

## Management Of Fractures Of Distal Femur

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Year Of Acceptance Of Thesis: 2013.

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**Abstract:** Distal femur fractures remain difficult fractures to treat successfully as they are often comminuted, unstable, with intra-articular extension and associated with severe soft tissue injury to the quadriceps mechanism and ligament disruption of knee joint. We intended to study the outcome and results of operative modalities of treatment for Distal femur fracture with Locking compression plates, Condylar buttress plate, Dynamic condylar screw with side plate and Retrograde intramedullary supracondylar nail.

**Method :** Different treatment modalities used for 50 patients with distal femur fractures are LOCKING COMPRESSION PLATE, CONDYLAR BUTTRESS PLATE, and DYNAMIC CONDYLAR SCREW WITH SIDE PLATE AND RETROGRADE INTRAMEDULLARY SUPRACONDYLAR NAIL.

**Results:** Extraarticular fractures (Type-A) had 90.90% excellent to good results and 9.09% fair to poor results whereas, Intraarticular fracture (type-C) had 60.72% excellent to good results and 39.28% fair to poor results. Average period of radiological union in this study was 14.16 weeks. Average knee flexion in our study was 109.5 degrees. 5.55% of cases had superficial to deep infection in plating group which recovered with necessary treatment. Significant extension lag of 15 degree developed in 8% patients. Knee stiffness developed in 8% patients. 6% patients (3 out of 50) of our study had limb shortening > 1.5cm.

**Conclusion:** In AO type A fracture pattern, all treatment modalities yields excellent to good results. In AO Type C1 and C2 fractures, locking compression plate, Condylar buttress plate and Dynamic condylar screw with side plate (DCS) had favourable outcome. Type C3 fractures with severe intraarticular comminution had less favourable outcome when fixed with any implant.

**Keywords:** Distal femur fracture, Condylar buttress plate, Locking compression plate, Dynamic condylar screw, Supracondylar nail.

**Thesis Question:** What is the best modality of treatment of Fractures of distal femur in adults?

**Thesis Answer:** It depends upon Patients age, configuration of fracture, with intra-articular extension and comminution, associated soft tissue injury and ligament injury of knee joint & Modality of fixation, Type C3 fractures with severe intraarticular comminution had less favourable outcome when fixed with any implant.

## THESIS SUMMARY

### Introduction

As Stewart et al. (1966) claimed that "fractures in the distal third of the femur continue to perplex the surgeon. Whether they are

transverse, oblique, or comminuted, supracondylar or intercondylar in a T, Y or V fashion their management still evokes much controversy because of the consistently poor results obtained."

Distal femoral fractures are much less common than hip fractures and account for about 4-7% of all femoral fractures. If fractures of the hip are excluded, 31% of femoral fractures involve the distal portion[1].

There is bimodal distribution of fractures. Most high energy distal femur fracture caused by motor vehicle accidents, sports and pedestrian accidents occurs in male between 15 & 50 years; while in women above 50 years, with osteoporosis, fractures occurs due to low velocity trauma such as fall from standing height at home[2].

Distal femur fractures remain difficult fractures to treat successfully as they are often comminuted, unstable, with intra-articular extension and associated with severe soft tissue injury to the quadriceps mechanism and ligament disruption of knee joint.

Both articular and extraarticular distal femur fractures require anatomical reduction in order to restore the functional and mechanical axis of the extremity. Also a stable internal fixation is required in order to start early range of movements to avoid stiffness of knee joint.

Various modes of treatment have been advocated by number of authors. They vary from closed treatment with traction, application of cast brace following preliminary traction, to open reduction and internal fixation with a variety of devices. But no single method of management overcomes all the problems associated with distal femur fractures.

Before 1970, the majority of distal femur fractures were treated conservatively where traction achieved acceptable results but exposed patient to the risk of prolonged bed rest, in addition to persistent angulatory deformity, knee joint incongruity and loss of knee motion[3].

With the development of improved internal fixation devices by the AO group, treatment recommendations have changed. Operative treatment is recommended for most fractures of the distal femur. The goal of operative treatment are anatomical reduction, stable internal fixation, early rapid mobilization of adjacent joints, preservation of blood supply and early functional rehabilitation of the knee. Early surgical stabilization can facilitate care of the soft tissue, permit early mobility and reduces the complexity of nursing care[4].

Several treatment options are available for fractures of the distal femur which require internal fixation using various plates such as 95 degree angled blade plate, condylar buttress plate, dynamic condylar screw with 95 degree side plate, locking compression plate, LISS (less invasive stabilization system) and intramedullary nails (ante grade/retrograde)[5]. It is not clear whether one implant is more reliable than another in achieving consistently good results. And there is no consensus on the ideal implant as such due to variable fracture patterns, comminution, and intra-articular extension in distal femoral fractures.

