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CLINICAL AND FUNCTIONAL RESULTS OF INTERNAL FIXATION OF DISTAL FEMORAL FRACTURES USING A DISTAL FEMORAL LOCKING COMPRESSION PLATE : A PROSPECTIVE STUDY.

Orthopaedics

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ABSTRACT

Aim

1. To study the union rate with locking compression plates
2. To study the clinical outcome associated with this treatment modality.

- Range of movements of the knee
- pain relief
- return to normal activities and work.

Introduction The femur is the largest bone in the body connecting the tibia and pelvic bone. It is surrounded by a large group of muscles, divided into three portions as the proximal, middle and distal third. The distal femur (supracondylar and intercondylar) comprises the distal 10-15 cm of the femur. **Materials And Methods** Hospital based prospective study of 30 patients diagnosed with distal femur fractures which include all skeletally mature patients(>18years) and patients willing to give informed written consent and excludes patients of age less than 18 years,not willing to give informed written consent,supracondylar fracture femur associated with fracture neck of femur, associated tibial plateau fractures,associated with IDK (internal derangement of the knee),nonunion and delayed union,with pathological fractures except for osteoporosis and open fractures. **Results** In our study majority of patients (67%) had satisfactory outcome, 30% had excellent outcomes, 3% had unsatisfactory outcome. **Conclusion** To conclude, open reduction and internal fixation with a locking compression plate resulted in good clinical and radiologic outcomes.

KEYWORDS

INTRODUCTION

The femur is the largest bone in the body connecting the tibia and pelvic bone. It is surrounded by a large group of muscles, divided into three portions as the proximal, middle, and distal third. The distal femur (supracondylar and intercondylar) comprises the distal 10-15 cm of the femur.

Distal femur fractures present a considerable challenge in the treatment. They are due to high energy trauma with extensive soft tissue damage with articular and metaphyseal involvement and also ligamentous involvement of knee joint. Older patients , sustain fractures due to osteoporosis.

Studies[1] has proved this bimodal distribution of supracondylar fractures of the femur. Fractures of distal femur are complex injuries producing long term disability.

AIMS AND OBJECTIVES

1. To study the union rate with locking compression plates
2. To study the clinical outcome associated with this treatment modality.

- Range of movements of the knee
- pain relief
- return to normal activities and work.

MATERIALS AND METHODS

Ethics committee clearance was obtained before starting the study. The study's purpose was explained to the subjects in their dialect, and written informed consent was obtained.

Study Design: Hospital based prospective study.

Place Of Study: Santhiram medical college and general hospital, Nandyal.

Study Duration: FEBRUARY 2023 to FEBRUARY 2024.

Study Subjects: 30 patients diagnosed with distal femur fractures.

Inclusion Criteria

1. All skeletally mature patients(>18years)
2. Patients willing to give informed written consent

Exclusion Criteria

1. Patients of age less than 18 years
2. Patients not willing to give informed written consent.
3. Supracondylar fracture femur associated with fracture neck of femur.
4. Associated tibial plateau fractures
5. Associated with IDK (internal derangement of the knee)
6. Nonunion and Delayed union
7. Patients with pathological fractures except for osteoporosis.
8. Open fractures.

Mechanism Of Injury:

Distal femur fractures are due to axial loading with varus, valgus, or rotational forces[24].

In young patients, distal femur fractures are seen with high-velocity trauma. In Elderly, fracture occurs due to a trivial trauma.

Displacements Of Fracture Fragments:

Displacements are due to the direction of the force and due to the contraction of surrounding musculature like Quadriceps and hamstrings leading to shortening and varus angulation. The contraction of gastrocnemius produces posterior angulation. In intraarticular fractures, soft-tissue attachments to the condyle will cause displacement and rotation of condyles leading to joint incongruity.

So, the fixation of these types of fractures is to overcome these forces and prevent re-displacement.

Radiological Evaluation:

1. Routine AP and lateral radiographs of the knee with the distal femur to be taken. Radiographs of the pelvis with both hips, full-length femur, full length tibia were also taken to rule out associated injuries.
2. C.T. with 3D reconstruction in intraarticular fractures.
3. Angiography to be done to assess any vascular injury .

