

## COMPARATIVE STUDY OF RESULTS OF FRACTURE DISTAL THIRD FEMUR TREATED WITH VARIOUS OPERATIVE MODALITIES

Mithlesh Kumar Meena<sup>1</sup>, Yogesh Kumar Gautam<sup>2</sup>, Lokesh Jangir<sup>3</sup>, Utsav C Shetty<sup>4</sup>

<sup>1,2,3,4</sup> Government Medical College, Kota

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**Corresponding author:** Utsav C Shetty

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### Abstract

Distal femoral fractures are difficult to treat and ideal treatment of such fractures will include anatomical reduction, rigid fixation of articular surfaces and early mobilization of knee joint. The purpose of the study is to evaluate the end results of surgical management of fracture of distal end of femur using various surgical modalities and analyze the complications and the causes of fractures.

**Materials and methods:** A Retrospective Study of 75 patients was evaluated from tertiary hospital for a period of July 2007 to July 2009. There were 75 fractures in 75 patients involving the distal femur, which were treated surgically by internal fixation using various surgical modalities.

**Results:** At the end of study, the cases were followed up for an average period of 15.6 months and functional results were evaluated using **modified Schatzker and Lambert (1982) criteria**. 36 cases were fixed with Supra Condylar nail ( SC nail), 20 cases were fixed with dynamic Condylar screw(DCS), 6 cases were fixed with Dynamic Compression Plate(DCP), 6 cases were fixed with Cancellous Screw, 4 cases were fixed with Enders Nail, 3 cases were fixed with Ext. Fixator

**Conclusion;** Fractures of distal femur can be very effectively treated by surgical methods. The satisfactory osteosynthesis of fractures and stable osteosynthesis is achieved by the right approach and correct surgical technique.

**Keywords:** distal femur fracture, internal fixation, dynamic condylar screws, supracondylar femur nail

### Introduction

The two major pandemics of modern era: Obesity & RTA have recorded an alarming increase in new millennium. These often involve the lower limbs, and femoral shaft fractures are among most common serious injury. Distal femur fracture contributes 4% of all femoral fractures <sup>(1)</sup>. The superconductor area of femur comprises of distal 9 centimetres of femur as measured from articular surface. The fracture has bimodal age distribution, incidents being highest in woman older than 75 years caused by minor trauma due to osteoporosis and in adolescent boys and men 15 to 24 years old caused by high energy trauma as RTA.

The mechanism of injury in most distal femoral fracture is thought to be axial loading with varus/ valgus or rotational forces.

Management of distal femur fracture in is a controversial subject. It poses problems the because-

- They are high-energy fractures in young patient that will be communitted.
- In old age there will be a thick cortex which results in screw pull out leading to implant failure
- These fractures are readily deformed secondary to the initial traumatic force and imbalance of surrounding

muscle pull that frequently results in posterior displacement of fracture fragment

- Associated injuries due to poly-trauma.
- Its proximity to knee joint leading to ligament injuries to knee joint

Once diagnosed, these distal third femoral fractures require early and proper treatment to avoid complications, such as Mal-union, Non-union, Knee stiffness and infection.

There is diversity of opinions about treatment of these fractures. Closed management (traction and cast bracing) remains the treatment of choice for these fractures in institutions where the experience, surgical instrumentation and rehabilitation are not available and also for simple, non-displaced fracture L/3 femur. There is not much dispute about the treatment of **condylar fracture** because these fractures with displacement are best treated by open reduction and internal fixation with Lag Cancellous Screw, T Buttress plates, dynamic condylar screw to maintain articular surface congruence.

Regarding other two fractures i.e. supracondylar fracture and fracture involving distal diaphysis, the treatment is very debatable. Operative procedures adopted are -

- Intra Medullary Inter Lock Nail (Antegrade)
- Intra Medullary K Nail

3. Supra Condylar Nail (Distal Femoral Nail)
4. Dynamic Condylar Screw Fixation (DCS)
5. 5 Lag cancellous screw
6. 6.-95° Angle blade plate
7. Ender's Nail
8. Dynamic Compression Plate Fixation.
9. Ext. Fixator with / without multiple K-wire fixation.

This prospective study to be undertaken to analyze all the cases of fracture distal third femur treated in this department by various operative procedures suitable for that particular fracture, its difficulties and delayed complications encountered, merits and demerits of procedures.

