

Impact of spinal alignment on adjacent segment disease and degeneration after short-segment lumbosacral fusion

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INTRODUCTION:

Adjacent segment disease (ASDis) and degeneration (ASDeg) are common complications following lumbar fusion, ranging from asymptomatic radiographic changes to debilitating symptoms requiring revision surgery. While the impact of spinopelvic alignment (SPA) on postoperative outcomes and ASDis prevention is well-studied in long-construct fusions, its role in short-segment lumbosacral fusions, particularly over the long term, remains unclear.

This study aimed to investigate the association between global and distal lumbar SPA with the development of ASDis and ASDeg in the long-term follow-up of patients undergoing short-segment lumbosacral fusion. Secondary outcomes were patient reported outcome measures (PROMs) in relation to adjacent segment changes.

METHODS: Pre- and postoperative standing radiographs were annotated and the following global lumbar SPA parameters analyzed: Pelvic incidence (PI), sacral slope (SS), pelvic tilt (PT), lumbar lordosis (LL), PI-LL-mismatch, lumbar pelvic angle (LPA). Additionally, the following distal lumbar SPA parameters were analyzed: Distal lordosis (DL) between L4-S1, lordosis distribution index (LDI=DL/LL), PI-DL-difference, DL-PI-ratio, adjacent segment lordosis (ASL). Postoperative ODI and EQ5D5L were assessed via a telephone interview.

RESULTS: Among 86 patients with a mean follow-up of 12±4 years the incidence of ASDis was 27.9% ($n=24$), while 7.0% ($n=6$) showed ASDeg. No significant differences in pre- and postoperative global lumbar SPA were found in patients who developed ASDis or ASDeg compared to patients who did not. PI (53.6° vs. 59.6°) and preoperative SS (34.9° vs. 40.3°) trended to be lower in the ASDis group compared to controls, although non-significant. Pre- and postoperative distal lumbar SPA parameters did not differ between groups. Patients with adjacent segment changes, regardless of whether they underwent revision surgery, reported worse PROMs. ODI scores were elevated in both the ASDis group (28, IQR 15–42) and the ASDeg group (34, IQR 14–47) compared to controls (10, IQR 2–24; $p=.005$). EQ5D5L scores were lower in both the ASDis (70, IQR 53–83) and the ASDeg groups (60, IQR 55–85) compared to controls (85, IQR 75–90; $p=.025$).

DISCUSSION AND CONCLUSION: In this long-term follow-up study of patients undergoing short-segment lumbosacral fusion, neither preoperative nor postoperative SPA was significantly associated with the development of ASDis or ASDeg. These findings suggest that other factors may have a greater influence on ASDis risk. Patients who developed adjacent segment changes, whether or not they required revision surgery, experienced worse long-term postoperative PROMs, indicating the importance of ASDis prevention.