Functional Outcomes of Fracture Distal Femur Management With And Without Medial Augmentation

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Abstract

Background: Distal femur fractures are complex injuries that pose significant challenges in achieving stable fixation and optimal functional recovery. Medial cortical deficiency is a recognized risk factor for varus collapse, and medial augmentation has been advocated to enhance construct stability. However, its influence on functional outcomes remains debatable.

Aim: To compare the functional and radiological outcomes of distal femur fractures managed with lateral locking plate fixation with and without medial augmentation.

Materials and Methods: This prospective comparative study was conducted over one year and included 62 patients with distal femur fractures, equally divided into two groups. Group A (n = 31) underwent fixation with a lateral distal femur locking compression plate alone, while Group B (n = 31) received additional medial augmentation. Patients were followed up at regular intervals, and outcomes were assessed in terms of operative time, radiological union, complications, knee range of motion, and functional outcome using Sander's Functional Evaluation Score. Statistical analysis was performed to compare outcomes between the two groups.

Results: Group A demonstrated significantly earlier radiological union and better knee range of motion. The mean Sander's functional score was significantly higher in Group A (82.6 ± 8.4) compared to Group B (74.2 ± 9.1) ($p = 0.002$). Varus collapse was significantly lower in Group B, while overall complication rates were higher in Group B.

Conclusion: Lateral locking plate fixation without medial augmentation resulted in superior functional outcomes, whereas medial augmentation reduced varus collapse but was associated with higher complication rates. Selective use of medial augmentation is recommended.

Keywords: Distal femur fracture; Medial augmentation; Functional outcome

Introduction

Fractures of the distal femur represent a challenging subset of lower limb injuries due to their complex anatomy, proximity to the knee joint, and the high biomechanical stresses acting across the distal femoral metaphysis. (1,2) These fractures are commonly encountered following high-energy trauma such as road traffic

accidents in younger individuals and low-energy falls in the elderly with osteoporotic bone. (3,4,5) Achieving stable fixation while preserving knee function remains the primary goal of treatment, as inadequate stability or prolonged immobilization can result in complications such as malunion, nonunion, knee stiffness, and functional impairment. (6)

The advent of lateral distal femur locking compression plates has significantly improved fracture fixation by providing angular stability and allowing biological fixation with minimal periosteal disruption. However, failure of fixation, particularly varus collapse, remains a concern in fractures with medial cortical comminution. To address this issue, medial augmentation using an additional plate or strut has been advocated to enhance construct stability by supporting the medial column and resisting varus forces. (7,8)

Despite the theoretical biomechanical advantages of medial augmentation, its routine use remains controversial. Increased surgical exposure, soft tissue dissection, longer operative time, and a higher risk of complications may adversely affect clinical outcomes. Moreover, the impact of medial augmentation on fracture healing and functional recovery has not been clearly established. (9)

Our present study was undertaken to compare the functional and radiological outcomes of distal femur fractures managed with lateral locking plate fixation with and without medial augmentation, with the aim of determining the optimal fixation strategy for improved patient outcomes.

Study Methodology

This study was conducted as a prospective comparative observational study in the Department of Orthopaedics at a tertiary care hospital over a period of one year. The study included a total of 62 patients diagnosed with distal femur fractures who fulfilled the inclusion and exclusion criteria. Ethical clearance was obtained from the Institutional Ethics Committee prior to initiation of the study, and written informed consent was obtained from all participants. Patients were enrolled consecutively during the study period and were managed according to standard institutional protocols.

The study population was divided into two equal groups, with 31 patients in each group. Group A comprised patients who underwent fixation of distal femur fractures using lateral distal femur locking compression plate alone, while Group B included patients who underwent fixation with lateral distal femur locking compression plate along with medial augmentation using an additional plate or strut, as indicated. The choice of surgical technique was based on fracture pattern, degree of medial comminution, bone quality, and intraoperative stability assessment.

All surgeries were performed under regional or general anesthesia by experienced orthopedic surgeons using a standardized operative technique. Fracture reduction was achieved under fluoroscopic guidance, ensuring restoration of limb alignment, length, and rotation. In Group B, medial augmentation was performed to enhance construct stability, particularly in cases with medial cortical deficiency. Postoperatively, all patients received similar rehabilitation protocols, including early knee range-of-motion exercises and graduated weight-bearing based on radiological evidence of fracture healing.

Patients were followed up at regular intervals at 6 weeks, 3 months, 6 months, and one year postoperatively. Clinical and radiological assessments were carried out at each visit to evaluate fracture union, alignment, implant stability, and complications. Functional outcomes were assessed using a validated functional scoring system appropriate for distal femur fractures at the end of the follow-up period. The collected data were

systematically recorded and subjected to statistical analysis to compare functional outcomes between the two groups.