### MATERIAL AND METHODS

This is a prospective interventional study conducted in the Department of Orthopaedics, Dr. S.N. Medical College and associated group of hospitals, Jodhpur during the period of July 2007 to July 2009.

This study includes patients of both sex and age group between 30-70 years old with fracture distal 1/3 femur (distal 9 cm. femur from knee articular margin), which includes fracture involving distal 1/3 diaphysis femur, Supra condylar fracture femur and Inter Condylar fracture femur.

### Management Protocol

Fracture Management done with following protocol:

#### Pre-Operative Assessment

Before instituting definitive treatment, thorough clinical history of date and mode of injury, time interval between injury and reporting of fresh case, any treatment taken meanwhile, any Allergic reaction for and inquiry about any medical illness done.

A thorough clinical examination of patient for involved extremity and other part of body taken to rule out associated trauma or disease.

#### Pre-Operative Investigations

##### Routine Investigations

Complete hemogram, Blood Sugar, Blood Urea, Serum Creatinine, HbSag, HIV, Complete Urine Investigation, X rays Chest and ECG done routinely.

##### Radiological Investigation:

##### X Ray

True AP, Lateral and 45° oblique view taken for fractured part.

##### CT Scan

CT Scan was needed sometimes for accessing exact location and severe comminution in comminuted intra articular fracture distal 1/3 femur.

Fracture classified according to Muller classification [ Type A,B,C ]

Open fractures will be classified according to Gustilo's Anderson classification of compound fractures

### Operative Methods

Various treatment modalities used such as Close Reduction and internal fixation done with Ender's Nail, Supracondylar Antegrade Inter Lock and Open Reduction and internal fixation with DCS, K-Nail, DCP depending upon individual case presentation.

### Post-Operative protocol

- After 48hours patient encouraged to start knee bending exercises at the edge of bed if fixation is good
- If fixation is unstable, then immobilization by Spica cast or Thomas splint is done.
- Patient can be discharged 3 days after surgery and called for follow up after 2 weeks for stitch removal.
- Patient is asked to report after 6 weeks, 10 weeks, 16 weeks and 6months for other complication occurred.
- Partial weight bearing with two crutches is allowed after 4-8 weeks or later, depending on the type of fixation.
- Full weight bearing is permitted after correlating clinical and radiological recovery of the patient.

### Grading of Results

Evaluation of results is based on the **modified Schatzker and Lambert (1982) criteria.**

### Observation & Results

Total number of cases treated in the department of Orthopaedics. Government General Hospital Jodhpur from July 2007 to July 2009 were 75, among them all 75 fractures were followed up till union occurred. Only 3 cases were bilateral.

Type of injury: 63 fractures were due to road traffic accidents, 7 cases were due to fall from various heights like tree and steps, 2 cases were due to assault and 3 cases were due to slip.

Type of fractures: According to muller's classification there were 21 cases of A type, 6 cases were B type, 51 cases of C type.

Age incidence: 43 cases were in 30-40 age group among them 1 was female and 42 were males. In 41-50 years age group 13 cases involved, 5 cases involved in 51-60 years age group.

General Condition of Patient: general condition was good in 23 cases, Fair in 43 cases and Poor in 9 cases.

Nature of Injury was closed in 48 cases and Open in 30 cases. No associated other bony injury was seen in 20

cases, Chest injury was seen in 2 cases and Head Injury was seen in 3 cases.

Duration of Hospital Stay: Duration was upto 7 days in 34 cases, 1-3 weeks in 39 cases, >3 weeks in 2 cases.

Time of healing: All cases showed radiological and clinical union between 12 weeks to 16 weeks. 10% cases reported with no radiological union.

Complication: Infection in 4 cases in which 2 fractures fixed with SC Nail, 1 was fixed with External Fixator and 1 fixed with Enders Nail. Pain was seen in 10 cases in which 2 cases with SC Nail, 3 cases with DCS, 1 case with DCP, 2 cases with Ext Fixator, 1 case with Enders Nail and 1 case with Canc Screw. Limb Length Disparity was seen in 7 cases including 2 cases with SC Nail, 2 cases with DCS, 1 case with DCP, 1 with Ext Fixator, 1 with Enders Nail. Knee Stiffness was seen in 3 cases which include 1 case with SC Nail, 1 case with DCS, 1 case with Ext Fixator. Malunion was seen in 5 cases including 2 cases with SC Nail, 1 case with DCS, 1 case with Ext Fixator and 1 case with Enders Nail.

