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Our experience with DF-LCP in the treatment of distal femoral fractures: A prospective study of 30 cases

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Abstract

Distal femoral fractures have been one of the greatest treatment challenge since ages. Before 1970, conservative treatment is associated with risk related with prolonged bed rest, and immobilization, persistent angulatory deformity, knee joint incongruity and loss of knee motion with poor final outcome. Due to continued research by AO, better implants are now available promising better results. DF- LCP is one of those recently developed implants.

Present study is designed to confirm the utility of DF-LCP as a better substitute for the treatment of supracondylar fracture femur.

A prospective study was conducted from June 2016 to July 2018 in the Department of Orthopaedics on 30 patients (21-71 yrs old, 19 males, 11 females) with distal femoral fractures.

They were treated using DF-LCP and followed up for 6 - 18 months.

Results were evaluated using Neer's rating System.

Average union-time was 15.1 week. There were 2 delayed union and no nonunion. Average time taken for full weight bearing was 13.43 weeks. Overall average knee flexion in 30 patients in this study was 114.47°. Neer's score was assigned for each patient after 24 to 36 weeks. Using this scale 16 cases (53.3%) showed excellent, 11 cases (36.7%) good and 3 cases (10%) poor result.

Conclusion: DF-LCP is a better implant for OTA type A and type C supracondylar femur fractures in both young and elderly patients with osteoporosis.

Keywords: Distal femoral fractures, DF-LCP, OTA Type A and type C supracondylar fracture femur

Introduction

Fractures of the distal end of femur especially comminuted with intra-articular extension remain the most challenging fractures faced by orthopaedic surgeons. These injuries produce significant long-term disabilities. They account for less than 1% of all fractures and comprise 6% of all femoral fractures [2, 3].

Before 1970, distal femoral fractures were treated conservatively with associated risk of prolonged bed rest, and immobilization, persistent angulatory deformity, knee joint incongruity and loss of knee motion with poor final outcome [6, 14].

With the development of newer implants by the AO group, treatment recommendations began to change. Now, operative treatment is recommended for most of these fractures to achieve anatomical reduction, stable internal fixation and early rapid mobilization of adjacent joints and early functional rehabilitation of the knee [8].

Locking compression plate has the advantage of combination of conventional compression plating and locked plating techniques which enhances the plate osteosynthesis. Anatomically precontoured plate reduces soft tissue problems and acts as an internal external fixator. It also has got distinct advantages of unicortical fixation and least chance of plate back out as the screw gets locked to the plate. The LCP-DF is a further development from the LISS which was introduced in the mid to late 1990's. The shaft holes on the LCP-DF (Locking Compression Plate for Distal Femur) are oval allowing for the options of a compression screw or a locking screw. This leads to a more precise placement of the plate, as it is able to be compressed more closely to the bone [9, 10].

Present study is designed to confirm the utility of LCP as a better substitute for the treatment of supracondylar fracture femur as against traditional fixed angle plates and nails.

Aim: To study the role of open reduction and internal fixation by Locking Compression Plate and its functional outcome in supracondylar fractures of femur.

Objectives

1. To assess radiological union by serial radiographs.
2. To assess functional status of patients after union of fractures by using NEER'S score.
3. To assess the complication of fracture if any.

Material and Methods

This was a prospective study conducted from June 2016 to July 2018 in the Department of Orthopaedics in a private medical college in Andhra Pradesh with a follow up period of 6 months to 18 months. After obtaining approval from institutional ethics committee, 30 skeletally mature patients with distal fracture femur fractures, satisfying the inclusion and exclusion criteria were enrolled. Informed and written consent was taken from the enrolled patients.

Inclusion criteria

1. All Patients above 18 yrs with closed /open (Gustillo-Anderson type I, II and IIIA) supracondylar fracture femur of Type A and Type C (OTA Classification).

Exclusion criteria

1. Fractures with neurovascular deficits.
2. OTA Type B fractures of distal femur.
3. Open fractures (Gustillo- Anderson classification) grade III B & III C.
4. Patients with additional fractures in the ipsilateral limb.
5. Pathological fractures except osteoporosis

All the patients were initially managed in emergency department according to advanced trauma life support guidelines. Later evaluated for local injury using a standard clinical and radiological format.

1. Fractures classified using AO/OTA classification.
2. CT of distal femur with (3D) reconstructions used to improve understanding of the fracture pattern particularly in TYPE C fractures.
3. All surgeries were performed using the standard operating techniques as described in

¹Rockwood and Green's "fractures in adults" (Text book of Orthopaedics) and the postoperative protocol including physiotherapy schedule was followed as prescribed.