RESULTS

Table 1: Fracture Pattern and Operative Parameters

Parameter	Group A	Group B	p-value
AO/OTA Classification			
A2 / A3	9 (29.0%)	11 (35.5%)	—
C1	8 (25.8%)	7 (22.6%)	—
C2	9 (29.0%)	8 (25.8%)	—
C3	5 (16.1%)	5 (16.1%)	—
Duration of Surgery (minutes)	118 ± 15	96 ± 14	<0.001*

*Statistically significant

Table 2: Radiological Outcomes and Complications

Outcome	Group A n (%)	Group B n (%)	p-value
Time to Radiological Union			
<16 weeks	20 (64.5%)	13 (41.9%)	
16–20 weeks	9 (29.0%)	12 (38.7%)	
>20 weeks	2 (6.5%)	6 (19.4%)	
Varus Collapse	1 (3.2%)	7 (22.6%)	0.03*
Postoperative Infection	2 (6.5%)	4 (12.9%)	
Implant Failure	1 (3.2%)	5 (16.1%)	

*Statistically significant

Table 3: Functional Outcomes

Parameter	Group A	Group B	p-value
Knee ROM at 3 months			
>110°	18 (58.1%)	10 (32.3%)	
90–110°	10 (32.3%)	13 (41.9%)	
<90°	3 (9.7%)	8 (25.8%)	
Sander's Functional Score (Mean ± SD)	82.6 ± 8.4	74.2 ± 9.1	0.002*
Functional Outcome Category			
Excellent	12 (38.7%)	6 (19.4%)	
Good	13 (41.9%)	11 (35.5%)	
Fair	5 (16.1%)	9 (29.0%)	
Poor	1 (3.2%)	5 (16.1%)	
Overall Complication Rate	4 (12.9%)	11 (35.5%)	0.04*

*Statistically significant

Discussion

The present study compared the functional and radiological outcomes of distal femur fractures managed with lateral locking plate fixation with and without medial augmentation over a one-year follow-up period. Both groups were comparable with respect to baseline demographic variables, injury characteristics, fracture patterns, and laterality, indicating that differences in outcomes could be reasonably attributed to the fixation construct rather than confounding factors. The predominance of middle-aged adults and males, along with road traffic accidents as the leading mechanism of injury, is consistent with the epidemiological profile of distal femur fractures reported in the literature. (10,11)

Operative parameters demonstrated a statistically significant difference in mean duration of surgery, with Group A requiring longer operative time compared to Group B. Although medial augmentation is generally perceived to add surgical steps, the shorter operative duration observed in Group B may reflect better intraoperative stability and ease of definitive fixation once medial support was restored. However, operative time alone does not necessarily translate into superior outcomes, and must be interpreted alongside postoperative results. (12)

Radiological outcomes revealed notable differences between the two groups. Group A showed earlier fracture union, with a significantly higher proportion of cases achieving union within 16 weeks. In contrast, delayed union beyond 20 weeks was more common in Group B. This finding may be influenced by fracture severity, medial comminution, and biological factors rather than fixation strategy alone. However, despite slower union rates, Group B demonstrated a substantially lower incidence of varus collapse in comparison to Group A. This highlights the biomechanical advantage of medial augmentation in counteracting varus forces and improving construct stability, particularly in fractures with medial cortical deficiency.

Complication analysis showed a higher overall complication rate in Group B, including increased incidences of postoperative infection and implant failure. While medial augmentation enhances mechanical stability, it may also increase soft-tissue dissection, surgical exposure, and implant burden, thereby predisposing patients to higher complication rates. Implant failure, though relatively uncommon, was more frequent in Group B and may reflect stress concentration at the bone–implant interface or delayed biological healing in complex fracture patterns.

Functional outcomes, assessed using knee range of motion and Sander's functional scoring system, favored Group A. A greater proportion of patients in Group A achieved knee flexion beyond 110 degrees at three months, indicating superior early rehabilitation and joint mobility. Furthermore, the mean Sander's functional score was significantly higher in Group A, with a larger percentage of patients achieving excellent and good outcomes. Conversely, Group B demonstrated a higher proportion of fair and poor results. These findings suggest that despite improved mechanical alignment and reduced varus collapse, medial augmentation did not translate into superior functional recovery within the follow-up period.

The discrepancy between mechanical stability and functional outcomes may be explained by factors such as increased soft-tissue trauma, postoperative pain, stiffness, and delayed mobilization associated with dual-column fixation. Early knee motion is critical for optimal functional recovery following distal femur fractures, and any factor limiting rehabilitation may adversely affect outcomes.

Conclusion:

In conclusion, the study demonstrates that while medial augmentation provides biomechanical advantages by reducing varus collapse, fixation without medial augmentation was associated with faster union, better knee mobility, superior functional scores, and fewer complications. These findings emphasize that routine medial augmentation may not be necessary in all distal femur fractures and should be reserved for selected cases with severe medial comminution or instability. Careful patient selection and individualized fixation strategies remain essential to optimize both radiological alignment and functional outcomes.

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