



COMPARATIVE STUDY OF FUNCTIONAL OUTCOME IN SINGLE PLATING AND DUAL PLATING OF DISTAL FEMUR FRACTURES

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ABSTRACT **Background And Objectives:** Fractures of the distal femur remain challenging to treat as satisfactory outcome demands anatomical articular reduction, rigid and stable internal fixation along with early range of motion. The purpose of our study is to evaluate the functional outcome in patients with fractures of the distal femur treated with single versus dual plating. **Results:** Out of the 40 patients treated with plating, 24 were treated with single lateral plate and 16 were treated with medial as well as lateral plate. Out of the 16 treated with dual plating, 2 were open fractures treated by staged procedure (lateral plating and subsequent medial plating with iliac crest bone graft via a separate medial incision after a period of 10 weeks following primary surgery). 3 of the patients treated with single lateral plate showed a varus collapse upon weight bearing 12 weeks post op. **Conclusion:** It was found that dual plating resulted in high union rates, early post op mobilization due to more rigid fixation and less chances of varus collapse. However, overall, when functional outcome was evaluated in both groups it was found to be comparable.

KEYWORDS : femur, plating, dual plating

INTRODUCTION

Distal femur fractures account for six percent of all femur fractures. They can be observed in a trivial fall in older osteopenic persons, or they are commonly observed in high energy trauma in a younger age group as a result of motor vehicle accidents or falls from heights. Complications encountered in single plating.

- persistent angulatory deformities
- articular incongruity
- stiffness and
- delayed mobilization (especially in patients with multiple injuries)^[1]

Irrespective of choice of fixation the following principles must be obeyed, which include:

- anatomical reduction of the distal femoral articular surface
- stable internal fixation
- minimal soft tissue stripping and
- early active mobilization.^[2]

Patients with osteoporosis, fractures with metaphyseal comminution and a defective medial cortex, or those with a short articular segment are recommended to have locked implants.^[3]

In 2016, Holzman et al^[4] reported addition of medial locking plate to an in situ lateral locking plate results in good healing of distal femur nonunion.

MATERIALS AND METHODS

We selected thirty patients of unstable distal femur fractures that were hospitalized between October 2022 and December 2023 to the Department of Orthopedics at ACPM Medical College in Dhule Maharashtra. This is a clinical retrospective study. The patients were told of the study's purpose and appropriate signed consent was obtained.

Inclusion Criteria:

- 1) Age 20-60 years.
- 2) Muller Type A3, C1, C2 and C3 fractures.
- 3) Very low distal femur fractures.
- 4) Extensive metaphyseal comminution with more than 1cm medial cortical defect.

Exclusion Criteria:

- 1) Skeletally immature individuals.
- 2) Muller Type A1, A2 and Type B fractures.
- 3) Grade IIIc open injuries (Gustilo – Anderson)

MANAGEMENT

Anteroposterior and lateral views of the X-rayed thigh were obtained after applying mild traction. A distal femur CT scan with 3D reconstruction was also obtained.

Fractures were classified according to Muller AO Classification system.^[3]

Type A fractures include extra-articular fractures and Type B fractures are partial articular fractures, meaning parts of the articular surface [Fig 3].

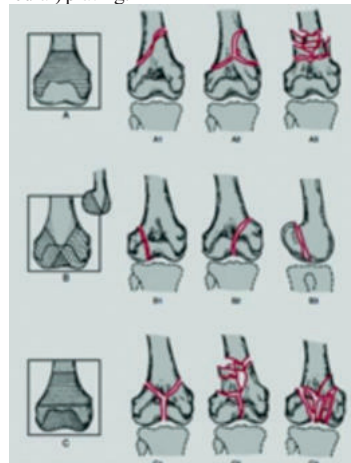
Type C fractures include complete articular fractures with both condyles being detached from the diaphysis.

Fracture type C is divided in.

- C1 (articular simple, metaphyseal simple),
- C2 (articular simple, metaphyseal multifragmentary) and
- C3 (multifragmentary)

The B3 type fracture – 'Hoffa's fracture'- has immense clinical significance in the final result following intervention and has been subdivided into three types.^[9]

All fractures are managed by either Single (Lateral) plating or Dual (Lateral and Medial) plating.