Follow up protocol

Patients were followed up after 2 weeks, 1 month, 3 months, 6 months and at 9 months.

They were assessed by NEER'S functional scoring which consists of: Functional (70units) and Anatomic (30units) scoring as shown below:

Table 1: Neer's score-pain

| Pain (20 units) | Unit value |
|-------------------------|------------|
| 5- No pain | 20 |
| 4- Intermittent | 16 |
| 3- With fatigue | 12 |
| 2- Restrict function | 8 |
| 1- Constant or at night | 4 |

Table 2: Neer's score (functional)

| Function (20 units) | Unit value |
|--------------------------------|------------|
| 5- As before injury | 20 |
| 4- Mild restriction | 16 |
| 3- Restricted, stairs sideways | 12 |
| 2- Cane or severe restriction | 8 |
| 1 - Crutches or brace | 4 |

Table 3: Neer's score-knee flexion

| Motion (20 units) Knee Flexion | Unit value |
|--------------------------------|------------|
| 5 - Normal or 135 degrees | 20 |
| 4 - 100 degrees | 16 |
| 3 - 80 degrees | 12 |
| 2 - 60 degrees | 8 |
| 1- 40 degrees | 4 |
| 0- 20 degrees | 0 |

Table 4: Neer's scoring work capacity

| Work(10units) | Unit value |
|------------------------------|------------|
| 5- As before injury | 10 |
| 4- Regular but with handicap | 8 |
| 3- Alter work | 6 |
| 2- Light work | 4 |
| 1- No Work | 2-0 |

Table 5: Neer's score gross anatomy

| Gross Anatomy (15 units) | Unit value |
|---|------------|
| 5. Thickening only | 15 |
| 4. 5° angulation or 0.5 cm short | 12 |
| 3. 10° angulation or rotation, 2.0 cm short | 9 |
| 2. 15° angulation or rotation, 3.0 cm short | 6 |
| 1. Union but with greater deformity | 3 |
| 0. Non-union or chronic infection | 0 |

Table 6: Neer's score roentgenogram

| Roentgenogram (15 units) | Unit value |
|---|------------|
| Near Normal | 15 |
| 5° angulation or 0.5 cm displacement | 12 |
| 10° angulation or 1.0 cm displacement | 9 |
| 15° angulation or 2.0 cm displacement | 6 |
| Union but with greater deformity; spreading of condyles; OA | 3 |
| Non-union or chronic infection | 0 |

Table 7: Neer's score-overall rating

| Excellent | Above 85 units |
|-----------------------|----------------|
| Satisfactory / good | 70-85 units |
| Unsatisfactory / fair | 55-69 units |
| Failure | Below 55 units |

Observations and Results

Table 8: Age distribution of patients in this study

| Age | Number of Patients | Percentage (%) |
|----------|--------------------|----------------|
| 21-30 | 9 | 30 |
| 31-40 | 10 | 33.3 |
| 41-50 | 3 | 10 |
| 51-60 | 4 | 13.3 |
| Above 60 | 4 | 13.3 |

Age of the patients ranged from 21 to 71 yrs with an average age of 41.9 years. Majority of the patients (63.3%) were in the age group of 21-40 years. Males were aged between 21-61 years with an average of 37.8 years. Females were aged between 30-71 years with average of 49.7 years.

Sex distribution in present study

Out of 30 patients 19 (63.3%) were male and 11 (36.7%) were female.

Nature of injury in present study

In this study group 22 (73.3%) fractures were sustained due to road traffic accidents and 8(26.7%) fractures are due to slip or fall from height.

Table 9: Nature of Injury in present study

| Nature of injury | Distal femur fractures | Percentage (%) |
|------------------|------------------------|----------------|
| RTA | 22 | 73.3 |
| Fall | 8 | 26.7 |
| Total | 30 | 100 |

Side affected in present study: Right femur was involved more than left. None had bilateral fractures.

Table 10: Side affected

| Side | Number of fractures | Percentage (%) |
|-------|---------------------|----------------|
| Right | 17 | 56.7 |
| Left | 13 | 43.3 |

Relation between age and nature of injury in present study**Table 11:** Relation between age and nature of injury

| Age (years) | RTA | | Fall | |
|-------------|--------------------|----------------|--------------------|----------------|
| | Number of patients | Percentage (%) | Number of patients | Percentage (%) |
| ≤50 | 19 | 63.3 | 3 | 10 |
| >50 | 3 | 10 | 5 | 16.7 |
| Total | 22 | 73.3 | 8 | 26.7 |

Majority of the cases 19 (63.3%) were due to road traffic accidents seen in below 50 years of age, whereas fractures due to ground level fall on flexed knee 16.7% (5 cases) seen in above 50years of age.

