



EVALUATION OF SAGITTAL SPINOPELVIC PARAMETERS BEFORE AND AFTER LUMBAR STABILIZATION SURGERIES

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ABSTRACT

Purpose: The aim of the study is to evaluate sagittal spinopelvic parameters before and after lumbar stabilization surgeries.

Materials-Methods: We inspected 60 patients who had been operated for lumbar stabilization between 2015 march and 2018 march retrospectively from the patient files. LL, PI, PT and SS angles were measured before and after surgery with Osirix® software.

Results: A total of 60 patients included in the analyses. Mean age of the study group was 57.2±11.5 years, and M/F ratio was 12/48 (20% vs. 80%). Most frequent diagnosis was L1-L5 stenosis (n=10, 16.7%). Comparisons between study periods revealed that there was no significant difference for LL (p=0.85), PI (p=0.33), SS (p=0.79) and PT (p=0.34).

Conclusion: It is important to always keep the targeted whole spine alignment in mind when performing spinal surgery. Sagittal spinopelvic parameters are not much affected with lumbar stabilization surgeries because the lumbosacral spine compensates so as to maintain the sagittal balance.

Key Words: Sagittal spinopelvic parameters, Lumbar lordosis, Sacral slope, Pelvic index, Pelvic tilt

Level of Evidence: Retrospective clinical study, Level III.

INTRODUCTION

Clinical importance of sagittal balance alignment is being recognized increasingly. The sagittal balance of the spine is determined by the pelvic shape, which is set by the pelvic incidence (PI) ⁽⁶⁾. Duval-Beaupère et al had first reported the PI in 1992 ⁽¹⁾. Sagittal spinopelvic parameters are being discussed for surgical planning of spinal deformities. Sagittal spinopelvic parameters are PI, Pelvic tilt (PT), sacral slope (SS) and lumbar lordosis (LL). The angle between the perpendicular to the upper sacral end plate at its midpoint and the line connecting this point to the femoral head axis is defined as PI and the angle between the vertical and the line through the midpoint of the sacral plate to the femoral head axis is PT ⁽⁸⁾. SS is defined as the angle between the horizontal and the upper sacral endplate ⁽¹⁰⁾. Lumbar lordosis (LL) is defined as the angle between the upper L1 endplate and the upper sacral endplate ⁽⁸⁾. PI is strongly correlated with the SS and PT,

and represents the algebraic sum of the SS and the PT (PI=SS+PT).

Abnormal spinal sagittal alignment can cause persistent low back pain (LBP) and the association of acute LBP with hyperlordosis, and the relationship of chronic LBP with hypolordosis have been demonstrated before ⁽³⁾. These parameters must be checked before and after stabilization and deformity surgeries.

The aim of the study is to evaluate sagittal spinopelvic parameters before and after lumbar stabilization surgeries.

MATERIALS AND METHOD

We inspected 60 patients who had been operated for lumbar stabilization between 2015 march and 2018 march retrospectively from the patient files. LL, PI, PT and SS angles were measured before and after surgery with Osirix® software as shown on Figure-1. LL was defined as the angle between the upper endplates of L1 and S1. SS corresponds to the angle

between the upper sacral endplate and the horizontal plane. All measurement values included for statistical analyse.

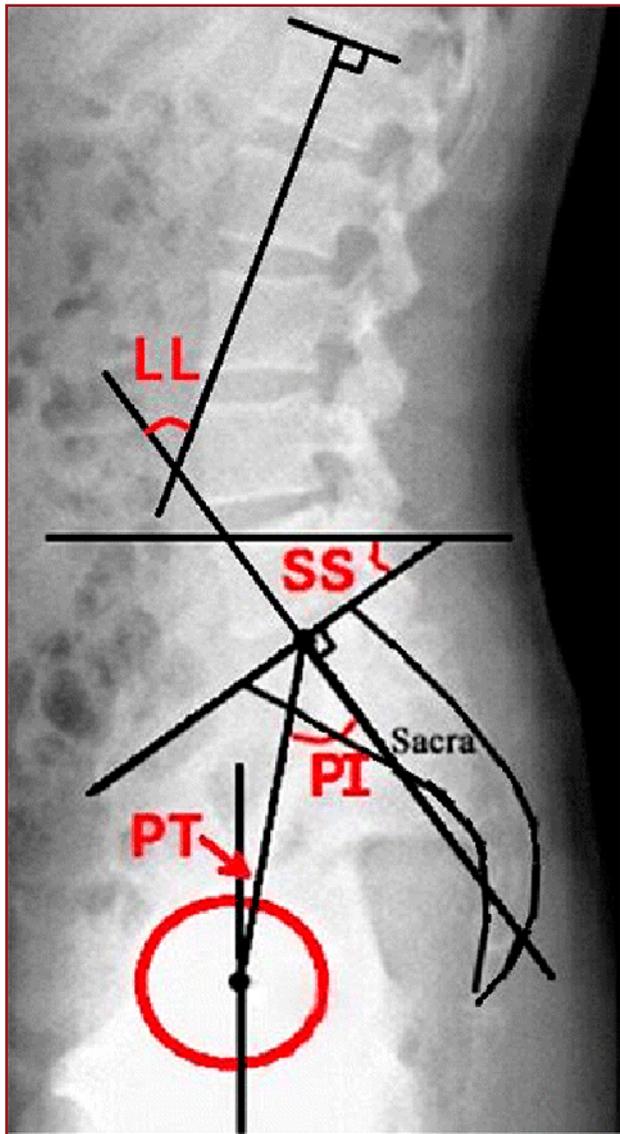


Figure-1. Evaluation of the spinopelvic measurements.

