A Multicenter Comparative Analysis of Ipsilateral Femoral Neck-Shaft Fractures Treated at 26 North American Level 1 Trauma Centers

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Purpose: Femoral neck fractures (FNFs) in young adults are at high risk for treatment failure. FNFs associated with an ipsilateral femoral shaft fractures ("associated FNFs") may be even more difficult to manage due to the complexity of the additional injury and its' treatment. The purpose of this study was to analyze the patients, surgical factors, and outcomes of associated FNFs, and then to compare to those with isolated FNFs.

Methods: This was a retrospective analysis of 492 patients <50 years old with surgically repaired FNFs (OTA / AO 31-B) from 26 North American Level I trauma centers. Patients with associated and isolated FNFs were separated for analysis. Patient, surgical, and treatment factors were recorded and compared. The main outcome measure was treatment failure of the femoral neck, encompassing failed fixation/nonunion, osteonecrosis, malunion (>15 mm of shortening), and the need for major revision surgery.

Results: There were 80 patients with associated FNFs and 412 with isolated FNFs. Patients with associated FNFs were younger, had a greater body mass index, and lower incidence of end-stage renal disease. Associated FNFs were more frequently displaced, vertically oriented, reduced open, and treated with a fixed-angle device ($P < 0.05$ for all). Overall, 20% of associated FNFs experienced treatment failure compared to 49% in isolated FNFs ($P < 0.001$). Specifically, associated FNFs sustained fewer failures by nonunion (7.5% vs 26%, $P < 0.001$) and malunion (2.6% vs 10%, $P = 0.002$). Femoral neck shortening was greater in isolated FNFs (5.7 mm vs 2.0 mm, $P < 0.001$). Osteonecrosis and the need for major reconstructive surgery did not exhibit a significant difference between groups. The number of devices (ie, 1 vs 2 implants) used to treat both fractures in associated FNFs was not associated with treatment failure.

Conclusion: Overall, young patients with associated FNFs have a superior prognosis compared to patients who sustain an isolated FNF. The demographics of patients with associated FNFs, the characteristics of the FNF, and the subsequent treatment outcomes were significantly different than isolated FNFs, which may explain their lower rates of treatment failure.

Patient, Surgical Factors, and Outcomes of all Femoral Neck Fractures, Isolated FNFs and Associated FNFs				
	Associated FNF	**Isolated FNFs**	**All FNFs**	**P-value**
Number of patients, n (%)	80 (16.2)	412 (83.8)	492	-
Female gender, n (% female)	33 (41.3)	139 (34.0)	172 (35.0)	*0.213*
Mean age (y) ± SD	33.3 ± 8.6	37.5 ± 8.7	36.8 ± 8.8	***<0.001***
Mean body mass index (BMI) ± SD	29.7 ± 8.5	26.6 ± 6.4	27.1 ± 6.9	***<0.001***
Metabolic bone conditions, n (%)	31 (39.0)	205 (50.0)	236 (48.0)	*0.087*
Current smoker	29 (36.2)	136 (33.0)	165 (33.5)	*0.493*
Diabetes mellitus	2 (2.5)	23 (5.6)	25 (5.1)	*0.260*
Current steroid use	1 (1.3)	20 (4.8)	21 (4.3)	*0.150*
Current alcohol misuse	5 (6.3)	45 (10.9)	50 (10.2)	*0.218*
End stage renal disease	0 (0.0)	24 (5.8)	24 (4.9)	***0.028***
OTA classification, n (%)				
OTA 31B1.1	1 (1.3)	65 (15.7)	66 (13.4)	***<0.001***
OTA 31B1.2	3 (3.8)	39 (9.4)	42 (8.5)	*0.095*
OTA 31B1.3	1 (1.3)	37 (9.0)	38 (7.7)	***0.018***
OTA31B2.1	2 (2.5)	27 (6.5)	29 (5.9)	*0.160*
OTA31B2.2	4 (5.0)	116 (28.1)	120 (24.4)	***<0.001***
OTA31B2.3	54 (67.5)	108 (26.2)	162 (32.9)	***<0.001***
OTA31B3.1	15 (18.8)	20 (4.8)	35 (7.1)	***<0.001***
Displaced femoral neck fractures , n (%)	76 (95.0)	301 (72.9)	377 (76.5)	***<0.001***
Mean modified Pauwels angle (degrees) ± SD	60.38 ± 10.58	51.39 ± 10.83	53.19 ± 11.35	***<0.001***
Pauwels classification for displaced FNFs, n (%)				***<0.001***
Type I (<30˚)	0 (0.0)	6 (1.46)	6 (1.22)	*0.731*
Type II (30˚-50˚)	9 (11.3)	113 (27.4)	122 (24.8)	***<0.001***
Type III (>50˚)	67 (83.7)	176 (42.7)	243 (49.4)	***<0.001***
Reduction method, n (%)				
Open	59 (73.8)	190 (46.0)	249 (50.6)	***<0.001***
Closed	21 (26.3)	222 (54.0)	243 (49.4)	
Construct Type, n (%)				
Fixed angle device	47 (58.8)	159 (38.6)	206 (41.9)	***0.0005***
Sliding hip screw	40 (50.0)	139 (33.7)	179 (36.3)	***0.002***
Cephalomedullary nail	7 (8.8)	20 (4.9)	27 (5.5)	***<0.001***
Multiple cannulated screws	32 (40.0)	254 (61.7)	286 (58.1)	***<0.001***
Treatment failure, n (%)	16 (20.0)	203 (49.2)	219 (44.5)	***<0.001***
Non-Union, n (%)	6 (7.5)	106 (25.7)	112 (22.8)	***<0.001***
Severe AVN, n (%)	3 (3.75)	54 (13.1)	57 (11.6)	*0.478*
Malunion (≥15mm), n (%)	1 (2.56)	38 (10.1)	39 (7.9)	***0.002***
Major Revision Surgery, n (%)	12 (15)	146 (35.4)	158 (32.1)	*0.972*
Mean Maximum Shortening of Femoral Neck (mm) ± SD	2.01 ± 4.0	5.72 ± 4.5	4.87 ± 4.7	***<0.001***