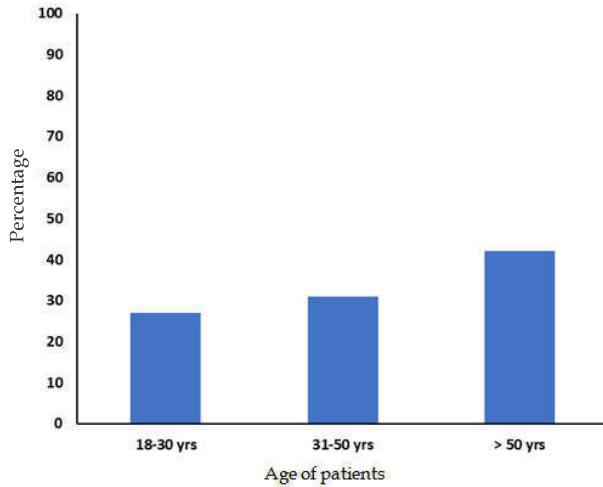


Fig. 2: Age wise distribution of patients

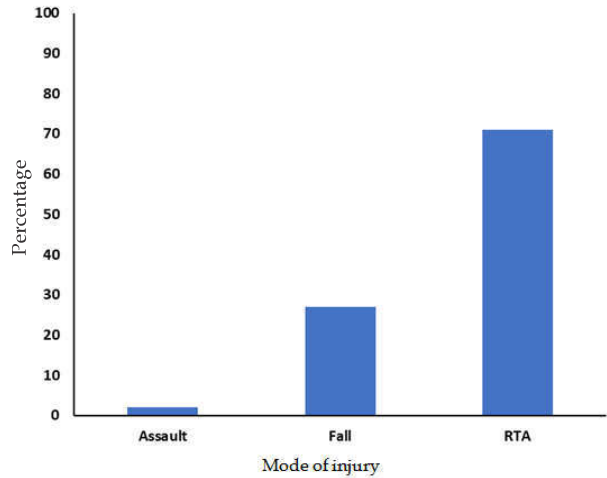


Fig. 5: Distribution of patients according to the mode of injury

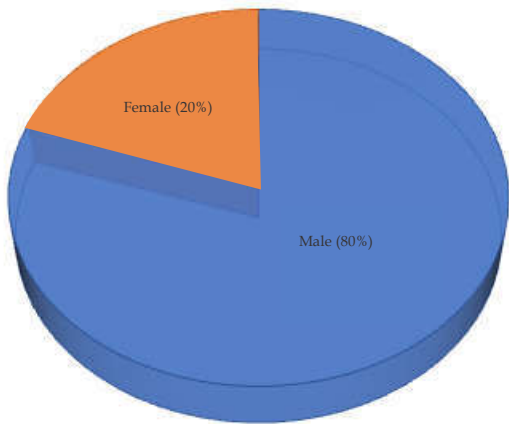


Fig. 3: Gender wise distribution of patients

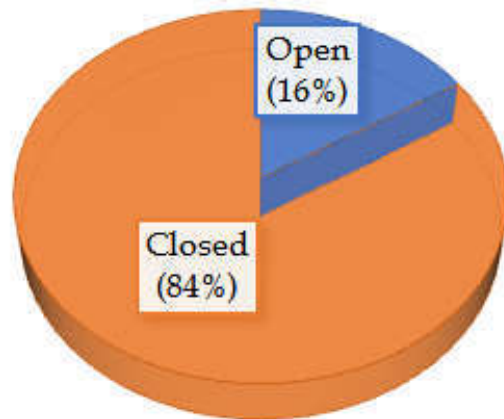


Fig. 6: Distribution of patients according to type of fracture

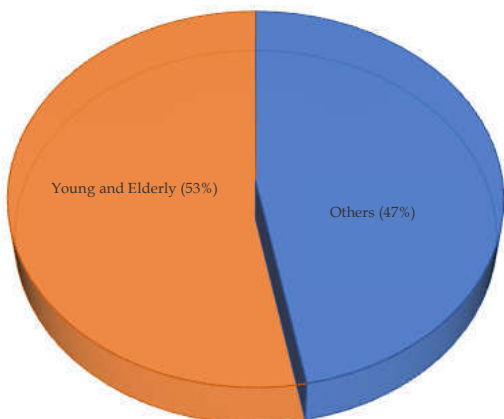


Fig. 4: Distribution of patients according to side of injury

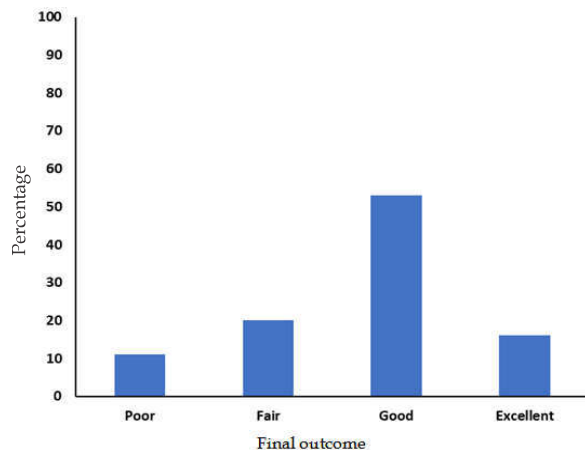


Fig. 7: Distribution of patients according to the outcome

Out of the total number of patients, 27% were between age 18-30 years, 31% between 31-50 years and 42% were above the age of 50 years. More than 50% subjects marked outcome score as good,

and most them were between age 31-50 years and above (Fig. 11). Higher proportion of male and patients indicated good score, as depicted in Fig. 12. Outcome score awarded as good was higher

