LATERAL PATIENT POSITIONING AND CENTRAL LAG SCREW PLACEMENT IN GERIATRIC CEPHALOMEDULLARY NAILING

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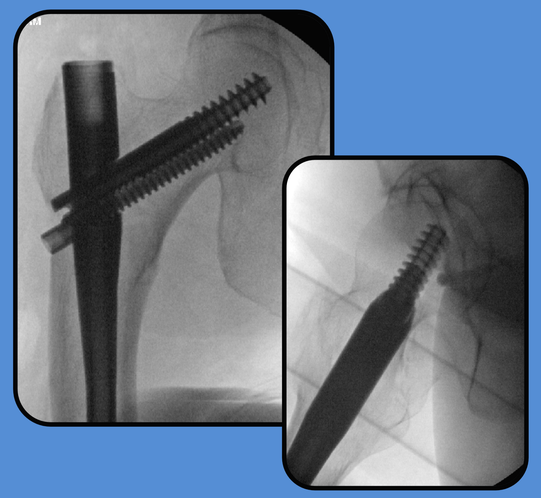


INTRODUCTION: Intertrochanteric femur fracture, or hip fracture, is a debilitating condition in the elderly. Internal fixation of these fractures is frequently performed with cephalomedullary nails, which feature a lag screw driven longitudinally through the femoral neck and into the femoral head. To reduce the risk of postoperative screw penetration through the femoral head, it is generally accepted that ideal screw placement is central or inferior in the coronal plane and central in the sagittal plane.[1,2] Traditionally, these nails have been implanted with the patient positioned supine, but some surgeons prefer a lateral patient position. This approach lets adipose tissue fall away from the incision site, potentially improving the surgeon's ability to achieve a desired nail starting point. Lateral nailing also theoretically provides more control over the aiming arm by preventing its rotation due to gravity. However, few studies have compared these approaches. The goal of this study was to investigate a potential association between lateral patient position and rate of central screw placement in the lateral plane. We hypothesized that such an association would be found due to the previously described advantages of lateral nailing. This study did not take postoperative patient outcome into consideration, instead solely focusing on the surgical technique.

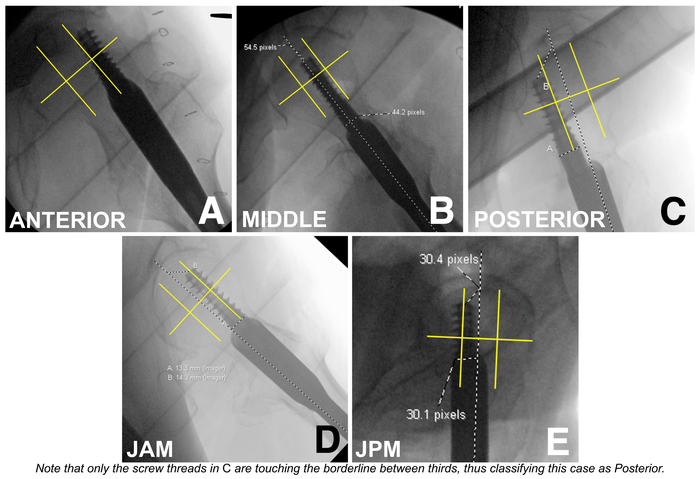
METHODS

Patients aged 60 or older receiving a cephalomedullary nail for an intertrochanteric femur fracture between June 2009 and April 2022 were identified via a records query of three hospitals (n=465).

Patient Characteristics

	Patient Position	
	Supine (n = 325)	**Lateral (n = 140)**
Age, mean ± SD (y)	79.1 ± 9.2	77.2 ± 9.7
Sex, n (%)		
Male	111 (34.2%)	42 (30.0%)
Female	214 (65.8%)	98 (70.0%)
BMI, mean ± SD	24.5 ± 5.0	26.1 ± 5.8
Re-Operations, n (%)	17 (5.2%)	2 (1.4%)

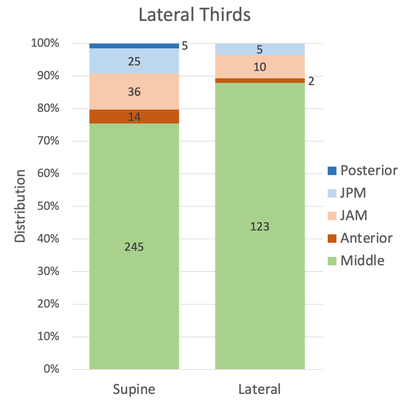
Lateral intra-operative fluoroscope images for each patient were de-identified and exported to Microsoft PowerPoint. An overlay was superimposed on each image, then scaled and rotated such that the head was divided in perfect thirds. The lag screw tip was then determined by visual inspection to reside in the Anterior, Middle, or Posterior third of the head. Cases in which the minor diameter of the screw was touching the line between thirds were considered Junction Anterior-Middle (JAM) or Junction Posterior-Middle (JPM).



Note that only the screw threads in C are touching the borderline between thirds, thus classifying this case as Posterior.

