Adult Spinal Deformity: The Influence of BMI on Achieving Age Adjusted Alignment Goals

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Disclosures

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Introduction

• Neutral sagittal spinopelvic alignment, having previously been correlated with positive health-related-quality-of-life (HRQL) outcomes, is targeted as an operative goal for adult spinal deformity (ASD) correction.

• Sagittal spinopelvic alignment targets vary dependent upon a patient’s age, calling for more rigorous alignment objectives in younger patients\(^2\).

• Currently, the influence of Body Mass Index (BMI) on sagittal alignment and lower-limb compensatory mechanisms is poorly understood. BMI is also believed to influence ideal operative alignment targets. Correction may need to be tailored to patient age and BMI.
Methods

• Retrospective review of a single-center stereoradiographic database.

• **Inclusion Criteria:** ASD patients (SVA >5cm, Coronal Cobb >20, PI-LL >10, PT >20) greater than 18 y/o, with full-body stereoradiographic images.

• Patients were stratified by BMI: Normal <25, Overweight 25-30, Obese <30

• Demographics and surgical details were described. Alignment parameters were compared between groups amongst baseline and 1-year postoperative follow-up using ANOVA, and paired t-tests to assess temporal differences.

• Patients were further stratified by age (<40, 40-65, >65), and were assessed on whether their postoperative alignment ‘Matched’ (+/- 10 years) or ‘Unmatched’ age-adjusted alignment targets.
Alignment Parameters

• Alignment Targets of Interest Included: Sag Vertical Axis (SVA), T1-Pelvic angle (TPA), pelvic tilt (PT), Pelvic Incidence minus lumbar lordosis (PI-LL). Lower extremity compensation parameters included hip extension (SFA), ankle flexion angle (AA), knee-flexion-angle (KA), pelvic-shift (PS), a global-sagittal-angle (GSA).

Age Adjusted Alignment Formulas

\[
\begin{align*}
\text{PI} - \text{LL} &= \frac{(\text{Age} - 55)}{2} + 3 \\
\text{PT} &= \frac{(\text{Age} - 55)}{3} + 20 \\
\text{SVA} &= 2 \times (\text{Age} - 55) + 25 \\
\text{TPA} &= \frac{(\text{Age} - 55)}{2} + 16
\end{align*}
\]
Results

- **116 patients** were included (29-Obese (BMI 35.3), 40-Overweight (BMI 27.4), 47-Normal (BMI 21.8)). Mean age: 61.59 years, 66.4% females.

- The **posterior surgical approach** was the most common among obese (69.2%), overweight (52.4%) and normal weight (60.0%) patients (p>0.05 between groups). Osteotomy prevalence: 38.8%, Avg. Op-Time: 302.38 minutes, EBL: 1536 mL. Levels fused: 6.73 Obese, 7.26 Overweight, 9.79 Normal; p<0.05.

- Following surgery, **obese** and **overweight patients** had more residual malalignment (worse PI-LL, TPA, PT, SVA) compared to normal patients (p<0.05).

- Additionally, obese and overweight patients recruited more **pelvic-shift** (62.36-Obese, 49.80-Overweight, 31.50-Normal) and had a **higher GSA** (6.51-Obese, 6.35-Overweight, 3.40-Normal)(p<0.05).
Results

• Obese and overweight patients exhibited lower overcorrection rates and higher under-correction rates (p<0.05).

• Obese patients exhibited worse postoperative HRQL-scores (SRS-22, ODI, VAS-Leg) than overweight and normal patients (p<0.05).

• Obese and overweight patients who ‘matched’ age-adjusted alignment targets for SVA or PI-LL exhibited no HRQL improvements, while normal ‘matched’ patients improved in SRS-22 Total and ODI scores (p>0.05)
Discussion

• Obese patients may not respond to corrective surgery in the same manner as normal weight patients.

• The discrepancy in postoperative sagittal alignment outcomes between obese, overweight, and normal weight patients is not well understood. Speculation from previous reports indicate that poorer radiographic outcomes may be reflective of a decreased ability to improve or maintain sagittal alignment in obese patients, or dependent on the type of surgical procedure and approach utilized.

• We speculate that there is greater stress on the instrumentation during correction of obese and overweight patients, resulting in a greater and progressive loss of rod contour postoperatively in comparison to normal patients. Further analysis is needed comparing immediate postoperative alignment to 1Y, 2Y and long term follow-up alignment.
Summary Points

• Following surgery, obese patients were under-corrected, more likely to have residual malalignment, recruited more pelvic shift, had a greater GSA, and worse HRQL scores.

• The benefits from age-adjusted alignment targets appear to be less substantial for obese and overweight patients as well, in that obese and overweight patients who ‘matched’ age adjusted alignment targets exhibited no significant HRQL improvement.

• Further research with greater power is needed to determine target alignment values that correlate with optimal postoperative clinical outcomes in obese patients.
Thank You!