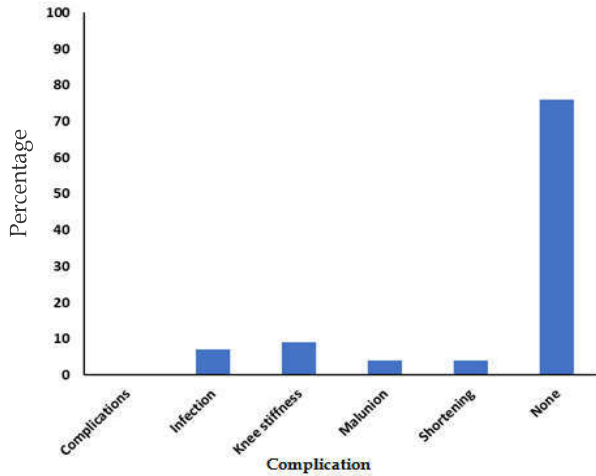


Fig. 8: Distribution of patients according to the complications

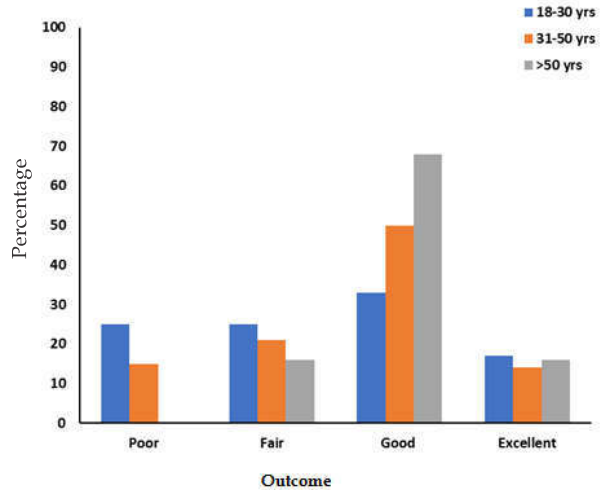


Fig. 11: Correlation of age with outcome

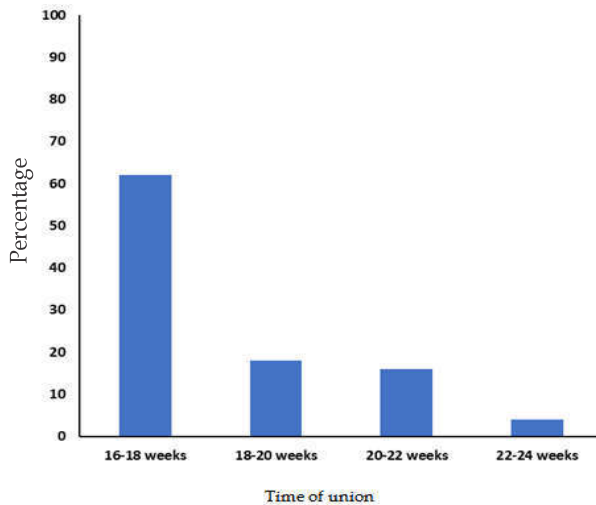


Fig. 9: Distribution of patients according to the time of union

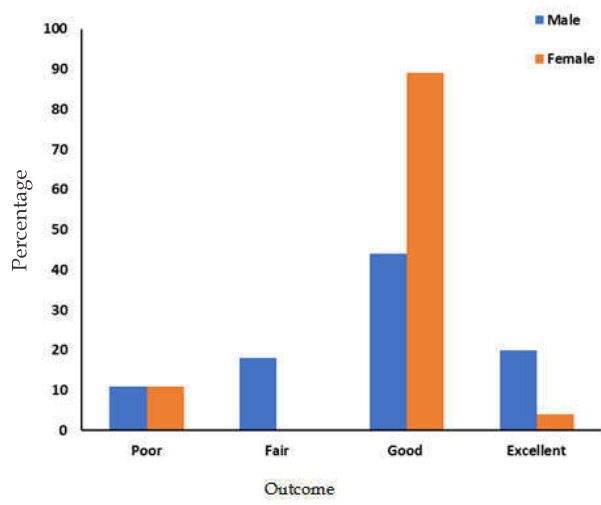


Fig. 12: Correlation of gender with outcome

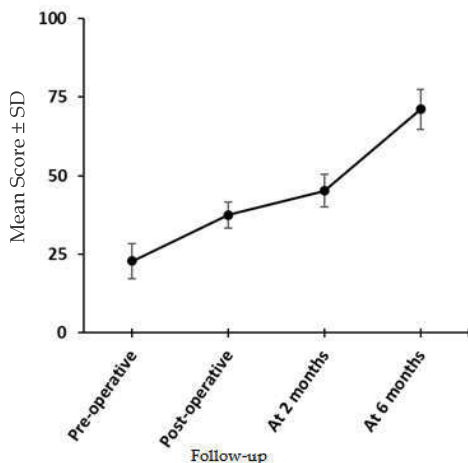


Fig. 10: Distribution of patients according to increase in score at follow up

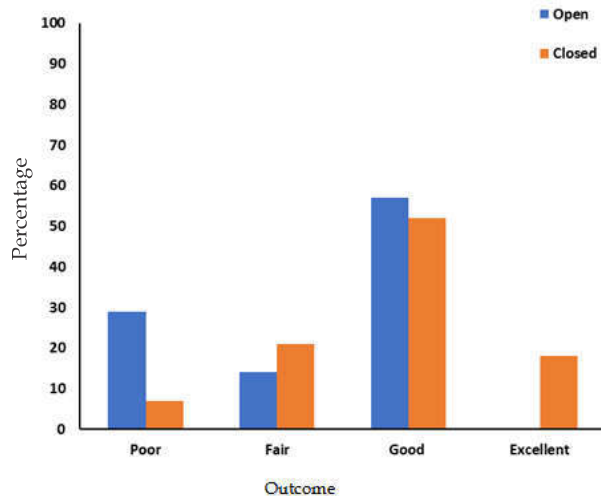


Fig. 13: Correlation of type of fracture with outcome

for both open and closed fracture cases (Fig. 13). Less than 10% patients exhibited complications in both the cases of open and closed fracture (Fig. 14). In patients with open fracture, reunion took place between 20-22 weeks, whereas in closed fractures,

70% patients indicated reunion between 16-18 weeks (Fig. 15). Age wise, maximum number of the patients revealed time of union duration between 16-18 weeks (Fig. 16).

