

Risk Factors for Deterioration of Sagittal Spinal Alignment after Lumbar Spine Surgery

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INTRODUCTION: Patients with lumbar degenerative disease often suffer poor spinal sagittal alignment associated with disc degeneration and/or pain. Although spinal sagittal alignment tends to improve after lumbar spine surgery due to pain-relieving effects and local correction, some of the cases show deterioration postoperatively. Given that poor postoperative sagittal alignment correlates with suboptimal clinical outcomes, understanding the risk factors is crucial. This study investigated the characteristics of patients whose sagittal vertical axis (SVA) increases, and sagittal alignment deteriorates following lumbar spine surgery.

METHODS:

We included patients who underwent lumbar decompression or lumbar interbody fusion at one or two levels in our hospital between 2016 and 2019. Inclusion criteria required a follow-up period of at least three years and availability of whole-spine lateral radiographs preoperatively, at one year and three years postoperatively. We analyzed preoperative clinical parameters such as age, body mass index, lumbar bone mineral density, spinopelvic parameters, grip strength, one-leg standing time, abdominal trunk muscle strength, knee extensor muscle strength, functional reach test (FRT), walking speed, and 2-step test to identify factors associated with sagittal alignment deterioration three years postoperatively. We categorized patients with an SVA value ≥ 40 mm and an SVA increase ≥ 30 mm into the deterioration group, and the rest into the non-deterioration group. Factors contributing to deteriorated sagittal alignment were investigated using univariate and multivariate analysis.

RESULTS: We included 89 patients in this study. The mean SVA change over three years was 4.1 mm (range: -106.3 to 211.7). Nineteen of the 89 patients (21%) were categorized into the deterioration group. One year postoperatively, the non-deterioration group exhibited a significant SVA decrease, while the deterioration group showed no statistical change. In univariate analysis, deterioration group patients were older (76 vs. 70 years), had higher pelvic tilt (PT) (25 vs. 21 degrees), and had lower one-leg standing time (9 vs. 26 seconds), FRT (29 vs. 35 cm), and 2-step test (0.99 vs. 1.14) values than non-deterioration group patients. No significant difference existed in preoperative SVA, postoperative osteoporotic vertebral fracture, and whether interbody fusion was performed between the two groups. In multiple logistic regression analysis, high PT and low FRT values emerged as significant risk factors for sagittal alignment deterioration post-lumbar surgery.

DISCUSSION AND CONCLUSION: Patients with high preoperative PT already started compensation for the deterioration of sagittal alignment due to lumbar spine degeneration. Therefore, lumbar spine surgery does not improve SVA, and sagittal alignment is expected to deteriorate further postoperatively. Indeed, SVA did not change at one year postoperatively in the deterioration group and increased significantly at three years in this study. Additionally, patients with low FRT values, indicating reduced muscle strength required for postural maintenance, may face future deterioration of sagittal alignment. In conclusion, the risk factors for sagittal alignment deterioration post-lumbar spine surgery were high preoperative PT and low FRT values.