Mode of Fixation: 36 cases were fixed with Supra Condylar nail ( SC nail), 20 cases were fixed with dynamic Condylar screw(DCS), 6 cases were fixed with Dynamic Compression Plate(DCP), 6 cases were fixed with Cancellous Screw, 4 cases were fixed with Enders Nail, 3 cases were fixed with Ext. Fixator.

Knee ROM: 11 cases had full flexion, 8 cases had 124-115<sup>0</sup> flexion, 51 cases had 115-90<sup>0</sup> flexion and 8 cases had <90<sup>0</sup> flexion. 63 cases had full extension, 8 cases had 10<sup>0</sup> ext lag, 7 cases had >10<sup>0</sup> ext lag.

Average time of partial weight bearing was 6-8 weeks for 6 cases( 2 cases with SC Nail, 2 cases with DCS, 2 cases with DCP), 8-10 weeks for 32 cases( 19 cases with SC Nail, 9 cases with DCS, 3 cases with DCP, 1 case with Canc. Screw), 10-12 weeks for 22 cases( 9 cases with SC Nail, 6 cases with DCS, 1 case with DCP, 2 cases with Enders Nail, 1 Case with Ext Fix, 3 cases with Canc. screw), >12 weeks for 15 cases(6 cases with SC Nail, 3 cases with DCS, 2 cases with Enders Nail, 2 cases with Ext Fixator, 2 cases with Canc. screw) and full weight bearing was 16-18 weeks in 13 cases(7 cases with SC Nail, 3 cases with DCS, 1 case with DCP, 1 case with Enders Nail, 1 case with Canc. Screw), 18-20 weeks for 35 cases(16 cases with SC Nail, 11 cases with DCS, 2 cases with DCP, 2 cases with Enders Nail, 1 case with EXT FIX, 3 cases with Canc. Screw), 20-22 weeks for 22 cases( 11 cases with SC Nail, 5 cases with DCS, 2 cases with DCP, 1 case with Enders Nail, 2 cases with Ext Fixator, 1 case with Canc. Screw), >22 weeks for 5 cases(2 cases with SC Nail, 1 case with DCS, 1 case with DCP, 1 case with Canc. Screw).

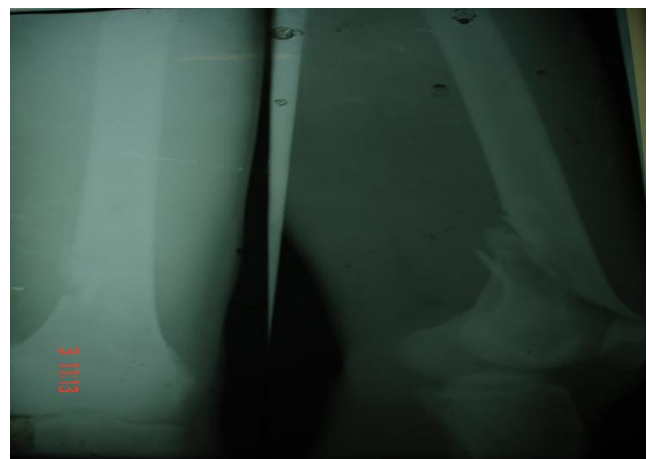
There were no cases of implant failures.



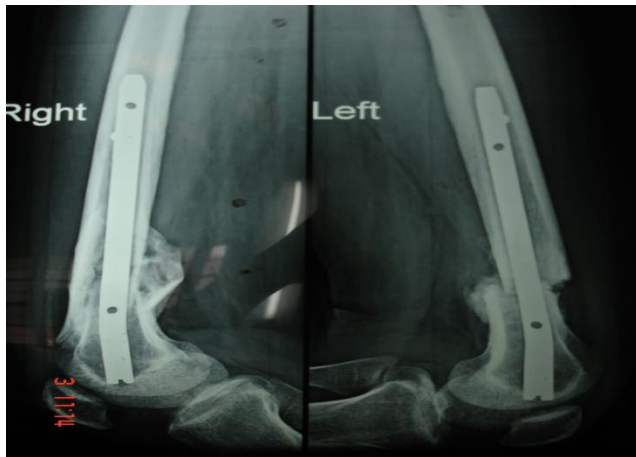
**Figure 1:** Xray image of compound supracondylar intracondylar fracture.