Type of injury in present study

Out of 30 fractures, 19 fractures accounting for 63.3% were open fractures. Rest of the fractures were closed.

Table 12: Type of Injury Open versus Closed

| Type of Injury | Number of Fractures | Percentage (%) |
|----------------|---------------------|----------------|
| Open | 19 | 63.3 |
| Closed | 11 | 36.7 |

Fracture type in present study

In this study, out of 30 fractures, type A fractures were seen in 13 patients (43.3%) and type C fractures were seen in 17 patients (56.7%).

Table 13: Fracture OTA Types in this study

| OTA classification Type | No. of patient | Percentage (%) |
|-------------------------|----------------|----------------|
| A1 | 5 | 16.7 |
| A2 | 4 | 13.3 |
| A3 | 4 | 13.3 |
| C1 | 6 | 20 |
| C2 | 7 | 23.4 |
| C3 | 4 | 13.3 |

Radiological union of fracture in present study

Average time for fracture union was 15.1 weeks. There was delayed union in 2 patients. There were no non-unions. Most of the fractures were united between 12 to 18 weeks.

Table 14: Time taken for radiological union

| Union time (weeks) | Number of fractures | Percentage (%) |
|--------------------|---------------------|----------------|
| ≤12 | 10 | 33.3 |
| 13-18 | 16 | 53.3 |
| 19-24 | 2 | 6.7 |
| 25-30 | 2 | 6.7 |

Time of full weight bearing in present study:**Table 15:** Time of full weight bearing after surgery

| Full weight bearing time (weeks) | Number | Percentage (%) |
|----------------------------------|--------|----------------|
| <12 | 4 | 13.3 |
| 12-16 | 23 | 76.7 |
| 17-20 | 2 | 6.7 |
| >20 | 1 | 3.3 |

Average time taken for full weight bearing in this study was 13.43 weeks.

Knee flexion achieved in this study**Table 16:** Post op knee flexion achieved

| Knee flexion (degrees) | Number of patients | Percentage (%) |
|------------------------|--------------------|----------------|
| >110 | 15 | 50 |
| 91-110 | 12 | 40 |
| ≤90 | 3 | 10 |

In this study 50% of the patients had knee flexion of more than 110 degree, 40% had 91-110 degree and 10% had less than 90 degree.

Table 17: Knee flexion in different OTA types fractures

| Type of Fracture OTA Classification | Number of Fractures | Average Knee Flexion (Degrees) |
|-------------------------------------|---------------------|--------------------------------|
| Type A | 13 | 118.66 |
| Type C | 17 | 110.27 |
| Total | 30 | 114.47 |

Average knee flexion in type A fractures was 118.66 degrees and type C was 110.27 degrees. Overall average knee flexion in 30 patients in this study was 114.47°.

Neer's pain score in present study**Table 18:** Neer's Pain Score

| Pain | Number of patients | Percentage (%) |
|----------------------|--------------------|----------------|
| No pain | 4 | 13.3 |
| Intermittent | 22 | 73.4 |
| With fatigue | 4 | 13.3 |
| Restrict function | 0 | 0 |
| Constant or at night | 0 | 0 |

Neer's function score in present study

Table 19: Neer's Score on Function

| Function | Number of patients | Percentage (%) |
|-----------------------------|--------------------|----------------|
| As before injury | 4 | 13.3 |
| Mild restriction | 22 | 73.4 |
| Restricted, stairs sideways | 4 | 13.3 |
| Cane or severe restriction | 0 | 0 |
| Crutches or brace | 0 | 0 |

Neer's scoring for work capacity in present study

Table 20: Neer's Score on Work Capacity

| Work capacity | Number of patients | Percentage (%) |
|---------------------------|--------------------|----------------|
| Same As before injury | 7 | 23.3 |
| Regular but with handicap | 20 | 66.7 |
| Alter work | 3 | 10 |
| Light work | 0 | 0 |
| No Work | 0 | 0 |