Treatment Of Distal Femur Fractures

Indications For Operative Fixation:

1. Displaced intraarticular fractures
2. Irreducible fractures with severe comminution

3. Displaced extraarticular fractures
4. Pathological fractures

Preoperative Planning And Preparation:
Fractures were classified with the assistance of radiographs.

Instruments:
- Locking compression plates
- Locking cortical screws
- Instrumentation

Intraoperative Imaging
The C-arm position is critical in achieving orthogonal views during surgery and should be tested before scrubbing.

Surgical Procedure
The patient has been placed semilateral on a radiolucent table with a cushion beneath the knee and buttock. The entire injured limb and ipsilateral iliac crest are prepared and draped. Tourniquet applied and inflated. A lateral linear incision is made corresponding to the femur's shaft. The distal end of the incision is curved anteriorly over the joint line.

The fascia overlying the vastus lateralis muscle is incised, and the muscle reflected anteriorly off the intermuscular septum. Minimal Stripping of soft tissue required for the application of plate and reduction of the articular surface is done Quite often femur shaft may be wedged between the two femoral condyles; if so, traction is applied to the leg with the knee flexed, and the femur shaft is brought back. Quadriceps and the patella are reflected medially to expose the entire lower part of the femur

Reduction of condyles:
A Steinmann pin was drilled horizontally into the lateral surface of the condyle to reduce the lateral condyle. If required, a second Steinmann pin was drilled into the medial condyle of the femur. Utilizing these pins as control and reducing the two condylar parts was made to regain the articular surface and to maintain the congruent patella-femoral groove.

Reduction of fracture:
When the plate is used as a reduction aid, the compression screw draws the bone towards the plate and uses the plate to reduce the fracture in the coronal plane. The plate doesn't help in the sagittal plane reduction or restoration of limb length.

MOBILIZATION
Mobilization of the limb was started on the third or fourth day postoperatively. Mobilization of the limb with Non-weight bearing was begun from the first post-op week till 6weeks to two months relying upon progress of callus formation at the fracture, and then partial weight-bearing was started after confirmation of the healing process of fracture union.

FOLLOW UP
All patients were followed up at the fourth, tenth, fourteenth, eighteenth week and so on from till fracture union is appreciated. Consequently, at the sixth-month, the ninth month, and one year.

Upon follow-up, patients were assessed clinically, radiologically, and practically by Neer's criteria.

Complications
- Intraoperative: Rotational and axial malalignment, limb length discrepancy and neurovascular injuries
- Early postoperative: Acute infection, wound complication
- Late complication: Implant failure, delayed and nonunion

Neer's criteria for evaluation of patients
FUNCTIONAL (70 POINTS)
a) Pain (20 points)
no pain 20
Intermittent 16
pain with fatigue 12
limits function 8
constant pain 4
b) Walking capacity(20 points)
same as before accident 20
mild restriction 16
restricted stair side ways 12
use crutches or other walking aids 4
c) Joint movements (20 points)
normal or 135 degrees 20
up to 100 degrees 16
upto 80 degrees 12
upto 60 degrees 8
upto 40 degrees 4
upto 20 degrees 0
d) Work capacity(10 points)
same as before accident 10
Regular but with handicap 8
alter work 6
light work 4
no work 2

ANATOMICAL (30 POINTS)
a) Gross anatomy(15 points)
thickening only 15
5 degree angulation or 0.5cm shortening 12
10 degree angulation or 2cm shortening 9
15 degree angulation or 3cm shortening 6
healed with considerable deformity 3
non union or chronic infection 0

b) Roentgenogram (15 points)
near normal 15
5^0 angulation or 0.5cm shortening 12
10^0 angulation or 1cm shortening 9
15^0 angulation or 2cm displacement 6
union but with greater deformity
spreading of condyles and osteoarthritis 3
nonunion or chronic infection 0

EXCELLENT ……More than 85 points
GOOD…….70to85points
FAIR……..55 to 69 points
POOR……Less than 55 points

RESULTS
Table 1: Distribution of study participants according to Muller's type of fracture (N=30)

Sl.no	Type of fracture	Frequency	Percentage
1	Muller A1	12	46.6
2	Muller A2	4	13.3
3	Muller C1	7	23.3
4	Muller C2	7	23.3

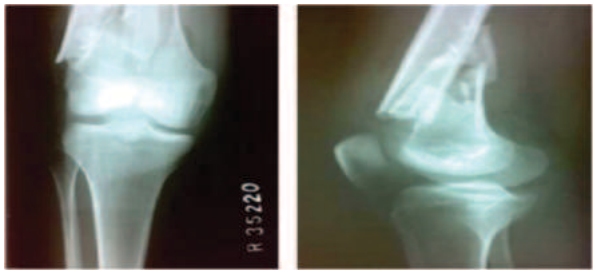
In our study, around 46.6% had Muller type A1 fracture,13.3% had Muller type A2 fracture, 23.3% had Muller type C1 fracture, and 23.3% had Muller type C2 fractures.