To prevent bias, the patient's surgical report was accessed last to identify whether the patient was positioned supine or laterally during the operation. All statistics were performed with threshold p=0.05.

RESULTS



Screws were found in the middle third in 245 of 325 supine cases (75.4%) and in 123 of 140 lateral cases (87.9%). Screws were found in the extreme anterior or posterior third in 5.8% of supine cases and in 1.4% of lateral cases.

Univariate analyses were performed comparing two outcome sets: Middle versus NOT Middle, and Extreme versus NOT Extreme.

Univariate Analysis

	Patient Position			
Outcome	**Supine (n=325)**	**Lateral (n=140)**	**Relative Risk (95% CI)**	***P***
Middle	245 (75.4%)	123 (87.9%)	**0.493 (0.304, 0.801)**	**0.004**
NOT Middle	80 (24.6%)	17 (12.1%)		
Extreme	19 (5.8%)	2 (1.4%)	0.244 (0.058, 1.035)	0.056
NOT Extreme	306 (94.2%)	138 (98.6%)		

Extreme = Anterior or Posterior

Multivariate linear regression analyses were performed to identify potential confounding variables in the results.

Multivariate Analysis – Middle vs. NOT Middle

Variable	Coefficient	95% CI	*P*	Favors
Patient Position	**0.096**	**(0.009, 0.183)**	**0.030**	**Lateral Position**
Age	**0.005**	**(0.001, 0.009)**	**0.009**	**Older Age**
BMI	0.002	(-0.005, 0.009)	0.628	-
Institution	-0.072	(-0.156, 0.011)	0.087	-
Nail Diameter	-0.002	(-0.047, 0.042)	0.919	-
Screw Diameter	**0.030**	**(0.006, 0.054)**	**0.014**	**Larger Diameter**
Sex	-0.023	(-0.103, 0.057)	0.573	-

Multivariate Analysis – Extreme vs. NOT Extreme

Variable	Coefficient	95% CI	*P*	Favors
Patient Position	0.035	(-0.010, 0.080)	0.124	-
Age	0.001	(-0.001, 0.003)	0.402	-
BMI	-0.001	(-0.004, 0.003)	0.769	-
Institution	-0.026	(-0.069, 0.017)	0.236	-
Nail Diameter	-0.001	(-0.025, 0.022)	0.909	-
Screw Diameter	0.006	(-0.007, 0.018)	0.381	-
Sex	0.007	(-0.034, 0.049)	0.727	-

RESULTS, CONTINUED

It was noted that 74.4% of patients in this study (n=346) were treated with an 11mm lag-compression screw (shown above). As a further investigation, statistical tests were performed on this patient subset.

Univariate Analysis, 11mm Screws Only

	Patient Position			
Outcome	**Supine (n=226)**	**Lateral (n=120)**	**Relative Risk (95% CI)**	***P***
Middle	172 (76.1%)	109 (90.8%)	**0.384 (0.209, 0.706)**	**0.002**
NOT Middle	54 (23.9%)	11 (9.2%)		
Extremes	12 (5.3%)	1 (0.8%)	0.157 (0.021, 1.193)	0.074
NOT Extremes	214 (94.7%)	119 (99.2%)		

Extreme = Anterior or Posterior

Multivariate Analysis – Middle vs. NOT Middle, 11mm Screws Only

Variable	Coefficient	95% CI	P	Favors
Patient Position	**0.114**	**(0.020, 0.208)**	**0.017**	**Lateral Position**
Age	0.003	(-0.002, 0.007)	0.239	-
BMI	0.001	(-0.006, 0.009)	0.755	-
Institution	**-0.100**	**(-0.198, -0.003)**	**0.044**	**Level 1 Trauma Center**
Nail Diameter	-0.011	(-0.063, 0.040)	0.671	-
Sex	-0.013	(-0.101, 0.076)	0.781	-

DISCUSSION

- In univariate analysis, lateral positioning was associated with a 0.493 relative risk of placement not fully within the middle region (p=0.004) and a 0.244 relative risk of placement in extreme anterior and posterior regions (p=0.056)
- Multivariate analysis found the following to be associated with higher rates of placement in the middle region: lateral position (p=0.030), older age (p=0.009), larger screw diameter (p=0.014)
- Similar results were found when controlling for screw diameter
- Future studies should use a prospective design to more strongly control for surgeon experience with this procedure, considering surgeons in trauma versus non-trauma subspecialties and involvement of residents in each case
- We conclude that in geriatric cephalomedullary nailing, lateral patient position may be associated with higher rates of central screw placement on the lateral fluoroscopy view

1. Kuzyk PRT, Zdero R, Shah S, et al. Femoral Head Lag Screw Position for Cephalomedullary Nails: A Biomechanical Analysis. *J Orthop Trauma*. 2012;26:414-421.
2. Hsueh KK, Fang CK, Chen CM, et al. Risk factors in cutout of sliding hip screw in intertrochanteric fractures: an evaluation of 937 patients. *Int Orthop*. 2010;34:1273-1276.