Comparative Outcomes of 80 Femoral Neck Fractures in Young Adult Patients with Ipsilateral Neck-Shaft Fractures Treated at 26 North American Trauma Centers

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INTRODUCTION:

Ipsilateral fractures of the femoral neck and shaft (neck-shaft fractures) are relatively uncommon injuries requiring complex treatments and are presumed to carry high risks for poor outcomes. Most studies involving femoral neck-shaft fractures have evaluated the shaft injury or the incidence of missed femoral neck fractures. The purpose of this multicenter study was to analyze patients, their injuries, operative treatments, and outcomes relating to the femoral neck in young adults who sustained ipsilateral femoral neck-shaft fractures.

METHODS:

A retrospective analysis of 26 North American Level 1 Trauma Centers was performed on 492 femoral neck fractures in skeletally mature patients <50 years of age. Patients with neck-shaft fractures (Group 1) and isolated femoral neck fractures (Group 2) were separated into comparative cohorts for analysis. Patient, injury, and treatment factors were recorded and compared. The main outcome measure was treatment failure, encompassing failed fixation/nonunion, osteonecrosis, malunion ($\geq$15 mm of shortening), and the need for major revision surgery. Comparative statistical analysis was performed, and significance was set at $P < 0.05$.

RESULTS:

There were 80 patients in Group 1 and 412 patients in Group 2; these groups had several notable differences. Compared to Group 2, Group 1 patients were younger, had a greater BMI, and had a lower incidence of end-stage renal disease. Additionally, the femoral neck fractures in Group 1 were more frequently displaced, vertically oriented, reduced open, had a good-excellent femoral neck fracture reduction, and were treated with a fixed-angle device ($P < 0.05$ for all). Overall, 20% of Group 1 fractures experienced treatment failure compared to 48% of Group 2 patients ($P < 0.001$). In contrast to Group 2, Group 1 patients sustained fewer failures by failed fixation/non-union (8% vs. 26%, $P < 0.001$) and malunion (1% vs. 8%, $P = 0.03$). Group 1 experienced less femoral neck shortening (5.7 mm vs. 2.0 mm, $P < 0.001$). However, osteonecrosis and the need for major reconstructive surgery did not exhibit a significant difference between groups. Group 1 patients were associated with a decreased risk of major failure (OR = 0.27, 95% CI = 0.15 - 0.48) and nonunion (OR = 0.24, 95% CI = 0.10 - 0.57). Additionally, Group 1 patients with fair-poor femoral neck fracture reduction were associated with an increased risk for treatment failure (OR = 19.3). No relationship was found between treatment failure and the use of a one- or two-device fixation construct to address contiguous ipsilateral fractures.

DISCUSSION AND CONCLUSION:

Outcomes of femoral neck fractures in combination with femoral shaft fractures (Group 1) were associated with a better prognosis than isolated femoral neck fractures (Group 2) in young adult patients. The patients, injuries, and treatments of neck-shaft fractures were different from those with isolated femoral neck fractures. These substantial differences may explain enhanced outcomes for this injury pattern compared to isolated femoral neck fractures in young adults.

Table 1: Patient, Injury, and Treatment Characteristics in all Fractures, Isolated Femoral Neck and Femoral Neck-Shaft Fractures

	Isolated Femoral Neck Fracture	Ipsilateral Neck-Shaft Fracture	Total Cohort	P-value
Number of patients, n (%)	412 (83.7)	80 (16.2)	492 (100)	N/A
Female gender, n (%)	140 (34.0)	33 (41.3)	173 (35.2)	*0.213*
Mean age (y) ± SD	37.54 ± 8.69	33.34 ± 8.56	36.86 ± 8.80	***<0.001***
Mean body mass index (BMI) ± SD	26.59 ± 6.43	29.74 ± 8.50	27.13 ± 6.92	***<0.001***
Any bone disease, n (%)	205 (49.8)	31 (39.2)	236 (48.1)	*0.087*
Smoking	136 (33.0)	29 (37.2)	165 (33.8)	*0.493*
Diabetes	23 (5.6)	2 (2.5)	25 (5.1)	*0.260*
Steroids	20 (4.8)	1 (1.3)	21 (4.3)	*0.150*
Alcohol dependence	45 (10.9)	5 (6.3)	50 (10.2)	*0.218*
End stage renal disease	24 (5.8)	0 (0.0)	24 (4.9)	***0.028***
Displaced neck-fractures, n (%)	301 (73.0)	76 (95.0)	377 (76.5)	***<0.001***
Mean modified Pauwels angle (degrees) ± SD	51.39 ± 10.83	60.38 ± 10.58	53.19 ± 11.35	***<0.001***
Pauwels classification, n (%)				
Type I (< 30˚)	6 (2.0)	0 (0.0)	6 (1.6)	*0.731*
Type II (30˚- 50˚)	113 (38.3)	9 (11.8)	122 (32.9)	***<0.001***
Type III (> 50˚)	176 (59.7)	67 (88.2)	243 (65.5)	***<0.001***
Reduction method, n (%)				***<0.001***
Closed	223 (54.0)	21 (26.3)	244 (49.5)	***<0.001***
Open	190 (46.0)	59 (73.8)	249 (50.5)	***<0.001***
Reduction quality , n (%)				
Excellent	117 (28.7)	51 (64.6)	168 (34.6)	***<0.001***
Good	146 (35.9)	19 (24.1)	165 (34.0)	***0.039***
Fair	28 (6.9)	3 (3.8)	31 (6.4)	*0.430*
Poor	8 (2.0)	2 (2.5)	10 (2.1)	*0.490*
Construct type, n (%)				
Fixed angle device	159 (38.5)	47 (58.8)	206 (41.8)	***<0.001***
Sliding hip screw	138 (33.4)	41 (51.2)	179 (36.3)	***0.002***
Cephalomedullary nail	21 (84.0)	7 (8.8)	28 (26.7)	***<0.001***
Multiple cannulated screws	253 (61.3)	32 (42.0)	285 (57.8)	***<0.001***

Table 2: Clinical Outcomes

Outcomes	Isolated Femoral Neck Fracture	Ipsilateral Neck- Shaft Fracture	Total Cohort	P-value
Number of Patients, n (%)	412 (83.8)	80 (16.2)	492	N/A
Major Failure, n (%)	199 (48.2)	16 (20.0)	215 (43.6)	***<0.001***
Non-Union, n (%)	106 (26.2)	6 (7.9)	112 (23.3)	***<0.001***
Osteonecrosis, n (%)	51 (24.1)	3 (16.7)	54 (23.5)	*0.478*
Malunion ≥15mm, n (%)	26 (8.1)	1 (1.3)	27 (6.80)	***0.034***
Major Revision Surgery, n (%)	137 (71.0)	12 (70.6)	149 (71.0)	*0.972*
Mean Maximum Shortening of Femoral Neck (mm) ± SD	5.72 ± 4.5	2.01 ± 4.0	4.87 ± 4.7	***<0.001***