**Figure 2:** Post operative xray of figure 1 treated with external fixator and 6.5mm CC screws



**Figure 3:** Preoperative image of closed fracture supracondylar femur



**Figure 4:** post operative image of figure 3 with supracondylar nail



**Figure 5:** Post operative range of motion as shown by cross legged sitting position of patient



**Figure 6:** Post operative range of motion showing full extension

### Discussion

Over the past few decades trauma has undergone a tremendous change both in terms of mode, magnitude and type as well as their treatment and prognosis.

Distal third femoral fractures often results from automobile accidents and fall from height. Mechanism of injury includes forces applied on antero-lateral aspect of flexed knee, violent trauma on lateral side of extended thigh and sometimes extreme violence on flexed knee results in fracture distal third of femur with varying degree of comminution according the energy of collision. Orthopaedics are trying to reduce the number of complications like knee joint stiffness and instabilities by early and rigid fixation instead of conservative management like hip Spica, functional cast brace.

Present study is conducted to evaluate the results of operative fixation of fracture lower third of femur by different procedures and their merits and demerits. In the present study, age at the time of sustaining distal femur fracture ranges from 30 years to 70 years. Average age in the study is 43.61 year. Major age group involved is 30\_40 years (4th decade), ratio is 5:1. According to study conducted by MJ Stewart and associates (1966)<sup>(2)</sup>, average found was 40 years and in study of Pritchett<sup>(3)</sup>(1984) it was 66 years. In study of D. G. Dunlop(1999)<sup>(4)</sup> average age was 82 year & study of Patel K et al (2004)<sup>(5)</sup> showing average age 31.5 year while study of Yeap, E.J. et al(2007)<sup>(6)</sup> showing age 44 year (avg. 15-35 year). Male predominance in Indian context indicates that males are much more mobile than female and engaged in day to day activities.

In the study, Maximum numbers of cases are injured in automobile accidents (84%), other causes are fall from height, assault and injury due to slip. Similar observation of increased incidence due to road traffic accidents were seen in the study of Stewart (1966)<sup>(7)</sup>, Olerud (1972)<sup>(8)</sup>, Chiron et al(1974)<sup>(9)</sup>. In study of John M Siliski et al(1989)<sup>(7)</sup> 76% cases were due to RTA & study of Patel K.(2004)<sup>(5)</sup> showing 84% cases due to RTA while Shelton et al<sup>(16)</sup> showed 70% cases caused by fall from height.

In most series automobile accidents predominate and indicate its relation with mobility of individual and increase in automobile traffic.

In our study 27% cases are extra articular distal diaphyseal fracture (Muller type A), unicondylar (type B) accounts for only 8% while comminuted inter condylar fracture distal third (type C) accounts for 65%.

Swiss study of Weller reported serious associated injuries (cranio-cerebral, chest, abdominal) 78% cases of associated injuries.

In our study,

- Supra Condylar Nail is used in 48% cases of fracture distal 1/3 femur and # femur with intercondylar extension as treatment modalities. (Muller type A & C) with/without fixation with cancellous screw.

- Cancellous Screw used as treatment modalities in 8% cases of Muller type B (Unicondylar # femur).
- Dynamic compression plate is used in 8% of cases which are present at distal diaphysis supracondylar region, comminuted type. Dynamic condylar screw is used in 27% cases which are of type A or C of Muller et al classification. Ext. Fixator used in 4% cases of open injury for temporary fixation.
- The entire armamentarium is kept at the disposal of surgeon to decide on the basis of needs and merits of individual fractures.

In the present study, 65% cases showed restriction of flexion of more than 20° (In the range of 115°-90") at knee. Full flexion at knee is seen in 14% of cases. 80% cases showed full extension while rest of the cases presented with extension lag. Three cases showed stiffness of knee joint because of long term GT Stab (these are open cases, & floating knee type of injury). Almost 15% of the resulted in both extension lag and restricted flexion. This is because of infection, improper joint congruency leading to intra/extra articular adhesions and lack of patients' compliance for physiotherapy. Almost similar results were observed by Borgan and Sprague(1975)<sup>(15)</sup>. Mize, Bucholz and Grogan(1982)<sup>(10)</sup> studied distal femoral fractures-range of movements at knee was restored to pre-injury level in all but 23% of patients. These 23% cases had loss of knee flexion ranging from 200-450.