Statistical Analyses

Descriptive data were presented using mean and standard deviation, and frequencies and percent. Wilcoxon test was used for comparisons between the dependent groups of the study (preoperative and postoperative lumbar and pelvic angle measurements), and statistical significance was evaluated according to a two-sided Type-I error level of 5%. Statistical Package for the Social Sciences (SPSS) 21 software (IBM Corp. in Armonk, NY) was used for all statistical analyses of this research.

RESULTS

A total of 60 patients included in the analyses. Mean age of the study group was 57.2 ± 11.5 years, and M/F ratio was

12/48 (20 % vs. 80 %). Most frequent diagnosis was L1-L5 stenosis (n=10, 16.7%). General demographics of the patients was presented in Table-1.

Changes in lumbar lordosis angle (LL), pelvic index angle (PI), sacral slope angle (SS), and pelvic tilt angle (PT) between preoperative and postoperative periods was presented in Table 2. Accordingly, comparisons between study periods revealed that there was no significant difference for LL (p=0.85), PI (p=0.33), SS (p=0.79) and PT (p=0.34) (Figure-2).



Figure-2. Spinopelvic parameters of the patient (S.O.) (a) preoperatively, and (b) postoperatively.

Table-1. General demographics of the patients.

	Mean	SD
Age (years)	57.2	11.5
	n	%
Gender		
<i>Male</i>	12	20
<i>Female</i>	48	80
Diagnosis		
<i>L1-L5 stenosis</i>	10	16.7
<i>L1-S1 stenosis</i>	6	10
<i>L2-3-4 stenosis</i>	6	10
<i>L2-5 stenosis</i>	6	10
<i>L2-S1 stenosis</i>	6	10
<i>L3-4 listesis</i>	6	10
<i>L3-4 stenosis</i>	4	6.7
<i>L3-4-5 stenosis</i>	4	6.7
<i>L3-S1 stenosis</i>	2	3.3
<i>L3-S1 stenosis</i>	2	3.3
<i>L4-5 listesis</i>	2	3.3
<i>L4-5 stenosis</i>	2	3.3
<i>L4-S1 stenosis</i>	2	3.3
<i>L5-S1 listesis</i>	2	3.3

Table-2. Pre- and post-operative lumbar and pelvic angle measurements.

	Preoperative		Postoperative		P
	Mean	SD	Mean	SD	
LL: Lomber lordosis angle	50.7	14.1	50.6	7	0.85
PI: Pelvic index Angle	46	7.2	45.5	7.1	0.33
SS: Sacral Slope Angle	32.4	8.6	32.4	7.4	0.79
PT: Pelvic tilt Angle	13.8	5.4	13	5.3	0.34

DISCUSSION

Although the restoration of normal sagittal alignment is a critical goal of reconstructive spine surgery, normal and pathologic alignment remain poorly defined⁽⁴⁾. Abnormal lordotic alignment may lead pathologic changes in the spine from load bearing and accelerate degeneration of the functional motion units⁽⁵⁾.

The wedging of the lumbar vertebral bodies and intervertebral discs forms lumbar lordosis. While lumbar lordosis is generally thought to decrease with aging according to Vudentam et al, many elderly subjects in the study of Yokoyama et al were found to have maintained lumbar lordosis^(9,11).

Düzkalır et al had reported LL and SS angle values were significantly higher in females when compared to males and LL and SS values showed statistically significant and strong positive correlation with each other through all age groups additionally significantly higher in 61-80 years⁽²⁾. Oh et al. reported the spinopelvic parameters of Korean normal population as followings, the PI was 49°; the SS was 38°; the PT was 11°, the LL was 48°⁽⁷⁾. LL and SS value range means in asymptomatic adults is 43-61 and 36-42 degrees⁽⁸⁾.

Spinopelvic parameters and global sagittal balance have been studied extensively in the literature. In our study we found that Comparisons between preoperative and postoperative lumbar stabilization surgeries revealed that there was no significant difference for LL (p=0.85), PI (p=0.33), SS (p=0.79) and PT (p=0.34). Many studies needed to make a standart data for either normal or pathologic values of sagittal spinopelvic parameters.

Conclusion

It is important to always keep the targeted whole spine alignment in mind when performing spinal surgery. Sagittal spinopelvic parameters are not much affected with lumbar stabilization surgeries because the lumbosacral spine compensates so as to maintain the sagittal balance.

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