Ability of the SRS-Schwab Adult Spinal Deformity Classification to Identify Patients with Severe Disability

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Introduction

The Scoliosis Research Society (SRS)-Schwab Adult Spinal Deformity (ASD) Classification\textsuperscript{1} is regarded as an important communication tool for spine surgeons as it summarizes the complex pathology of ASD with four coronal curve types and three sagittal modifiers.

For each of the sagittal modifiers the cut-off values separating grade 0 from + are based on proposed predictions of severe disability defined by an Oswestry Disability Index (ODI) score of more than 40\textsuperscript{1,2}.

Purpose:
The aim of the present study was to evaluate the accuracy and predictive values of the SRS-Schwab classification modifiers regarding identification of patients with severe disability defined as an ODI score of at least 40.
SRS-Schwab ASD Classification

Coronal curve types (>30°)

- **T:** Thoracic only
  - (apical level of T9 or higher and lumbar curve < 30°)

- **T/L:** Thoracolumbar/Lumbar only
  - (apical level of T10 or lower and thoracic curve < 30°)

- **D:** Double curve
  - (T and TL/L curves >30°)

- **N:** No major coronal deformity
  - (all coronal curves < 30°)

Sagittal modifiers

- **PI-LL**
  - 0: <10°
  - +: 10–20°
  - ++: >20°

- **PT**
  - 0: <20°
  - +: 20–30°
  - ++: >30°

- **Global alignment (SVA)**
  - 0: <4 cm
  - +: 4–9.5 cm
  - ++: >9.5 cm

PI-LL = Pelvic incidence minus lumbar/Lordosis
PT = Pelvic tilt
SVA = Sagittal vertical axis
Methods

Between March 2013 and May 2014 all ASD patients from our tertiary outpatient clinic aged ≥18 years having sufficient long standing X-rays were prospectively invited to participate in the study by answering the ODI questionnaire by mail.

Patients having deformity surgery within 6 months prior to the study were excluded.

The radiographs were uploaded to an online imaging system and classified according to the SRS-Schwab classification by one of two investigators (authors DHN and CRD).
Methods

Diagnostic statistics were calculated for the threshold values:
- Pelvic incidence minus lumbar lordosis (PI-LL) = 10°
- Pelvic tilt (PT) = 20°
- Sagittal vertical axis (SVA) = 4cm

These thresholds constitute the cut-off values separating “normal” from “abnormal” SRS-Schwab sagittal modifier grades.

The ODI was dichotomized and a score of at least 40 was considered severe disability.
Results

A total of 286 (62%) of 460 eligible patients were included for analysis.

- 123 (43%) had PI-LL >10°
- 156 (55%) had PT >20°
- 148 (52%) had SVA >4cm

The prevalence of severe disability (ODI >40) was 45%
### Results

**Table 1. Accuracy and predictive values for the SRS-Schwab modifiers to identify patients with severe disability**

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Positive predictive value (PPV)</th>
<th>Negative predictive value (NPV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI-LL &gt;10°</td>
<td>65%</td>
<td>69%</td>
<td>60%</td>
<td>66%</td>
</tr>
<tr>
<td>PT &gt;20°</td>
<td>57%</td>
<td>54%</td>
<td>54%</td>
<td>65%</td>
</tr>
<tr>
<td>SVA &gt;4cm</td>
<td>65%</td>
<td>59%</td>
<td>57%</td>
<td>67%</td>
</tr>
<tr>
<td>At least one abnormal modifier</td>
<td>80%</td>
<td>40%</td>
<td>53%</td>
<td>70%</td>
</tr>
</tbody>
</table>

PI-LL = Pelvic incidence minus lumbar lordosis; PT = Pelvic tilt; SVA = Sagittal vertical axis
Discussion

Although the PI-LL modifier was the most sensitive predictor, an abnormal value only identified 65% of patients with severe disability and had a false positive rate of 31% (1- specificity)

When combining the modifiers, having at least one abnormal modifier increased the sensitivity/true positive rate to 80%, while the false positive rate increased to 60%

Considering that the modifier cut-offs were specifically designed to predict severe disability defined by an ODI score >40 we find the PPVs obtained (53-60%) weak and the NPVs (65-70%) moderate

These results indicate that sagittal spinal imbalance defined by the SRS-Schwab modifiers and cut-offs is not reliable in predicting severe disability in all ASD patients
Discussion

- It is our hypotheses that the classification would have higher predictive values
  1) if it was applied to a more defined population of ASD patients excluding patients with concomitant causes of disability and
  2) if the cut-offs were determined for different age groups

- The strengths of the current study were the prospective design and the consecutive cohort of ASD patients from a non-US tertiary referral institution

- One of the major limitations for this study was the moderate response rate to the questionnaire
References


Disclosures

Authors:  
Dennis Hallager Nielsen  (a) Globus Medical  
Lars V. Hansen  No disclosures  
Casper R. Dragsted  No disclosures  
Martin Gehrchen  (a) Globus Medical, (a) Medtronic  
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