Neer's score gross anatomy

Table 21: Neer's Gross Anatomy Score

| Gross anatomy | Number of fractures | Percentage (%) |
|--|---------------------|----------------|
| Thickening only | 20 | 66.7 |
| 5° angulation or 0.5 cm short | 10 | 33.3 |
| 10° angulation or rotation, 2.0 cm short | 0 | 0 |
| 15° angulation or rotation, 3.0 cm short | 0 | 0 |
| Union but with greater deformity | 0 | 0 |
| Non-union or chronic infection | 0 | 0 |

Neer's score roentgenogram in present study

Table 22: Neer's Rontgenogram Score

| Roentgenogram | Number of fractures | Percentage (%) |
|---|---------------------|----------------|
| Near Normal | 12 | 40 |
| 5° angulation or 0.5 cm displacement | 15 | 50 |
| 10° angulation or 1.0 cm displacement | 3 | 10 |
| 15° angulation or 2.0 cm displacement | 0 | 0 |
| Union but with greater deformity; spreading of condyles; osteoarthritis | 0 | 0 |
| Non-union or chronic infection | 0 | 0 |

Neer's score-overall rating in present study

Long term results were rated using Neer's rating system. Neer's score was assigned for each patient after 24 to 36 weeks. Using this scale 16 cases (53.3%) shown excellent, 11 cases (36.7%) good and 3 cases (10%) poor result.

Table 23: Final outcome as per Neer's score

| Out come | Number of patients | Percentage (%) |
|-----------------------|--------------------|----------------|
| Excellent | 16 | 53.3 |
| Satisfactory / good | 11 | 36.7 |
| Unsatisfactory / fair | 3 | 10 |
| Failure | NIL | 0 |

Complications in present study

The complications we encountered include superficial infection in 2 patients, plate lift in one patient and varus malalignment in three patients. Superficial infections were subsided by

intravenous antibiotics. Out of three varus malalignments two were of type C3 fracture and one type C2. Factors contributing to malalignment were severe comminution and improper reduction.

Table 24: Complications encountered in present study

| Complications | Number |
|-----------------------|--------|
| Superficial infection | 2 |
| Plate lift | 1 |
| Varus malalignment | 3 |

Illustrative case



Fig 1: Preop x-ray

Fig2: Immediate post op x-ray



Fig 3: 1 yr 3 months old post op

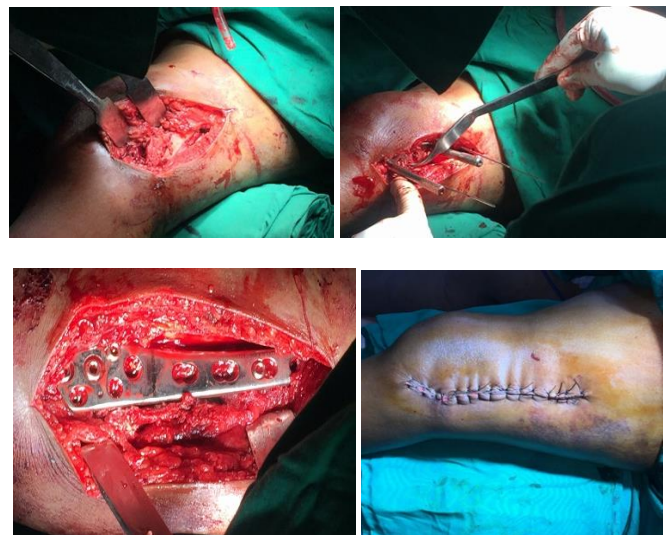


Fig 4 : Intra operative photo showing LCDCP fixation

Functional outcome



Fig 5: Knee extension in supine



Fig 6: Knee flexion in supine

Discussion

The aim of the study is to assess the functional outcome of open reduction and internal fixation by distal femoral locking compression plate. The study was particularly relevant as supracondylar fracture of femur historically has been difficult to treat. Problems such as knee stiffness, varus collapse, mal-union and non-union frequently resulted. These limitations have encouraged surgeons to resort to definitive operative management of the fractures by internal fixation using distal femoral locking compression plates. Successful treatment restored the anatomy and maintained the congruence of articular surface.

In the present study, age of the patients ranged from 21 to 71 years with an average age of 41.9 years. Of these 19 (63.3%) cases were in the age group of 21-40 yrs. However, present study does not show biphasic age distribution of the patient population as observed in other studies (Bell *et al...*, 1992).²⁵ High energy trauma was the cause in 73.3% of our patients from younger group. In Yeap *et al...* (2007) study, patients ranged from 15 to 85 years with a mean age of 44 years^[15]. In Mongkon Luechoo Wong, 2008 study the mean age was 41.6 years.^[16]

In Bachu S *et al...* (2017) study, patients ranged from 20-75 years with median age of 40 years^[19].

