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RELATIONSHIP BETWEEN COBB MAGNITUDE AND APICAL DISTRIBUTION IN SINGLE CURVES OF ADOLESCENT IDIOPATHIC SCOLIOSIS: ANALYSIS OF A LARGE OBSERVATIONAL COHORT AT RISSER 0

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Background

A prior study described the percentage distribution of vertebral apices in single adolescent idiopathic scoliosis (AIS) curves, showing a marked concentration at T12 with progressively fewer apices cranially and caudally. It is unknown whether curve severity, measured by Cobb degrees, follows a similar spatial pattern.

Study Design

Retrospective observational study

Objective (s)

To compare Cobb magnitude across groups defined by apical vertebral level and to determine whether a systematic relationship exists between apical distribution and angular severity in single curves of AIS.

Methods

Retrospective observational study at a tertiary conservative scoliosis center. We included 1,837 treatment-naïve patients with single-curve AIS, age 9-14 years, Cobb ≥10°, and Risser 0. For each curve we recorded apical vertebra and Cobb angle. Apices located on an intervertebral disc were apportioned equally to the adjacent vertebrae (0.5 each), as in the prior report. To minimize confounding by skeletal maturity the analysis was restricted to Risser 0 curves. Correlation between mean Cobb and apical frequency distribution was assessed with Spearman's rank correlation.

Results

Apical counts peaked at T12 (415 curves) with progressive reduction both cranially (T11-T4) and caudally (L1-L4). Mean Cobb did not mirror apical frequency. Higher mean Cobb values were observed for mid-thoracic apices (T8-T10), peaking at T9 (28.4°) and T8 (28.3°), whereas smaller mean angles occurred for high thoracic apices (T4-T7: 16.2°-19.2°) and low lumbar apices (L2-L4: 15.4°-18.7°). Spearman analysis showed no consistent monotonic relationship between apical frequency and mean Cobb, indicating a dissociation between the most frequent apical level and greatest angular severity

Conclusion(s)

In single-curve AIS at Risser 0, apical distribution and angular severity follow distinct patterns: T12 is the most frequent apex but the largest Cobb angles localize predominantly to the mid-thoracic region (T8-T10). Apex location alone is therefore not a direct proxy for curve severity.

The disproportionate severity of mid-thoracic apices may reflect regional biomechanical factors. The mid-thoracic spine is influenced by the rib cage, thoracic kyphosis, and a relatively long lever arm allowing greater coronal moment generation during growth. Rib-vertebra coupling and reduced capacity for compensatory sagittal realignment could amplify asymmetric loading and vertebral growth modulation, promoting greater Cobb progression at T8–T10. Conversely, T12—at the thoracolumbar transition—may be a frequent apex due to geometric transition but subject to different stabilizing forces that limit angular magnitude. These interpretations are hypothesis-generating and require prospective biomechanical and longitudinal study.

Clinical significance

Apical level should not be used in isolation to estimate curve severity or progression risk. Awareness that mid-thoracic apices tend to present with larger Cobb angles supports targeted monitoring, individualized bracing strategy, and consideration of regional sagittal and rib-cage factors in prognosis and treatment planning.