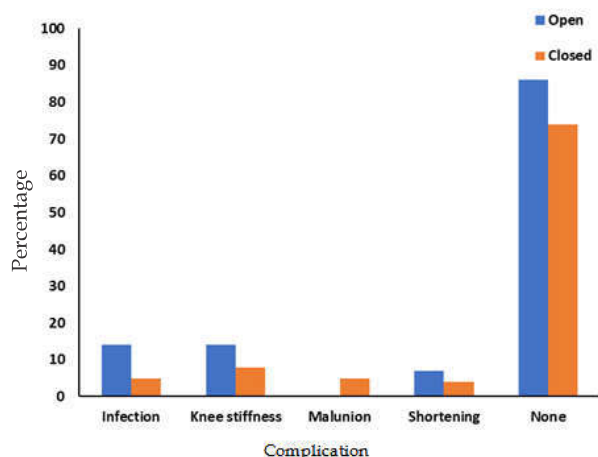


Fig. 14: Correlation of type of fracture with complication

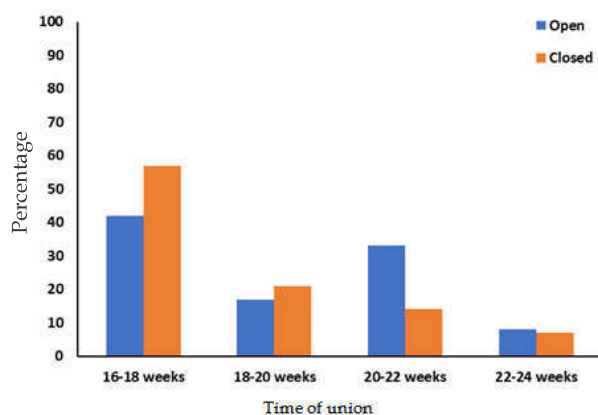


Fig. 15: Correlation of type of fracture with time of union

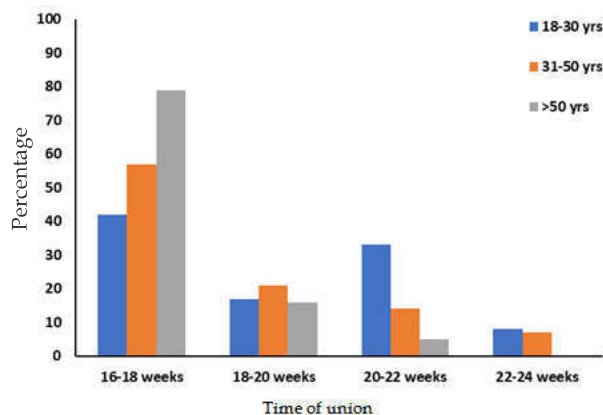


Fig. 16: Correlation of age with time of union

### Discussion

Comminuted supracondylar fractures of femur historically have been difficult to treat. Problems such as varus collapse, malunion and nonunion frequently resulted before fixed angle plates and indirect reduction techniques were popularized.

The minimum age of the patient was 18 years, whereas the maximum age was 75 years old. The mean age in the series was 45.6 years. The comparative age occurs in other studies as well [6-9]. The maximum (80%) patients were males in our study; one of the causes of preponderance in the males could be the fact that this fracture is usually associated with high energy trauma to which males are more commonly exposed than the females [8]. The right and left side were almost equally affected, showing no predilection for any side.

Studies done in 1960's by Watson-Jones, Charnley, and Neer et al. [7] revealed better outcome for patients treated non-operatively than for those treated operatively. However, complications of non-operative treatment included angular deformity, joint incongruity, knee stiffness and delayed patient mobilization [6,7,10].

But as per majority consensus of orthopaedicians now open reduction and fixation is the method of choice. Intra-medullary nails, external fixation, plates and prosthesis are the various strategies while fixing distal femoral fractures. Currently, most commonly used method is locking screws plates and intra-medullary nailing. The mean union time in our series was 18.9 weeks and this was comparable to that in the standard series [8,11,12].

LCP is a single beam construct whose unique biomechanical function is based on splinting rather than compression which gives good stabilization, protects from stress shielding and induction of callus formation. It can be applied through a minimally invasive technique preserving blood supply that allows prompt healing, lower rates of infection and reduced bone resorption. This intramedullary device maintains the anatomical axis, therefore failure of fixation in osteoporotic bone is less. Hence can preferably be used in osteoporotic fractures where it provides 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. In addition, a retrograde intra-medullary supracondylar nail has got distinct advantages of preservation of fracture hematoma, decreased blood loss, minimal