In the context of movements the results of individual procedures separately which are included in this study. In our study- 63% cases operated with Supra condylar achieved knee flexion in range of 114-90 degree, 13% having full flexion and cases having poor results (<90

degree knee flexion) because these cases are either open injury or floating knee type injury, 79% Cases having full extension in our series, rest showing extension which is comparable to study by A Saw & CP Lau(2003)<sup>(18)</sup> where mean range of flexion was 123.8 deg. (range 150-90 deg.), 7% cases showing 10 deg. Extension lag & rest able to do full Extension. In study of Patel K. et al(2004)<sup>(5)</sup> average knee flexion was 117 deg., even in open injuries 85.7% had >110 deg. flexion. All patient could return to their pre injury style.

For dynamic condylar screw, 85% cases showed flexion at the knee in the range of 114-90. showed full flexion while 5% cases showed poor results in terms of flexion at the knee less than 90deg. This is because of improper anatomical alignment of fracture fragments causing incongruent joint surfaces, less rigid fixation and infection causing adhesions. These results are comparable to study of Khan et al (2006)<sup>(17)</sup> which showing knee flexion >120 deg. in 50% cases, between 90-120 in 33.5% cases 81; <90

deg. 16.5% cases Mize et al(1982)<sup>(10)</sup> study showed overall better results.

In cases operated by dynamic compression plate, 100% cases showed full extension while 67% cases showed flexion at the knee in the range of 114-90. The study conducted by Rady, D.Mercier, A. Jodoin and C. Martirnean (1984) showed slightly better results. In their study. 70% cases regained 120 deg. knee flexion. This is because of earlier institution of gradually increasing pattern of exercises and physiotherapy

In study, partial weight bearing is allowed in majority of the cases during 8-10 weeks and full weight bearing started in 47% cases during 18-20 weeks. Thus average time to consolidate in cases of firm fixation is 3-4 months. The study of L.K. Sood (1998) showed similar results with consolidation time being about 12-24 weeks. The study of Patel.K. et al(2004)<sup>(5)</sup> showing time of union 3.1 months(range 2-4 months). The fact that consolidation time in our series is comparable to other series inspite inclusion of more severely comminuted fracture and use of primary bone grafting in fewer cases, goes to show that meticulous surgical technique and minimal soft tissue handling in hands of dynamically oriented surgeons is successful outcome.

In our study, infection is reported in 5.3% of cases , Infection rate in present series is not much different from other series inspite of the fact about overcrowding and illiteracy leading to non compliance of patient for taking and poor socio-economic status.

Malunion is observed our study as valgus deformity in 6.66% in the form of slight valgus. This is because of failure to achieve proper alignment, loose fixation failure to osteoporotic bones.

In present study, results of operative fixation are found to be excellent, good to fair among 90.67% of cases of fracture distal 3rd femur, while 9.33% cases showed poor results. Poor results are because of stiffness of knee joint, infection, malunion or improper fixation. Our results are almost similar to those observed in statis series (1971)[18], Schatzker and Lambert (1974)<sup>(12)</sup>, Geles et al(1982)<sup>(11)</sup>, mize et al(1982), Healy and Brooker(1983)<sup>(14)</sup>, D.G.Dunlop et al(1999)<sup>(4)</sup>, Patel.K.et al(2004)<sup>(5)</sup>.

In our country the male is bread earner of the family. His absence from the work affects him and economical status of his whole family. So as soon as the patient is symptom free, with knee flexion of 90 deg. and assured of osseous union, there is false sense of security that makes him to return to the work. His concentration from physiotherapy is lost and hence accountability for high rate of stiffness of knee. Geriatric patient confines himself to bed rest, further exaggerate this problem. This is in contrast to Western countries where patient is more secure financially and can

focus mainly on his rehabilitation. Thus we could explain the relative large number of patients with better results there.

### Conclusion

After going through all studies and comparing various aspect of treatment at each step, I have tried to justify the use of various armamentarium in our series according to merits and need of fracture.

Patient has been treated under constrained circumstances in our series. Over burden of patients, work and limited resources had affected outcome when compared with other series. In our study I came to conclusion- that if the patient is operated as early as possible, with full

Armamentarium best suited to merits of the cases, complication rate is low and results better.

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