Position:

Supine position on radio lucent table with sandbag under ipsilateral pelvis to facilitate internal rotation of limb.

Approach:

All patients were operated by either single lateral approach or a dual approach(lateral plus medial)

Implants:

Laterally we used lateral distal femur locking compression plate. It has two 6.5mm locking holes and five 5 mm locking screws in condylar part. Combiholes in stem part

Medially we used mainly large fragment T buttress plate in 15 cases.

The medial plate is shorter than the lateral plate to avoid a stress riser.

Surgical Techniques:

To achieve precise anatomical reduction, the articular block was rebuilt first, and it was then reattached to the metaphysis. After reducing the fracture, the area is temporarily secured using pointed clamps, K wires, and lag screws. Any sagittal split of posterior condyles came first in the reduction process, followed by coronal splits and intercondylar components.

Osteochondral fragments were fixed with headless Herbert screws. Small < 5mm fragments were excised.

The alignment and rotation of the length, coronal plane, and sagittal plane were meticulously evaluated and corrected. Removing loose fragments from soft tissue attachments whenever you can. Prevent harm to the collateral ligaments and meniscus.

The primary bone grafting procedure used an iliac crest or fibular strut graft if there was any bone loss or a medial cortical defect. The knee was flexed and extended two or three times after the wound was closed.

This procedure removes any soft tissue interposition between the bone and the implant or sutures that may have later resulted in post-operative pain.

Post-operative rehabilitation:

Adequate rehabilitation following surgery is just as important as surgical care. Stable stiff internal fixation is the primary requirement for an early and intensive rehabilitation program in cases of unstable distal femur fractures.

The first day after surgery was when isometric exercises began. Active range-of-motion exercises were introduced after the seventh post-operative day, with a primary focus on patellar gliding, extension, and static quadriceps strengthening.

The first week of continuous passive motion began. It also relieves pain more quickly. It avoids joint stiffness, enhances cartilage nourishment, and reverses collagen loss. Walking without weight bearing for a week or two. The partial weight bearing (10 kg) was permitted if post-operative scans revealed bone healing. After the fracture had healed, around 10 to 12 weeks later, full weight bearing was permitted.

Follow up protocol:

Every patient's post-operative x-ray of the thigh with knee anteroposterior and lateral view was taken immediately after surgery. Then followed up on 1st, 2nd, 4th, 6th, 8th and 12th weeks then every 3rd month. These radiological evaluations were used for fracture alignment, fixation stability and fracture healing assessment. Any loss of reduction, plate lift off, implant breakage was recorded. On every follow up patient evaluated for range of flexion, extension lag, amount of pain.

The functional outcome was evaluated using Sander's Functional Evaluation Scoring System at the end of 3 months follow up. It has a total of 100 points.

By this score we evaluated range of flexion, extension lag, pain on weight bearing, angulation deformity, limb length shortening and walking, and stair climbing ability and return to previous work status.

According to this patient's final outcome functional status graded as

excellent. (36-40 points), good (26-35), fair (16-25) and poor (0-15) outcomes.

RESULTS

A total of 30 patients were selected. All are unstable complex distal femur fractures: 15 were treated with lateral plating alone and 15 were treated with lateral as well as a medial buttress plating.

Table 1. Profile Of Cases Studied.

A) Single Plating

Sr.No.	Variable	Range	Mean	SD
1	Sanders Score	13-32	25.33	6.48
2	Time to Union (Weeks)	8-32	15.47	5.63

B) Dual Plating

Sr.No.	Variable	Range	Mean	SD
1	Age	22-56	36.87	9.125
2	Sanders Score	26-38	33.13	4.54
3	Time to Union (Weeks)	8-24	14.67	5.38

Out of the 30 patients 5 were female and 25 were male.

Table 3. Mode Of Injury.

The mode of Injury for distal femur fractures were mostly due to motor vehicular accidents (87%) compared to self-fall at home (13%).

Table 4. Grade Of Injury

Grade	No. of Cases	Percentage
Closed	19	63%
Type 1 open	3	10%
Type 2 open	4	13%
Type 3 open	4	13%
Total	30	100%

Table 5. Type Of Fracture.