Table 2: Neers Score- Overall rating (N=30)

Sl.no	Outcome	Rating	Frequency	Percentage
1	Excellent	Above 85 units	9	30
2	Satisfactory	70-85 units	20	67
3	Unsatisfactory	55-69 units	1	3
4	Failure	Below 55 units	0	0

In our study majority of patients (67%) had satisfactory outcome, 30% had excellent outcomes, 3% had unsatisfactory outcome.

CASE ILLUSTRATION
CASE 1



Preoperative x-rays

Immediate post-operative


12 weeks follow up


Functional Outcome

DISCUSSION

Our study comprised 30 patients with distal femur fractures who were treated by a locking compression plate. The overall outcome was measured in terms of loss of knee function using Neer's score.

Age

The overall mean age of the participants was 49±11 years. The majority of them were in the age group of 51-60 years (33.3%), followed by 30-40 years (26.7%).

Adult distal femur fractures present in a bimodal distribution. Most of the time, young patients present secondary to high-energy mechanisms, like motor vehicle accidents. Old patients present commonly after a low-energy mechanism, like ground level-falls.

Mode of Injury

In our study, around 57% of the study participants had R.T.A., followed by 23% fall from a height, and the remaining 20% had fallen in the bathroom.

All studies fetched similar results as our study, with the common mode of injury being road traffic accidents.

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Classification of fracture

In our study, around 46.6% of them had Muller A1 type, followed by 23.3% had Muller C1 and C2 respectively, and the remaining 13.3% had Muller A2.

The most common type of fracture seen in our study was type Muller A1. In Shenoy et al. and Chandra et al., it was Muller C2, and in Reddy et al., it was Muller A2 type from the above table findings.

Type of fracture

Distal femur fractures could be closed —in a sense, the skin needs to be intact or open. An open fracture is one where bone fragments are exposed out through the skin or a wound that penetrates down to the fractured bone. An open fracture often involves much more damage to the muscles, tendons, and ligaments surrounding it. They have a very high risk for complications and usually take a longer time to heal.

Type of reduction

The majority of the study participants, 100%, had O.R.I.F. with L.C.P.

Knee flexion

In our study, 23% patients had achieved flexion of $>109^0$, 37% had achieved 91^0-109^0, and 40% had achieved $<90^0$. Average knee flexion achieved in our study was about 93^0.

Fracture union in weeks

The majority of the study participants, 33%, took <16 weeks for the union.

Full weight-bearing in weeks

The majority of study participants took16-20 weeks for complete weight bearing

Early weight-bearing benefits are increasing the functional recovery, early independence, the diminished effect on the family, increased psychological benefits, decreased utilization of medicinal services, the diminished requirement for family involvement.

Complications

The distal femoral locked nailing includes the opening of the knee joint and is related to the protrusion of the nail into the joint and joint pain. The intraarticular section could prompt knee stiffness, knee sepsis, and patellofemoral pain related to a high rate of removal of the implant.

NEER'S SCORE

The results of our present study were consistent with the existing literature with minimal complications. .

CONCLUSION

Locking compression plate is the best option for the management of comminuted distal femur fractures. Locking compression plate avoids damage to periosteal blood vessels, metaphyseal collapse and maintains limb length in comminuted fractures.

There is less chance of implant failure. In type-A fractures, we have seen a high Neer's score; however, in some type-C fractures outcome is unsatisfactory, but it is the implant of choice for type-C fractures.

Complications like knee stiffness, limb shortening, plate breakage, wound infections are seen.

In our study, out of 30 patients, eight patients had excellent outcomes, 21 patients had satisfactory outcomes, and one patient had unsatisfactory outcomes.

To conclude, open reduction and internal fixation with a locking compression plate resulted in good clinical and radiologic outcomes.

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