Prediction of height increment using preoperative radiological parameters following selective thoracic fusion with alternate-level pedicle screw construct in Lenke 1 and 2 adolescent idiopathic scoliosis patients

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Abstract
Purpose: This study aims to derive a formula to predict post-operative height increment in Lenke 1 and Lenke 2 adolescent idiopathic scoliosis (AIS) patients using preoperative radiological parameters. Methods: This study involved 70 consecutive Lenke 1 and 2 AIS patients who underwent scoliosis correction with alternate-level pedicle screw instrumentation. Preoperative parameters that were measured included main thoracic (MT) Cobb angle, proximal thoracic (PT) Cobb angle, lumbar Cobb angle as well as thoracic kyphosis, Side-bending flexibility (SBF), and full-coring bending flexibility (FCBF) were derived from the measurements. Preoperative height and post-operative height increment was measured by an independent observer using a standardized method. Results: MT Cobb angle and FB Cobb angle were significant predictors ($p < 0.001$) of height increment from multiple linear regression analysis ($R = 0.784, R^2 = 0.665$). PT Cobb angle, lumbar, SB Cobb angle, preoperative height and number of fused segments were not significant predictors for the height increment based on the multivariable analysis. Increase in post-operative height could be calculated by the formula: increase in height (cm) = (0.09 x preoperative MT Cobb angle) + (0.04 x FB Cobb angle) – 0.5. Conclusions: The proposed formula of increase in height (cm) = (0.09 x preoperative MT Cobb angle) + (0.04 x FB Cobb angle) – 0.5 could predict post-operative height gain to within 5 mm accuracy in 51% of patients, within 10 mm in 70% and within 15 mm in 86% of patients.

Keywords
adolescent idiopathic scoliosis, height increment, preoperative radiological parameters, selective thoracic fusion

Introduction
Curve progression in adolescent idiopathic scoliosis (AIS) will result in height loss in the spinal deformity. One of the main concerns of parents and patients is the effect of spinal fusion on the height of the patient. Although it is known that scoliosis correction surgery will result in the lengthening of the spinal column height, there is little evidence available to quantitatively predict the amount of height gain post-operatively. Several formulas have been proposed by various authors to determine the increase in height after scoliosis correction. However, these formulas are based on a combination of preoperative and post-operative radiological parameters. Using these formulas, the increase in height could only be determined after the surgery. This would limit the clinical use of such formulas. In our knowledge, no study has reported on the prediction of...