Characteristics of Sagittal Spinopelvic Alignment in Hip Osteoarthritis with Developmental Dysplasia of Hip

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INTRODUCTION: Dislocation is still one of the main causes of revision after Total Hip Arthroplasty (THA). Recent reports have focused on the relationship between functional sagittal alignment of the acetabular component and sagittal spinopelvic alignment to prevent dislocation. There are few reports of spinopelvic pathology in patients with developmental dysplasia of hip (DDH). DDH patients are considered to have pelvic anterior tilt and lumbar lordosis, however, there is an absence to support this.

The aim of this study is to measure spinopelvic alignment and assess spinal degeneration in severe hip osteoarthritis (OA) due to DDH.

METHODS:

This study was a retrospective and observational study in one institution. Patients who underwent primary THA for secondary hip OA due to DDH and healthy controls from April 2019 to March 2022 were assigned to two groups. A total of 316 DDH hips and 538 healthy individuals with no history or radiographic signs of hip or spinal pathology were included in this study. Then, to adjust for baseline demographic differences, 1:1 propensity score matching was performed between the two groups based on age, sex, body height, and body weight. Radiographic spinopelvic parameters (pelvic incidence (PI), lumbar lordosis (LL), sacral slope (SS), PI–LL, and sagittal vertical axis (SVA)) were measured in each group and compared respectively. Additionally, spinal degenerations were classified with Lane classification from grade 0 to 2. Preoperative and postoperative data were compared within the DDH group.

Between-group comparisons were performed using the student's t-test. Paired t-tests were used for within-group comparisons of preoperative and postoperative values in the DDH group. To account for multiple testing, Bonferroni correction was applied. A two-sided P-value < 0.05 was considered statistically significant.

RESULTS: There were the cohort consisting of 126 DDH patients and 186 healthy controls, after propensity score matching, yielding 95 matched pairs for analysis (Table1). There were statistically significant differences in SS and SVA between DDH group and controls (32.0° vs. 27.8°, p = 0.0014; 39.0-centimeter vs. 21.4-centimeter, p = 0.0005) (Table2). Spinal degeneration had proceeded in the DDH group rather than control group (p < .0001) (Table3).

Comparison of preoperative and postoperative DDH showed a statistically significant decrease in PI–LL (7.5° vs. 6.2°, p = 0.0079), PI (49.5° vs. 47.5°, p < .0001), and SS (32.0° vs. 30.0°, p < .0001). SVA improved from 39.0 to 31.7 centimeters (p = 0.0273).

DISCUSSION AND CONCLUSION: This study revealed the characteristics of spinopelvic pathology in DDH patients compared to healthy hip individuals. Our study suggests DDH patients have higher anterior pelvic tilt without lumbar lordosis.

Table2 Spinopelvic parameters in standing position in the pre-operative and post-operative DDH group and control group

	Control Group* (N=95)	pre-operative DDH Group* (N=95)	p-value†	post-operative DDH Group* (N=95)	p-value‡
PI-LL (Deg)	4.1(10.6)	7.5(13.7)	0.0518	6.2(14.6)	0.0079
PI (Deg)	46.4(10.7)	49.5(11.9)	0.0627	47.5(12.2)	<.0001
LL (Deg)	42.3(12.0)	41.9(13.7)	0.824	41.3(13.6)	0.1398
SS (Deg)	27.8(5.6)	32.0(9.1)	0.0014	30.0(9.4)	<.0001
SVA (cm)	21.4(24.9)	39.0(33.8)	0.0005	31.7(41.5)	0.0273

DDH, developmental dysplasia of hip; PI, pelvic incidence; LL, lumbar lordosis; Deg, degree; SS, sacral slope; SVA, sagittal vertical axis; cm, centimeter

*The values are given as the mean and the standard deviation, with the range in parentheses. †Independent-samples t test comparing the values between the pre-operative DDH group and the control group. ‡Paired-samples t test comparing the values between the pre-operative DDH group and the post-operative DDH group.

Table1 Demographic data of the Cohort

Parameter	DDH Group (N=95)	Control Group (N=95)	p-value
Age* (year)	67.1(9.8)	66.6(9.8)	0.73†
Sex‡			0.66§
Male	13(14%)	10(11%)	
Female	82(86%)	85(89%)	
Body Height* (cm)	155.4(7.3)	155.8(7.4)	0.68†
Body Weight* (kg)	57.1(11.4)	56.8(11.8)	0.84†

*The values are given as the mean and the standard deviation, with the range in parentheses. †Independent-samples t test. ‡The values are given as the number of patients, with the percentage in parentheses. §Chi-square test.

Table3 Spinal degeneration distribution of Lane classification in the DDH group and control group

Lane Classification	DDH Group* (N=95)	Control Group* (N=95)	p-value†
Grade0	27(28)	57(60)	<.0001
Grade1	58(61)	36(38)	<.0001
Grade2	10(11)	2(2)	<.0001

*The values are given as the number of patients, with the percentage in parentheses. †Determined with use of a Mann-Whitney U test, the higher prevalence of spinal degeneration change that appeared in the DDH group compared with the control group (Grade0, 28% compared with 60%; Grade1, 61% compared with 38%; Grade2, 11% compared with 2%; p<0.0001).