Classification	No. of cases	Percentage
A3	3	10%
C1	8	27%
C2	14	47%
C3	5	17%
Total	30	100

Table 6. Complications

Complications	Single Plating	Dual Plating
Yes	3	1
No	12	14
Total	15	15

Table 7. Outcome

	Medial Plate Use	Outcome				Total
		Excellent	Good	Fair	Poor	
	YES	7	8	0	0	15
	NO	0	8	5	2	15
	Total	7	16	5	2	30

Chi score = 14, Df = 3 and P = 0.003

There was no association found between dual and single plating in extension, pain, walking, climbing stairs and returning to work.

Case Illustration

Case 1: 39M Closed Type C2 Left side.



Pre op Xray
3 Month follow up:

Post op Xray
Clinical Images

Case 2: 37 F Closed Type C1 Right side

Preop Xray:

Postop Xray:

Case 3: 56 F Closed Type C2 Right Side

Preop Xray:

Post op Xray:

**DISCUSSION**

Generally, the distal femur fractures are caused by high velocity injuries.

Though it commonly occurs in young adults between 15 to 40 years old, also increased incidence present in women more than 50 years who is osteoporotic.

In our study, out of the 30 patients 5 were female and 25 were male.

The patients were aged between 20-56 (mean 39.53 ± 10.623) among those who underwent single plating and 22-56 (mean 36.873 ± 9.125) among those who underwent dual plating. Hence the patient's ages were approximately the same.^[7,8]

Because of these critical challenges like comminution, medial cortical loss, intra articular extension, muscle force on fractured fragments and instability; unstable distal femur fractures become one of the more complicated trauma cases to operate on. 5-10 % of open injuries add to the complexity.

Type A3, C1, C2, and C3 fractures-which are taken into consideration in our study-as unstable fractures among the Muller classification. These fractures require careful soft tissue management, appropriate reduction, accurate alignment, and implant selection that can tolerate these stresses and the right fixing technique. The healing rate is slowed down by metabolic variables. Open wounds and long-term smokers increase the healing time. Even though these are unanticipated obstacles during fracture healing, we can still alter other aspects, such as implant selection and surgical methods, to promote healing.

Compared to other implants, this one has greater strength under axial compression, but less strength under torsion. Because the locking plates are not in direct touch with the bone, the periosteal blood flow can be preserved.

Locking compression plates are therefore both physiologically compatible and biomechanically better. As recommended by several biomechanical studies, we employed lateral plates in conjunction with medial enhanced plates to solve this issue.

According to a study published by Bologna, Claudio et al and Kregor PJ in 2019 fixation using medial with lateral plates demonstrated higher rates of union and a lesser need for revision surgery compared to using just single plate in comminuted fractures of the distal femur.^[4,5]

Out of the 30 patients in our study, 7 had an excellent Sanders score and were treated with dual plating; 16 had a good outcome that was equally distributed between the dual and single plating groups; 5 had a fair outcome and 2 had a poor outcome, both of which were treated with single plating.

Patients undergoing dual plating saw a faster union time of 14.67 ± 5.38 weeks and 15.47 ± 5.63 weeks in single plating, respectively, and a higher mean Sanders score of 33.13 ± 4.54 compared to single plating's 25.33 ± 6.48 .

The areas of degree of flexion, deformity repair, and post-operative limb shortening showed a significant improvement in Sander's score, which in turn led to a considerable improvement in Sander's overall score.

SUMMARY

The purpose of this study was to determine the most effective course of therapy for distal femur fractures by comparing the clinical and functional outcomes between single and dual plating. Considering the above findings, it was discovered that dual plating produced better results in terms of degree of bending and deformity correction. It also produced equivalent results in terms of surgical time, blood loss, weight bearing, time of union, and return to normal activities. Furthermore, it was discovered that patients who underwent single plating surgery had a higher prevalence of problems such stiffness and varus collapse.

CONCLUSION

In conclusion, a medial buttress support will improve patient outcomes for patients treated with a single plating in cases of unstable distal femur fractures without lengthening the surgical procedure or increasing blood loss, making it a superior option for treating these fractures. The recommended method of fixation for distal femur fractures is the use of biomechanical locking plates since they have dramatically decreased the rate of complications and increased fixation stability in unstable fractures of the distal femur.

No Conflict Of Interest

Permission From Research Society Of College Obtained, Dept Of Orthopaedics, ACPM Medical College Dhule

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