95° angled blade plate was one of the first plates; but due to problems like inadequate fixation in osteoporotic bone & difficulty in accurate insertion in three planes; it is not commonly used.

Dynamic condylar screw is the implant of choice when distal bone block of 4 cm was available for supracondylar fixation. Its advantages includes its ability to apply the inter-fragmentary compression across the femoral condyles for intercondylar fractures, better purchase in osteoporotic bones and the need for only two plane alignment. Main disadvantage is DCS fixation requires removal of large amount of bone from femoral condyles which makes revision surgery difficulty (if necessary).

Condylar buttress plate should be restricted to cases in which the

femoral condyles are comminuted or there are multiple intra-articular fractures in the coronal & saggital plane.

Most recently condylar locked plating systems has been developed. Locking condylar plates with minimum invasive technique yields higher union rates & have better fixation in osteoporotic bones & have better knee range of motion. Locking plates are relatively costlier than other devices. Locking plates are very useful in osteoporotic bones and in comminuted fractures. In today's orthopedics, Locking plate is one of the main treatment modality in fractures of distal femur.

Intramedullary supracondylar nail are load sharing rather than load bearing implant. Intra-medullary supracondylar nailing can be used for most AO type A fractures & may be used for intercondylar type C-1 & type C-2 fractures. Advantage with nailing is less tissue trauma & high union rates. Limitation for its use is that it cannot be used in intraarticular comminuted fracture.

### Aims & Objectives

This study was conducted in the Department of Orthopaedics of Government medical college, Latur to study and compare the results of:

1. LOCKING COMPRESSION PLATE.
2. CONDYLAR BUTTRESS PLATE.
3. DYNAMIC CONDYLAR SCREW WITH 95° SIDE PLATE.
4. RETROGRADE INTRAMEDULLARY SUPRACONDYLAR NAIL.

In various types of fractures of distal femur.

### Materials

Study Design:-

The present clinical study was carried out in our tertiary Institute over a period of December 2011 to November 2013. Patients with fracture of distal femur admitted to the hospital were selected as cases & all the necessary clinical details were recorded in proforma prepared for this study. Different treatment modalities used for 50 patients with distal femur fractures are LOCKING COMPRESSION PLATE, CONDYLAR BUTTRESS PLATE, and DYNAMIC CONDYLAR SCREW WITH SIDE PLATE AND RETROGRADE INTRAMEDULLARY SUPRACONDYLAR NAIL.

Inclusion criteria

1. The fractures of the distal femoral metaphyseal, metaphysiodiaphysial with or without intraarticular extension.
2. Closed fractures.

3. All compound fractures

Exclusion criteria

1. Fracture in patients of age < 18 years.
2. Any pathological fracture (except due to osteoporosis)

Method of study:-

Every patient was evaluated after history, clinical examination and radiological investigation and fracture pattern was classified according to AO classification. The best suitable FDA approved implant for a particular fracture pattern of distal femur was used. All patients were followed up at 1.5, 3, 5 & 7th post operative months for assessment of fracture union, range of knee motion, knee pain, and to note any complications.

At time of follow up a thorough clinical evaluation was done for any complaints, severity of knee pain, healing of wound, and knee range of motion, weight bearing, limb length discrepancy and deformity. Implant status and signs of union were also assessed on X-rays. Accordingly weight bearing was allowed. At final follow up all the cases were evaluated clinically and radiographically as per the under mentioned proforma and the results were rated on the basis of 'Schatzker and Lambert criteria' as – excellent, good, fair and poor results.

### Results

- In this study, patients were of age group between 20-70 years. Average age was 46.12 years. The ratio between male to female was 2.84:1.
- In our study, 66% of the fractures were because of Road traffic accident, 32% of fractures were because of fall, and only 2% were due to other causes such as assault. In this series, Road traffic accident constitutes the major cause of morbidity (81.81%) in < 50 years of age whereas self fall mainly results in morbidity (64.71%) in > 50 years of age.
- In this study, 66% of fractures were closed and 34% of fractures were compound.
- In this series, majority of the fractures were Intra-articular (56%) out of which AO type C1, C2 & C3 were 16%, 20% and 20% respectively. Remaining were Extra-articular (44%) out of which AO type A1, A2 & A3 were 16%, 20% and 8% respectively.
- In this study, 62.5% of the patients operated with Locking compression plate had blood loss >300ml whereas 37.5% had blood loss <300ml. Average blood loss was 284.38 ml.
- 57.2% of the patients operated with Condylar buttress plate had blood loss >300ml whereas 42.8% had blood loss <300ml. Average Blood loss was 282.14ml.
- 33.4% of the patients operated with Dynamic compression screw with plate had blood loss <300ml whereas 66.6% of the patients had blood loss >300ml. Average blood loss was 291.66 ml.
- All the patients (100%) fixed with Supracondylar nail had blood loss <300ml as compared to 37.5% of those operated with Locking compression plate, 42.8% those operated with Buttress plate and 33.4% of those operated with Dynamic compression screw with plate. The average blood loss was least (142.85 ml) with Supracondylar nail and when compared with Locking compression plate, Condylar Buttress plate and Dynamic compression screw with plate, it was found to be statistically significant. ( $t=8.505$ ,  $df=28$ ,  $p<0.0001$  highly significant for Locking plate and Nail,  $t=7.848$   $df=26$   $p<0.0001$  highly significant for Buttress plate and Nail,  $t=8.851$   $df=18$   $p<0.0001$  Highly significant for Dynamic condylar screw with plate and Nail)

