A preliminary validation of a severity index for early detection of progressive adolescent idiopathic scoliosis

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Summary

The aim was to assess the relevance of a severity index based on 3D reconstruction from biplanar X-Rays, for early detection of progressive adolescent idiopathic scoliosis. 56 patients were enrolled at their first exam. They were followed until end of growth (non-progressive) or brace decision (progressive). 95% of early predictions regarding progression vs non-progression were consistent with the actual clinical outcome. Although still requiring large scale validation, results are promising for early detection of progressive curves.

Introduction

AIS risk of progression is routinely estimated according to multiple clinical factors including skeletal maturity, menarchal status, curve pattern and amplitude. However careful follow up is still the gold standard method to assess the deformity progression and to decide whether or not to treat. The present study describes a predictive severity index for early detection of progressive AIS patients based on 3D geometrical criteria of the deformity obtained from EOS spine acquisitions.

Methods

Inclusion criteria followed the SRS guidelines for AIS diagnosis (curve > 10°, Risser 0-2). All patients were followed until skeletal maturation (Risser > 3, stable scoliosis) or decision for bracing (progressive scoliosis). A set of parameters describing the major curve (Cobb angle, kyphosis, vertebral axial rotations, torsion) were obtained from bi-planar x-rays and 3D reconstructions of the spine. A severity index (normalized between 0 and 1) was calculated with a discriminant analysis algorithm by comparison with a database of 45 progressive scoliosis (Cobb Angle > 25°) and 48 non-scoliotic subjects. A severity index lower than 0.4 was associated with stable scoliosis, while an index higher than 0.6 with progressive scoliosis.

Results

Fifty-six AIS patients were enrolled prospectively in this study (15 boys and 41 girls, 12 ± 2 years old, mean Cobb angle 15.5 ± 4.8°, range 11-26°). Fifty-three out of 56 patients (95 %) were adequately classified by the severity index (results are detailed in Table 1). Two cases were false negatives and one false positive, corresponding to a sensibility of 97 % and a specificity of 91 %.

Conclusion

Our preliminary results suggest that this severity index is a promising prognostic tool for scoliosis in skeletally immature patients. Recommendations to optimize the performance of the prognostic index are discussed regarding patient positioning, 3D reconstruction uncertainty and curve type. A large multi-centric study is in progress to validate the proposed severity index and investigate its robustness.

Table 1

Clinical outcome	Index < 0.4	Index > 0.6	0.4 < Index < 0.6
Non-progressive	34	1	0
Progressive	2	19	0