Table 25: Comparison of sex incidence in present study with other similar studies

| Studies | Sex incidence | |
|--|---------------|-------------|
| | Males (%) | Females (%) |
| Present study | 63.3 | 36.7 |
| Yeap <i>et al...</i> , 2007 ^[15] | 73.33 | 26.67 |
| Mongkon Luechoowong, 2008 ^[16] | 63.64 | 36.36 |
| Tapi Nalo <i>et al...</i> , 2015 ^[20] | 76.67 | 23.33 |

The male preponderance (19 males 63.3% versus 11 females 36.7%) can be explained as male patients were more involved in outdoor activities than females hence, more prone to vehicular accidents and trauma.

In our study 22 (73.3%) patients sustained fractures due to RTA

and 8 (26.7%) by slip and fall. Majority of RTA patients were below 50 years. Fall was the common mechanism in elderly. In the study by Yeap *et al...*, 2007^[15] 63.63% had RTA and 36.36% had fall as injury mode.

Out of 30 patients, 19 (63.3%) had open injuries including twelve patients of Gustillo-Anderson Type-1, five Type-2 and two Type-3A.

As per OTA classification, seventeen patients (56.7%) had intra articular (type C) fractures (C1-6, C2-7 and C3-4 cases) and rest 13 (43.3%) had extra articular (type A- A1-5, A2-4 and A3-4) fractures. This indicates that type C fractures occur more commonly than type A. The comparison with other studies is shown in following table.

Table 26: Comparison of Present Study with Various other studies

| Studies | A1 | A2 | A3 | C1 | C2 | C3 | B2 | Total no of patients |
|--|----|----|----|----|----|----|----|----------------------|
| Present study | 5 | 4 | 4 | 6 | 7 | 4 | - | 30 |
| Yeap <i>et al...</i> , 2007 ^[15] | 4 | - | 2 | 1 | 1 | 3 | - | 11 |
| Yang Teng <i>et al...</i> 2011 ^[18] | 8 | 5 | 5 | 5 | 3 | 5 | 4 | 35 |
| Weight <i>et al...</i> , 2004 ^[23] | - | 4 | 3 | - | 12 | 3 | - | 22 |

In this study majority of cases 22 (73.3%) had surgery within 7days. This was comparable to the study conducted by Yeap *et al...*^[15] in which the average number of days from injury to surgery was 9.9 days with a range of 4-19 days. The delay in surgery (>15 days) for 2 patients was due to late presentation, delay in surgical fitness and associated injuries. Others had 8-14 days delay in surgery due to medical comorbidities and financial constraints. All the 3 patients having unsatisfactory result had delay in surgery. We conclude that interval between injury to surgery plays an important role in fracture union and rehabilitation.

The post-operative rehabilitation was started with quadriceps strengthening, knee and ankle mobilization exercises from 2nd post-operative day as per the tolerance of patient.

Partial weight bearing was started after 6weeks and full weight bearing was started after full union of fracture on follow up. We had to delay weight bearing in three patients, up to 20 weeks in two and up to 24weeks in one case in view of infection. There were no cases of non-union in our study. In 2009 Kolb *et al...*¹⁷ also mobilised their patients non-weight bearing as early as 2-3rd postoperative day. In 2007 Kanabar *et al...*²¹ study, early partial weight bearing was allowed under supervision of the physiotherapist. Full weight bearing was started depending on the clinical and radiological progress of fracture healing.

We conclude that physiotherapy and rehabilitation have important role in restoring maximal functional outcome.

In our study the average time for the fracture union was 15.1 weeks. 26 patients (86.6%) had union within 12 to 18 weeks. Two patients had delayed union and no non-union. The comparison with other study is shown in following table.

Table 27: Comparison of fracture union time in present study with other similar studies

| Studies | Duration for fracture union (weeks) |
|--|-------------------------------------|
| Present study | 15.1 |
| Bachu S <i>et al...</i> , 2017 ^[19] | 16.6 |
| Tapi Nalo <i>et al...</i> , 2015 ^[20] | 26.47 |
| Yeap <i>et al...</i> , 2007 ^[15] | 18 |
| Wong <i>et al...</i> , 2005 ^[24] | 30 |
| Weight <i>et al...</i> , 2004 ^[23] | 13 |

Except the study of Tapi nalo *et al...* and Wong *et al...*, the fracture union time in our study was comparable to remaining all studies.

