Positional Shift of Femoral Neurovascular Structures Relative to the Acetabulum: A Multicenter CT-Based Analysis

Tomonori Tetsunaga, Tomoko Tetsunaga, Toshifumi Ozaki

INTRODUCTION: Femoral nerve palsy and arterial injury are serious complications during total hip arthroplasty (THA), especially related to retractor placement. While anatomical variation due to patient positioning is suggested, comparative imaging data remains scarce. This study aimed to compare the anatomical positions of the femoral nerve and artery between the lateral and supine positions using computed tomography (CT), and to identify patient factors influencing these variations.

METHODS: This multicenter retrospective study analyzed 111 patients who underwent both supine and lateral CT scans between 2016 and 2023 for spinal surgery planning. In a horizontal section including the femoral head center, distances from the anterior acetabular margin to the femoral nerve (Distance N) and artery (Distance A) were measured (Fig. 1). ΔDistance (lateral minus supine) was calculated for both structures. Multiple linear regression analyses were performed to identify factors associated with Distances N and A as well as ΔDistances. Variables included sex, height, and body weight. Additionally, subgroup analyses stratified by average values were conducted to explore demographic predictors of anatomical proximity.

RESULTS:

Both the femoral nerve and artery were significantly closer to the acetabulum in the supine position than in the lateral position (Distance N: 21.1 ± 4.4 mm vs. 26.5 ± 5.1 mm; Distance A: 20.4 ± 4.9 mm vs. 26.8 ± 5.4 mm; both $P < 0.001$). Regression analysis revealed that low body weight was independently associated with shorter Distance N in both positions (P = 0.003, 0.002, Table 1) and smaller ΔDistance N (P = 0.045), indicating reduced nerve mobility with positional change (Table 2).

DISCUSSION AND CONCLUSION: Patient positioning significantly alters the anatomical relationship between the acetabulum and the femoral neurovascular bundle. Particularly in low body weight individuals, the femoral nerve remains close to the acetabulum even in the lateral position, potentially increasing the risk of iatrogenic injury during THA. These findings underscore the need for individualized surgical planning and cautious retractor placement.
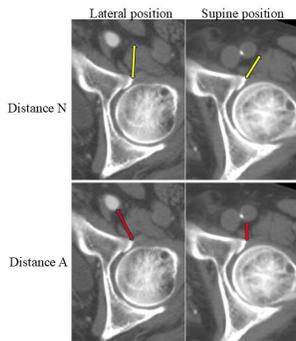

Fig. 1

Table 1 Multiple linear regression analysis of Distances N and A in the lateral and supine positions

Variables	Partial regression coefficient	Standard error	95% CI Lower	95% CI Upper	P value
Distance N in the lateral position					
Sex (female)	-0.290	0.111	-0.510	-0.070	0.010
Body height	0.006	0.006	-0.006	0.018	0.340
Body weight	0.012	0.004	0.004	0.020	0.003
Distance A in the lateral position					
Sex (female)	-0.176	0.112	-0.399	0.047	0.002
Body height	0.010	0.006	-0.003	0.022	0.122
Body weight	0.013	0.004	0.005	0.021	0.121
Distance N in the supine position					
Body height	0.007	0.006	-0.004	0.018	0.202
Body weight	0.014	0.004	0.005	0.022	0.002
Distance A in the supine position					
Sex (female)	-0.003	0.123	-0.247	0.241	0.978
Body height	0.009	0.007	-0.004	0.023	0.182
Body weight	0.009	0.005	0.001	0.018	0.044

CI, confidence interval

Table 2 Multiple linear regression analysis of "Δlateral–supine Distance N" and "Δlateral–supine Distance A"

ΔLateral–supine Distance N

Variables	Partial regression coefficient	Standard error	95% CI Lower	95% CI Upper	P value
Body height	0.003	0.006	-0.008	0.015	0.591
Body weight	0.010	0.005	-0.001	0.019	0.045

ΔLateral–supine Distance A

Variables	Partial regression coefficient	Standard error	95% CI Lower	95% CI Upper	P value
Sex (female)	-0.236	0.129	-0.491	-0.019	0.069
Body height	-0.002	0.007	-0.011	0.015	0.740

CI, confidence interval
Data presented as mean ± SD