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ACCURACY OF IS-GROWTH PREDICTIONS OF THE RISK OF REACHING THE CLINICALLY SIGNIFICANT THRESHOLDS OF 30°, 45° AND 50° IN IDIOPATHIC SCOLIOSIS PATIENTS

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Background

IS-GROWTH has recently been developed to predict the progression of Idiopathic Scoliosis (IS) at all ages, with curves up to 70° at start. While it provides a graphical representation of the wide range of possible evolutions, IS-GROWTH does not offer risk thresholds, unlike the previously developed BrAIST-Calc (applicable only to adolescents IS curves 20-40°, Risser 0-2).

Study Design

Secondary analysis of a retrospective study on prospectively collected data.

Objective (s)

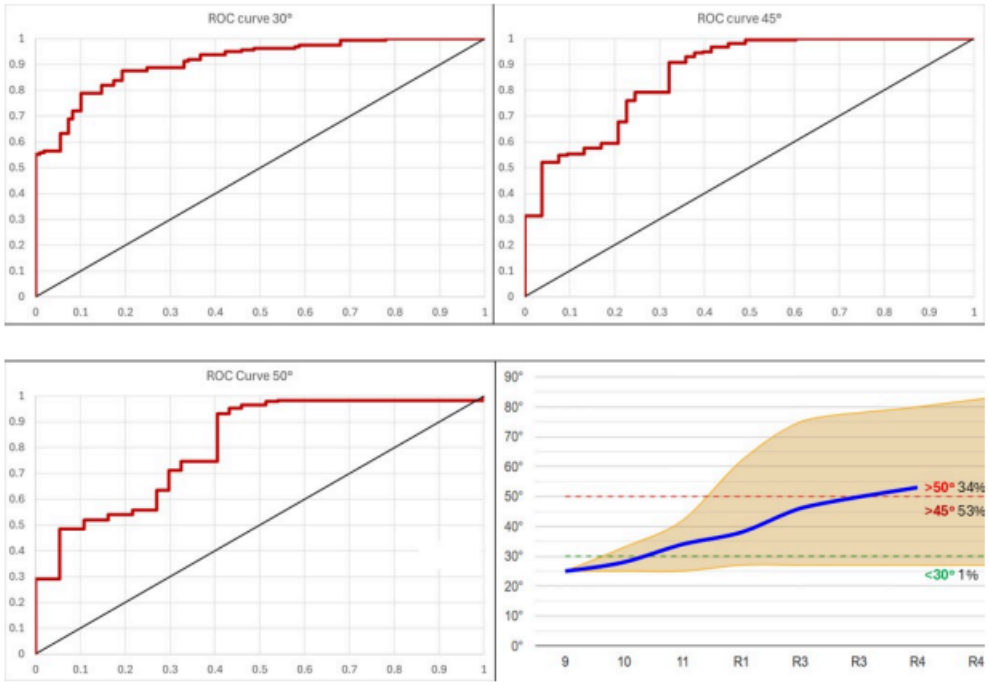
To develop IS-GROWTH predictive formulae for the risk of reaching significant clinical thresholds at the end of growth: 30° for probable stability in adulthood; 45° and 50° for surgical indications.

Methods

We considered the two groups (development and temporal validation) from the previously published IS-GROWTH paper, which included all available IS children who presented to our institute with prior X-rays taken before any treatment. We examined the distribution within the individually predicted ranges in the validation group. We applied a mathematical transformation to approximate a normal distribution and assessed normality using the Asymmetry and Kurtosis tests. We developed prediction models for the 30°, 45°, and 50° thresholds. We performed temporal validation on all radiograph pairs. We assessed performance using the Area Under the Curve (AUC) for discrimination, the accuracy of risk estimates through Brier Scores (BS) with 95% Confidence Intervals (95CI), and calibration analysis using risk deciles to compare predicted probabilities with observed outcomes.

Results

We evaluated the distribution of IS-GROWTH predictions for 552 patients (74% female, 12.4±2.0 and 14.7±1.7 years, 19±9° and 26±11° at start and end, respectively). A square-root transformation provided the best approximation to a normal distribution (asymmetry 0.01, kurtosis 0.72). To temporally validate the prediction model, we had 270 pairs of radiographs (187 patients; 87% female; first radiograph below age 10 for 17, and above age 10 at Risser 0, 1, 2, and 3 for 80, 31, 56, and 86, respectively). At the end of growth, we had 109 radiographs <30°, and 53 and 37 >45° and 50°, respectively. The AUC (95CI) were 0.91 (0.87-0.95), 0.86 (0.80-0.93) and 0.81 (0.72-0.90) for the 30°, 45° and 50° thresholds, respectively. Overall predictive accuracy was high, with Brier Scores of 0.19 (0.15-0.22) for 30°, 0.15 (0.12-0.18) for 45°, and 0.14 (0.11-0.17) for 50°. Calibration analysis showed a strong correlation between predicted and observed risks across all thresholds, with high reliability even at the probability extremes for surgical indications.



Conclusion(s)

IS-GROWTH provides accurate, validated probabilities for reaching clinically significant thresholds. Complementing graphical trajectories with quantitative risk estimates offers a more comprehensive prognostic tool than existing models, applicable to a wider clinical population.

Clinical significance

These validated risk percentages allow for personalised counselling and shared decision-making. Physicians can now quantify the individual risk of surgical progression or long-term stability, optimising treatment timing and patient engagement.