

Clinical and Radiological Outcome of Distal Femur Fractures Treated with Retrograde Intramedullary Nailing

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Abstract: Distal femur fractures constitute a small but significant proportion of lower limb fractures and often present a challenge to orthopedic surgeons due to their complex anatomy and involvement of the knee joint. These fractures may occur due to high-energy trauma in young individuals or low-energy trauma in elderly patients with osteoporosis. Surgical management has evolved significantly over the past few decades, with retrograde intramedullary nailing emerging as a preferred technique in selected cases. The present study evaluates the clinical and radiological outcomes of distal femur fractures treated with retrograde supracondylar intramedullary nailing and Ender's nail fixation. Patients with distal femur fractures who underwent surgical management were assessed for functional outcomes using the Knee Society Score along with radiological evaluation of fracture union. The study demonstrated satisfactory functional outcomes with good radiological union rates and minimal complications. Retrograde intramedullary nailing proved to be an effective method for managing distal femur fractures, allowing early mobilization and stable fixation.

Keywords: Distal femur fracture, retrograde intramedullary nail, supracondylar femur fracture, Knee Society Score, Ender's nail

1. Introduction

Fractures occurring at the distal femur present intricate challenges for orthopedic surgeons. They are relatively rare, accounting for approximately 0.4% of all fractures and 3% of femur fractures. [1] The overall occurrence rate of distal femoral fractures is estimated to be around 8.7 per 100,000 people per year. [2] These fractures commonly arise from high-energy impacts in younger individuals, often accompanied by additional injuries. Conversely, elderly patients with significant osteoporosis may experience isolated distal femoral fractures even from minor traumas.

Distal femur fractures represent approximately 0.4% of all fractures and 3% of femoral fractures. Historically, distal femur fractures were treated conservatively using traction and immobilization.

However, conservative treatment often resulted in complications such as malunion, joint stiffness, and prolonged immobilization. With advances in orthopedic surgery, operative management has become the standard of care as it allows anatomical reduction, stable fixation, and early mobilization.

Various surgical techniques have been described for the management of distal femur fractures including plating systems, intramedullary nailing, and minimally invasive fixation techniques. Among these, retrograde intramedullary nailing has gained popularity due to its biomechanical advantages, minimal soft tissue disruption, and improved stability.

This study aims to evaluate the clinical and radiological outcomes of distal femur fractures treated with retrograde supracondylar intramedullary nailing and Ender's nail fixation.

2. Materials and Methods

Study Design

Prospective observational study.

Study Population

30 Patients presenting with distal femur fractures requiring surgical management.

Inclusion Criteria

- 1) Patients with distal femur fractures including the supracondylar fractures
- 2) Patients with closed fracture and open grade-1 fracture
- 3) AO type A1, A2 & A3 fractures
- 4) Distal femur fractures associated with ipsilateral shaft femur fracture
- 5) Peri-implant/peri-prosthetic Distal femur fracture
- 6) Patients greater than 18 years of age.

Exclusion Criteria

- 1) Patients with open grade 2 and 3 fracture
- 2) AO type B and C fractures
- 3) Fractures associated with vascular injury that requires amputation
- 4) Fractures with epiphyseal plate open
- 5) Pathological fractures
- 6) Patients lost to follow up
- 7) Patients with active infection at the operative site.
- 8) Patient not willing for surgery or patient unfit for surgery.

Surgical Technique



Figure 1: Patient's Position: Supine Position with Bolster



Figure 2: Incision

Patients were treated surgically using either:

- Retrograde supracondylar intramedullary nail
- Ender's nail fixation
- Under appropriate anesthesia, fracture reduction was achieved and fixation was performed through a standard surgical approach.

Evaluation

Patients were followed postoperatively and evaluated based on:

- Clinical examination
- Radiographic evidence of fracture union

Functional outcome using Knee Society Score

3. Results

The overall result based on knee society score was excellent in 20 patients, good in 8 patients, fair in 1 patients and poor in 1 patient.

we observed that higher range of movement achieved in A2 type fracture followed by A1 than A3 fracture at final follow up.

Overall complications occurred in 16.67% cases (5 patients) out of which 4 cases were re-operated accordingly as described above.

Most patients achieved satisfactory functional outcomes following surgical fixation. Radiological evaluation showed successful fracture union in the majority of cases.

Early mobilization was possible due to stable fixation provided by retrograde intramedullary nailing.

