Hidden Spinal Deformity: Prevalence of Severe Sagittal Malalignment in Patients Undergoing Short-Segment Lumbar Fusion

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INTRODUCTION:

Short-segment 1-2 level lumbar fusion is frequently performed to address localized degenerative spine conditions. Despite the targeted nature of these interventions, there is limited understanding of the prevalence and impact of baseline sagittal malalignment in patients undergoing these fusion procedures. The present study aimed to determine the prevalence and severity of baseline sagittal malalignment using established modifiers (Schwab modifiers and segmental L4-S1 lordosis) in patients undergoing short-segment lumbar fusion.

METHODS: Adult patients over the age of 18 years who underwent short (1-2 level) lumbar interbody fusion were included. Sagittal alignment was classified by Schwab modifiers: pelvic incidence-lumbar lordosis (PI-LL; 0: <10°, +: 10-20°, ++: >20°), pelvic tilt (PT; 0: <20°, +: 20-30°, ++: >30°), and sagittal vertical axis (SVA; 0: <40mm, +: 40-95mm, ++: >95mm), with the latter only assessed in a sub-group of patients with full-body radiographs available. Schwab modifier distribution was described overall and compared across age groups (<40, 40–60, >60 years), and surgical history (primary or revision) using chi-square analyses. Regional L4-S1 alignment across Schwab modifiers was similarly compared using one-way analysis of variance.

RESULTS:

Among 1,024 patients undergoing short-segment spinal fusion (mean age 59 years, 55% female), 20.3% had severe sagittal Schwab++ deformity. In total, 14.3% had PT++, 17.3% PI-LL++, and 15.0% SVA++. The proportion of patients with severe Schwab malalignment increased with age (PT++: 6.3% in <40 years vs 10.2% in 40-60 years vs 18.6% in >60 years; PI-LL++: 4.7% vs 11.6% vs 23.6%; SVA++: 0.0% vs 4.9% vs 21.5%; all $p<0.01$). The proportion of patients with severe Schwab malalignment was also higher in revision patients (PT++: 12.6% in primary vs. 22.3% in revision; PI-LL++: 16.6% vs. 20.3%; all $p<0.05$). Decreased regional L4-S1 lordosis was significantly associated with increasing PT (0: 33.5º, +: 30.9º, ++: 24.2º), PI-LL (0: 33.5º, +: 31.7º, ++: 23.7º), and SVA (0: 33.0º, +: 28.2º, ++: 21.3º).

DISCUSSION AND CONCLUSION: In this study of over 1,000 patients undergoing 1-2 level lumbar fusion, over 20% had baseline severe sagittal malalignment (Schwab++). Rates were higher with increasing age, and in patients undergoing revision fusion. Standard preoperative assessment of segmental, regional, and global sagittal deformity is essential in this population to inform surgical planning and improve outcomes by preventing the cycle of iatrogenic flatback syndrome.