soft tissue dissection, less operative time and reduced rate of infection. In addition, since this is unicortical fixation it has least chance of plate back out [13]. The LCP construct showed higher axial stiffness than the RAFN construct for both Normal and Low BMD groups (80% and 60%, respectively) which can be explained by higher axial load sharing in the LCP construct. Also, the larger number of screws in the LCP resulted in more load sharing and consequently less local deformation [14]. In the study conducted by Ginger K. Bryant et al., locked-plates maintained fracture alignment beyond the time to fracture union and also concluded that the locked-plate-screw construct provided the strength to maintain plate position in the area of the femoral stem, negating the need for additional stability from cerclage cables or wires. This sole method of stabilization appears to neutralize flexion-extension, varus-valgus, and torsional forces [15].

It has been suggested that using a long plate that spans the greater part of the femur provides additional strength along the femur, decreasing the risk of future peri-implant fracture that may occur secondary to the patients with osteopenia [16]. Thus we concluded that the LCP condylar plate is the treatment of choice in the management of comminuted distal femoral fractures especially Type A fractures where we have found higher Neer scores [17,18]. However in type C fractures the outcome is poorer. But still LCP remains the implant of choice for type C fractures also, though there are complications like knee stiffness and extensor lag were encountered in a few cases. LCP show better results than dynamic condylar screw and Angle Blade Plate [18,19]. Our technique and results are consistent with basic and empirical evidence that minimal soft-tissue dissection promotes fracture union [20,21]. Our technique of using LCP helped in maintaining limb length and had fewer complications, emphasizing the need to follow basic principles of fracture fixation [22].

### Conclusion

Distal femoral LCP is a good implant in fixation of comminuted supracondylar fracture of femur. Early knee Mobilisation can be done even in osteoporotic patients with modern locking compression plate fixation (LCP) techniques. Primary debridement has a great role in achieving better results in

compound injuries. Early fixation and mobilisation of knee with proper physiotherapy regime and timely follow-up is essential to achieve excellent results in these notorious supra-condylar distal femur fracture and prevent complications.

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