Average period of union in our study was 14.16 weeks.

The average weight bearing in our study was at 15 wks

In this study, 75% patients fixed with Locking plate had no shortening, 18.75% had <1.5 cm shortening, while 6.25% had 1.5-2.5 cm of shortening. All patients fixed with Dynamic compression screw with plate had no shortening, 85.72% patients fixed with Buttress plate had no shortening, 7.14% had <1.5 cm and 7.14% had 1.5-2.5 cm shortening. 85.72% patients fixed with

Supracondylar nail had no shortening, 7.14% had <1.5 cm shortening, while 7.14% had shortening between 1.5-2.5cm. No patient had shortening >2.5 cm.

- In this study, 43.75% patients fixed with Locking compression plate had knee flexion >110 degrees, 43.75% patients had knee flexion between 110-90 degrees, while only 12.5% had knee flexion < 90 degrees. Average knee flexion for locking plate was 109.370 28.57% patients fixed with condylar buttress plate had knee flexion >110 degrees, 50% had knee flexion between 110-90 degrees and 21.42% had flexion <90 degrees. Average knee flexion for condylar buttress plate was 105 degree. 83.33% patients fixed with Dynamic compression screw with plate had knee flexion >110 degrees, 16.67% patients had knee flexion between 110-90 degrees, while no patients had knee flexion < 90 degrees. Average knee flexion for Dynamic compression screw was 118.350.50% patients fixed with Supracondylar nail had knee flexion >110 degrees, 35.71% had knee flexion between 110-90 degrees and 14.28% of patients had flexion <90 degrees. Average knee flexion for Supracondylar nail was 110.350.

- In this study, 31.25% of the fractures fixed with locking plate had excellent results, 43.75% had good results, and 12.5% had fair results, whereas only 12.5% had poor results. 21.45% of fractures fixed with buttress plate had excellent, 42.85% had good results, 14.28% had fair and 21.42% had poor results.

- 66.66% of the fractures fixed with Dynamic compression screw with plate had excellent results, 33.33% had good results. 42.85% of the fractures fixed with Supracondylar nail had excellent results, 28.57% had good results and 14.28% had fair results, whereas 14.28% had poor results.

- In this study, 90.90% patients with extra-articular fractures had excellent to good results. Whereas only 60.17% patients with intra-articular fractures had excellent to good results indicating that the extra-articular fracture patterns are associated with favourable outcome as compared to intra-articular fracture pattern.

- **Type A fracture pattern** In this study, all 4(100%) patients having AO type A fracture pattern operated with locking plates had excellent to good results. Whereas, 2 (66.66%) out of 3 patients operated with condylar buttress plate had excellent to good results. On the other hand, all 4(100%) patients operated with DCS with plate had excellent to good results & 10(99.99%) out of 11 operated with supracondylar nail had excellent to good result.

- **Type C1 fracture pattern** In this study, 3(100%) patients operated with locking plate for above fracture pattern had excellent to good results. Whereas out of 2 patients operated with DCS with plate 1(50%) had Excellent and 1(50%) had good result. On the other hand, 2 patients operated with condylar buttress plate, 1(50%) has excellent & 1(50%) has good result. 1 patient operated with Supracondylar nail, had fair result.

- **Type C2 fracture pattern** In this fracture pattern, out of 5 patients operated with locking plates, 1(20%) had excellent results, 2(40%) had good results, 1 had fair & 1 poor result. Out of 3 operated with condylar buttress plate 1(33.33%) has excellent and 2(66.67%) had good result. 2 (100%) patients operated with supracondylar nail has poor results.

- **Type C3 fracture pattern** In this fracture pattern, out of 4

patients operated with locking plates, 2(50%) had good results, 1(25%) had fair results and 1(25%) had poor results. Out of 6 patients operated with condylar buttress plate 2(33.33%) had good, 1(16.7%) has fair and 3 (50%) had poor results. This fracture pattern is unsuitable for DCS and Supracondylar nail. So, DCS and Supracondylar nail are not included in AO type C3.