Table 1: Mode of Injury

Site	Number	Percentage
Road Traffic Accident	20	66.67
Fall Down	10	33.33
Total	30	100

Table 2: Functional Outcomes Based on KSS Score in Different Surgical Modality

Score Rating	ENDERS	IMSC	Total	Percentage
Excellent	11	9	20	66.67%
Good	2	6	8	26.67%
Fair	0	1	1	3.33%
Poor	0	1	1	3.33%
Total	13	17	30	100%

4. Case Presentation

A 70-year-old female, H/O RTA, distal femur fracture (Muller AO/OTA 33-A1) on left side. a) preop image b) immediate postop image c) 1 month follow up image d) 6 month follow up



Clinical Image:





5. Discussion

Acharya et Rao reported a prospective series in 28 patients treated with retrograde nailing with union in 93%, malunion in 10% and excellent or good functional results in 85% of cases [5]. For Thompson et al., statistical results for the rate of surgical revision and the rate of malunion are better for retrograde intramedullary nailing [6].

Hierholzer et al. confirmed these results in a retrospective series of 115 fractures comparing retrograde nailing ($n = 59$) and mini-invasive locking plate ($n = 56$). 91 % Healing rate seen in retrograde nailing group and 88 % healing rate seen in mini-invasive locking plate. 7% cases of retrograde nailing group patient need to be reoperate while 12 % cases of mini-invasive locking plate group patient need to be reoperated. [7].

Thin elastic intramedullary Enders nails were originally developed by Rush [8] and later redesigned by Ender and Simon-Weidner [9]. In the latter form, as Ender nails, they were felt to be technically easier and less time consuming than traditional rigid nails as designed by Kuentscher.

In present study, the average age was found to be 48 years. Handolin et al [3] had mean age of 63.9. Iannacone et al [4] had mean age of 42 and Acharya et al [5] had mean age of 41. This suggest that distal femur fractures are common in adults and elderly age group.

In present study, 56.67% of the patients are female. Acharya et al had 74% male patients. Iannacone et al had 52.6% male patients. handolin et al had 63.6% female patients. [3,4,5]

Fractures of distal femur also occur due to domestic fall or trivial trauma in old age patients secondary to osteoporosis. Fractures in young age groups are mainly due to high velocity trauma or direct blow injury. In our study, 66.67% patients had road traffic accident as mode of injury. Acharya et al had 50% patients with road traffic accident as the mode of injury

[5]. Handolin et al [3] had 20.45% patients with high energy trauma. Road traffic accident is most common mode of injury in our study.

In our study, there were 15(50%) of A1 type, 8(26.67%) of A2 type and 7(23.33%) of A3 type of distal femur fracture treated by various surgical Modalities like IMSC nailing or Enders nailing. There were 17 female and 13 male with a mean age of 48 years (19 to 74) and mean follow-up was for 16 months (7 to 24). In 29 patients (96.67%), the fracture united. On an average, clinical and radiological union was seen at 13 weeks and 16 weeks respectively. The mean Knee society score at final review was 81.4.

In our present study, patients with road traffic accident had associated injuries i.e., head injury, tibia-fibula shaft fracture and other associated bone fractures in the same limb. As a result, in our study 18 (60%) patients had associated injuries to other limbs and systems.

In our study, 17(56.67%) patients were operated on simple table for IMSC nailing and 13 (43.33%) patients were operated on fracture table for Enders nailing. In our study, there was an average 77 ml blood loss and an average 107 minutes for IMSC nailing, an average 38 ml blood loss and an average 56 minutes for Enders nailing.

The mean Knee society score at final review was 81.4 graded as excellent in 20 cases, good in 8 cases, fair in 1 case and poor in 1 case. Also, there was significant difference in outcome when comparing patients with fracture types. The mean knee society score was 82.46 in A1 type, 85.12 in A2 type and 75 in A3 type. There was difference in outcome when comparing patients aged less than 55 years (17 patients) having mean KSS score of 84 and with those aged more than 55 years (13 patients) mean KSS score of 78. This shows fracture complexity and patient's age affects the functional outcomes

In our study, there was one case of superficial skin infection with delayed wound healing which recovered within 2 weeks

by proper antibiotics and regular sterile dressing. There were three cases of implant related complications, among them, two case had ENDERS nail impingement for which nail removal was done. One case had distal screw of IMSC nail impingement with screw back out for which removal of screws were done. One case of non-union which was re-operated with removal of IMSC nail with dual plating and bone grafting. Overall complications occurred in 16.67% cases (5 patients) out of which 4 cases were re-operated accordingly as described above.

6. Conclusion

Distal femur fractures are complex fractures. Proper anatomical reduction and stable fracture fixation is an important factor for better functional outcome.

AO/Muller type A distal femur treated by IMSC Nail and ENDERS Nail give gratifying results with low complication rates especially on elderly patients with osteoporosis due to minimally invasive procedure and shorter duration of surgery. IMSC nail is an ideal construct and a stable implant to use for supracondylar fractures of the distal femur, hence allowing early mobilization of the knee joint and gives better outcome.

Early mobilization exercises and physiotherapy yields better functional outcomes.

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