The longer fracture union time is usually due to higher incidence of comminution and osteoporosis. Possibly due to early intervention, less soft tissue handling and early mobilisation, we had reduced fracture union time.

Majority of the patients 27 (90%) were allowed full weight bearing within 16 weeks. Average duration before allowing full weight bearing was 13.43 weeks.

50% of the patients had knee flexion > 110°, 40% had 91°-110° and 10% had < 90° flexion. The minimum flexion obtained was 85° and maximum being 135°. Average knee flexion in type A fractures was 118.66° and type C was 110.27°, which shows that intra articular fractures lead to intra-articular stiffness and decreased range of motion.

In this study overall, average knee flexion in 30 patients was 114.47° possibly due to the stable and sturdy construct and the early range of motion achieved with DF-LCP. The comparison with other studies is shown in following table.

Table 28: Comparison of knee ROM achieved in present study with other similar studies

| Studies | Knee range of motion |
|-------------------------------------|----------------------|
| Present study | 114.47° |
| Bachu S <i>et al...</i> , 2017 [19] | 110° |
| Kolb <i>et al...</i> , 2009 [17] | 120° |
| Kanabar <i>et al...</i> , 2007 [21] | 100° |
| Yeap <i>et al...</i> , 2007 [15] | 107.7° |

We conclude ROM around knee is better in patients treated with DF-LCP. Postoperative ROM is less in type C fractures compared to type A.

All the patients in our study were followed for an average of 11.83 months (ranging from 6-18 months). All fractures were united eventually and there were no non-unions.

Table 29: Comparison of Average follow up done

| Studies | Average follow up (in months) | Range (in months) |
|------------------------------------|-------------------------------|-------------------|
| Present study | 11.83 | 6-18 |
| Yeap <i>et al...</i> , 2007 [15] | 9.7 | 6-15 |
| Kim KJ <i>et al...</i> , 2010 [22] | 14 | 6-20 |

In our study 16 (53.3%) cases had excellent functional outcome, 11 (36.7%) cases had good functional outcome and 3 (10%) cases had unsatisfactory results.

Table 30: Comparison of final results with other similar studies

| Studies | Excellent | Good | Unsatisfactory | Failure |
|--|-----------|--------|----------------|---------|
| Present study | 53.3% | 36.7% | 10% | - |
| Yeap <i>et al...</i> , 2007 ¹⁵ | 36.36% | 36.36% | 18.18% | 9.1% |
| Bachu S <i>et al...</i> , 2017 ¹⁹ | 56.66% | 26.66% | 6.66% | 10% |
| Tapi Nalo <i>et al...</i> , 2015 ²⁰ | 83.33% | 13.33% | 3.33% | - |

Unsatisfactory results are due to compound comminuted fractures and delayed surgical intervention.

We encountered following three complications:

Table 31: Comparison of complications in various studies

| S. N | Complications | number of patients | Possible cause/ treatment done |
|------|------------------------|-------------------------------|---------------------------------|
| 1 | Superficial infections | 2 | Intravenous antibiotics |
| 2 | Plate lift | 1 | - |
| 3 | varus malalignment | 3 (two Type C3 + one Type C2) | comminution, improper reduction |

In Sanders *et al...* [12] (1991) and Ostrum and Geel¹³ *et al...* (1995) reported 5.8% and 3% mal-union respectively. Bolhofner [14] (1996) observed only one malunion in his study. Mize [11] reported 7.3% of malunion in his series. Wong *et al...* [24] (2005) had no infection.

In Weight *et al.* [23] (2004) there were no cases of failed fixation, implant breakage, or infection. Only three mal-union, one angulatory (8° of valgus) and 2 rotatory (external rotation between 10° and 15°) were reported. 4 patients had painful hardware.

In Schütz *et al.* [7] (2001) deep infection requiring several debridement's occurred in 2 patients.

We had extensor lag in 3 cases (two 10° and one 5°) as compared to the study of Schütz *et al...* [7] (2001) where they also had 3 cases of extensor lag of more than 5°.

Conclusion

We conclude that distal femur locking compression plate (DF-LCP) can be an implant of choice for OTA type A and type C supracondylar femur fractures in both young and elderly with osteoporosis. It provides stable fixation, prevents metaphyseal collapse and maintains limb length in severely comminuted fractures.

LCP design precludes the need for plate to be contoured exactly to the bone, provides angular stability in the metaphyseal zone with minimal periosteal disruption. Careful selection of patients and strict adherence to the basic principles of fracture fixation will go a long way in reducing the complications of fracture fixation using locking compression plates.

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