Nail Plate Fixation for Distal Femur Fractures: A Multicenter Case Series

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Purpose: Surgical management of distal femur fractures is challenging given their often displaced, intra-articular, and/or comminuted nature. While the optimal mode of fixation remains controversial, nail-plate fixation (NPF) has been proposed as a means of combining the virtues of both individual techniques. The purpose of this multicenter retrospective case series is to report on outcomes of patients with distal femur fractures treated with NPF.

Methods: All adult patients with distal femur fractures who underwent NPF between 2012 and 2020 at 1 of 8 Level I trauma centers were identified. Patient demographics, injury characteristics, fracture classification and characteristics, surgical details, implant information, radiologic outcomes, and clinical outcomes were collected and summarized.

Results: Patient and injury characteristics are summarized in Table 1. Of the 49 included patients, 15% had periprosthetic fractures, 37% had open fractures, and 67% had comminuted fractures. At mean 11-month follow-up, no patients exhibited varus or hyperextension deformity and >90% were ambulatory with no or minimal pain. Seven patients underwent reoperation (3 for nonunion) at mean 14 months after surgery and all 7 were ambulatory at final follow-up, with only 1 patient reporting functionally limiting pain. No demographic, injury, or surgical characteristics were significantly associated with risk of nonunion requiring reoperation.

Conclusion: This multicenter case series of 49 patients is the largest series to date reporting on the performance of NPF for distal femur fractures. Despite a high proportion of open and comminuted fractures, we report a low rate of reoperation, radiologic deformity, or significant functionally limiting pain, suggesting that nail-plate fixation can achieve good outcomes with a high rate of union for a variety of distal femur fracture morphologies.

Table 1: Patient, Injury, and Surgical Characteristics*

Age		53.6 +/- 17.8 (23, 92)
Female Sex		28 (57%)
Tobacco Use		13 (27%)
Diabetes		13 (27%)
ASA		
	I	0 (0%)
	II	15 (31%)
	III	28 (57%)
	IV	5 (10%)
	V	1 (2%)
BMI		30.2 +/- 10.9 (17, 80)
Mechanism of injury**		
	High energy	34 (69%)
	Low energy	15 (31%)
Periprosthetic		7 (15%)
Intra-articular		28 (58%)
OTA classification		
	A1	0 (0%)
	A2	11 (22%)
	A3	10 (20%)
	C1	6 (12%)
	C2	15 (31%)
	C3	7 (14%)
Gustilo-Anderson		
	Closed	31 (63%)
	Type I	1 (2%)
	Type II	2 (4%)
	Type IIIA	12 (25%)
	Type IIIB	0 (0%)
	Type IIIC	3 (6%)
Comminution		
	None	15 (31%)
	Medial	8 (16%)
	Lateral	3 (6%)
	Both	22 (45%)
Surgical Approach		
	Anterolateral	15 (32%)
	Direct Anterior	5 (11%)
	Direct Lateral	18 (38%)
	Anterior and Lateral	3 (6%)
	Medial only	1 (2%)
	Medial and Anterior/Lateral	5 (11%)
Reduction		
	Closed or Percutaneous	10 (20%)
	Open	39 (80%)
Bone Void after Fixation		6 (13%)
Plate		
	Lateral only	43 (88%)
	Medial only	4 (8%)
	Dual plate	2 (4%)

Table 2: Outcomes after Nail-Plate Fixation of Distal Femur Fractures*

Radiologic deformity		0 (0%)
Reoperation		7 (14%)
	Infection	2
	Nonunion	3
	Bone loss	1
	Stiffness and pain	1
mRUST score at 3 months		8.5 +/- 3.7 (1-16)
Pain		
	Absent	8 (19.5%)
	Mild, not functionally limiting	29 (70.7%)
	Severe, functionally limiting	4 (9.8%)
Ambulatory		
	No	4 (9.8%)
	Yes	37 (90.2%)
Assistance		
	None	15 (40.5%)
	Cane or crutch	8 (21.6%)
	Walker	14 (37.8%)

* Categorical variables reported as N (%), continuous variables reported as mean +/- standard deviation (range).
** High energy injuries include automobile or motorcycle collisions, vehicle versus pedestrian, bicycle, or scooter, falls from height, gun shot wounds, and explosive injuries. Low energy injuries include ground level falls.