



Can Coronal Deformity Angular Ratio Predict Progression in Adolescent Idiopathic Scoliosis?

Laerke Ragborg^{1,2}, David Thornberg², Megan Johnson², Amy McIntosh², Daniel Sucato², Martin Gehrchen¹, Benny Dahl¹, Soren Ohrt-Nissen¹.

¹Spine Unit, Department of Orthopedic Surgery, Rigshospitalet, Denmark

²Texas Scottish Rite for Children, Dallas, Texas

Background

A limited number of studies have examined the relationship between C-DAR and curve progression. C-DAR is calculated as the Cobb angle magnitude divided by the number of vertebrae in the curve, yielding a larger value in short curves. Prior studies have shown curves involving fewer vertebrae tend to be less flexible, the purpose of this study was to assess whether C-DAR is a useful predictor for progression to surgical magnitude in AIS patients treated with TLSO.

Methods

Patients diagnosed with AIS, prescribed a full-time TLSO, major curve Cobb between 20-40°, Risser 0-2, who wore the brace ≥ 12.9 hours and reached skeletal maturity/surgery were included. The main outcome of this study was to examine the association between C-DAR and the risk of progression to surgical magnitude

(>45°). Logistic regression models included sex, curve location, BMI, in-brace correction (IBC) and Risser.

Results

A total of 165 patients with a mean Cobb angle of $30\pm 6^\circ$ were included. Of these, 46/165 (28%) progressed $\geq 6^\circ$ and 26/165 (16%) had reached surgical magnitude at the end of treatment. At baseline, the groups differed significantly on CDAR, pre-treatment Cobb angle magnitude and IBC, but not on remaining variables (Table 1).

Multiple logistic regression found that C-DAR was a significant predictor for risk of progression to surgical magnitude with an OR of 1.9 (CI 1.2-2.9) per unit increase in C-DAR. A threshold value of 5.15 was established. C-DAR exceeding 5.15 yielded an OR of 5.9 (CI 2.1-17.9).

Conclusion

C-DAR is an independent predictor for progression to a surgical magnitude in a compliant population even when adjusting for in-brace correction. Patients with a higher C-DAR should be counseled to help set realistic expectations in regard to likelihood of curve progression despite compliance with brace wear.

Table 1

Variables		Total n=165	<45* n=139	≥45* n=26	p-value
Sex, Female		140 (84.85)	120 (86)	20 (77)	0.220
Age		12.2 ± 1.4 (10 - 15.6)	12.3 ± 1.3 (10 - 15.6)	11.9 ± 1.5 (10 - 15.1)	0.162
Risser	0	117 (71)	94 (67)	23 (88)	
	1	28 (17)	26 (19)	2 (8)	
	2	20 (12)	19 (14)	1 (3)	0.127
Ethnicity	Non-Hispanic	134 (82)	110 (80)	24 (92)	
	Hispanic	30 (18)	28 (20)	25 (96)	0.170
Major Curve	Thoracic	126 (76)	101 (73)	25 (96)	
	Lumbar	39 (24)	38 (27)	1 (4)	0.010*
Duration of Treatment, days		727 ± 294 (266 - 1824)	701 ± 272 (266 - 1824)	863 ± 368 (403 - 1694)	0.009*
Wear Time, hours		17.3 ± 2.3 (12.9 - 23.1)	17.3 ± 2.4 (12.9 - 23.1)	17.8 ± 2.4 (12.9 - 23.1)	0.178
BMI		18.9 ± 3.5 (1.9 - 34.6)	18.9 ± 3.1 (14.2 - 34.58)	19 ± 4 (13 - 32)	0.981
Pre-brace Major Cobb		30 ± 6 (20 - 40)	29 ± 6 (20 - 40)	34 ± 5 (22 - 40)	0.001*
In-brace Major Cobb		18 ± 8 (1 - 39)	17 ± 7 (1 - 39)	26 ± 6 (8 - 36)	<0.001*
In-brace correction %		40 ± 22 (-14 - 95)	43 ± 22 (-15 - 95)	24 ± 15 (-13 - 64)	<0.001*
C-DAR		4.8 [3.8-5.6]	4.7[3.7-4.7]	5.5 [4.4-6.4]	0.030*
Post-brace Major Cobb		31 ± 12 (5 - 67)	27 ± 8 (5 - 44)	52±6 (45 - 67)	<0.001*

All numbers are presented as means ± SD, Medians [IQR] and Absolute values (%). * Indicates significant value

Disclosures

Megan Johnson: Is a consultant/advisor for Nuvasive

Amy McIntosh: Is a consultant/advisor for Nuvasive

Daniel Sucato: Royalties Globus Medical

Martin Gehrchen: Is a consultant/advisor for Stryker, and institutional grants from Nuvasive and Cerapedics

Benny Dahl: Is a consultant/advisor for Stryker and has received financial support from The Alfred Benzon Foundation

The remaining authors have no financial or non-financial interests to disclose.

None of the financial support mentioned has directly supported this study.