- In this study, 81.81% patients having closed fractures were having excellent to good results as compared to 57.13% of Gr-I compound and 66.37% of Gr-II Compound fractures with excellent to good results. Closed fractures had 18.18% of fair to poor results whereas Gr-I compound had 42.85% and Gr-II Compound had 33.33% fair to poor results.

- In this study, superficial infection in the form local stitch abscess developed in 1 patient operated with Locking plate which subsided after local drainage and i.v. antibiotics. Deep infection in the form of frank pus from the operated site developed in 1 patient operated with condylar buttress plate which has associated ipsilateral Grade III compound fracture calcaneus and same case has gone into delayed union which eventually united on 24th week postoperatively.

- One case fixed with Supracondylar nail had knee impingement and continuous knee pain while weight bearing which relieved after nail removal.

- Significant Shortening (>1.5cm) developed in 3 patients out of which 1 patient was fixed with Locking plate (2cm shortening), 1 fixed with Buttress plate (2cm shortening) 1 patient was fixed with Supracondylar nail (2.5 cm shortening).

- Significant extension lag of 15 degree developed in 4 patients (1 with Locking plate, 2 with condylar buttress plate and 1 with supracondylar nail).

- Knee stiffness developed in 4 patients (1 patient fixed with locking plate, 2 with condylar buttress plate and 1 with Supracondylar nail)

- One patient fixed with buttress plate had Loosening of screws and another has preoperative foot drop.

### Discussion

Fractures of the distal part of femur are difficult to treat, whether surgical or non-surgical methods are selected. Conservative treatment often leads to knee stiffness, quadriceps wasting, fracture angulation, knee joint incongruity and displacement within the cast.

The surgical principles outlined and popularized by AO/ASIF group have improved the operative results in these fractures significantly. As with any other Fracture treatment the goal of treatment is restoration of limb function. These can be achieved with anatomic reduction of the distal femoral articular surface, stable internal fixation with restoration of axial alignment, minimal soft tissue stripping and early active mobilisation [51].

Although surgical treatment is recommended for most of the distal femoral fractures, controversy remains selecting the optimum fixation device [52].

Available implants for fixation of these fractures are Fixed angle blade plate, Condylar buttress plate, DCS with side plate, cancellous screws, Locking plate and Supracondylar nail.

The standard treatment for distal femoral fracture, with or without intra-articular involvement is open reduction and stable

internal fixation with plates and screws. With the use of aseptic precautions, the incidences of infection and non-union have been lessened, but still are frequent. The use of plates and screws in the fixation of fractures has the inherent drawback of producing load-shielding effect. This is especially important in elderly patients who have osteoporotic bones [36]. On the contrary, locking plates are considered as the treatment of choice in elderly patients due to multiplanar cancellous screw fixation with locking heads in the condylar region which provide better fixation of osteoporotic femur.

Despite a proven higher stiffness of plate systems compared with intramedullary nails, the latter devices provide the advantage of an indirect fracture reposition away from the almost always comminuted metaphyseal region. The use of bone grafts may be reduced. In addition, nail acts as a load sharing implant. Thus avoiding the drawback of load-shielding effect of plates [46]. Retrograde nail also does not provide stable and rigid fixation due to wide medullary cavity in the distal femur and relatively small size of the nail.

A prospective study was conducted in 50 patients who presented with closed and compound supracondylar fracture femur and fitting in the determined inclusion and exclusion criteria. Informed and written consent taken of each patient. The patients were thoroughly assessed with regards to complete history, clinical examination, and routine haematological and radiological investigation. The patients were classified according to AO/OTA classification. The best operative modality of treatment (FDA approved implant) for a particular fracture pattern was chosen. After getting anaesthesia fitness, patients were operated. Routine post operative care was given and patients were called for follow-up visits after discharge. Thus the study was conducted with the aim to evaluate the clinical profile of distal femoral fractures, to compare the results and complications of operative modalities by following implants namely- Locking plate, Condylar buttress plate, Dynamic condylar screw with side plate and Retrograde Supracondylar nail for Distal femoral fractures.

### Conclusion

In AO type A fracture pattern, all treatment modalities yields excellent to good results. In AO Type C1 and C2 fractures, Locking compression plate, Condylar buttress plate and Dynamic condylar screw with side plate (DCS) had favourable outcome. Type C3 fractures with severe intraarticular comminution had less favourable outcome when fixed with any implant.

### Clinical Message

How results of your thesis might affect clinical practice.

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Conflict of Interest: Nil  
Source of Support: None

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**How to Cite this Article:** Gawali S R, Gajanan K M, Bhosage M, Niravane P V. Management Of Fractures Of Distal Femur. Journal Medical Thesis 2015 May-Aug ; 3(2):31-35.