

Adult spinal deformity surgical decision-making score -Development and internal validation-

Takashi Fujishiro^{1,2} • Louis Boissière² • Derek Thomas Cawley² • Daniel Larrieu² • Olivier Gille² • Jean-Marc Vital² • Ferran Pellisé³ • Francisco Javier Sanchez Pérez-Grueso⁴ • Frank Kleinstück⁵ • Emre Acaroglu⁶ • Ahmet Alanay⁷ • Ibrahim Obied²
On behalf of European Spine Study Group, ESSG

1 Department of Orthopedic Surgery, Osaka Medical College, Osaka, Japan

2 L'Institut de la Colonne Vertébrale, Bordeaux University Hospital, Bordeaux, France

3 Spine Surgery Unit, Hospital Universitario Val Hebron, Barcelona, Spain

4 Spine Surgery Unit, Hospital Universitario La Paz, Madrid, Spain

5 Spine Center, Schulthess Klinik, Zürich, Switzerland

6 Ankara Spine Center, Ankara, Turkey

7 Spine Surgery Unit, Acibadem Maslak Hospital, Istanbul, Turkey



CHU
Hôpitaux de
Bordeaux

Purpose

To develop and validate the scoring system
to guide the decision-making process
for ASD patients

Patients cohort

Retrospective review with prospectively collected data

Inclusion criteria

- ≥ 18 years
- Meeting one of the following radiographic parameters
 - Any coronal Cobb angle $\geq 20^\circ$
 - Sagittal vertical axis (SVA) ≥ 5 cm
 - Thoracic kyphosis (TK) $\geq 60^\circ$
 - Pelvic tilt (PT) $\geq 25^\circ$

Exclusion criteria

- Patients with history of
 - Congenital scoliosis
 - Neuromuscular disease
 - Scheuermann disease
 - Post-traumatic deformity

Additional inclusion

The cases with complete data of the following variables

Independent variables to analyse

Demographics

- Age
- BMI
- Previous spine surgery
- Charlson comorbidity index
- NRS back pain
- NRS leg pain

HRQOL measures

- SRS-22
 - Function
 - Pain
 - Self-image

Radiographic measures

-Coronal plane-

- Coronal Cobb angle

Radiographic measures

-Sagittal plane-

- PI-LL mismatch
- Relative Spinopelvic Alignment (RSA)

(Yilgor. *JBJS*, 2017)

Analytic procedure

- Patients were divided into a derivation set (80%) and a validation set (20%).
 - The decision-making score was developed separately in younger and older patients (≤ 40 years, and > 40 years).

Step 1: Selecting the factors incorporating into the classification system

- The factors with P -value < 0.15 in univariate analyses were included in multivariate analyses.
- The factors, which were incorporated into the classification system, were identified by multivariate logistic regression with a forward stepwise procedure.

Step 2: Development of the classification system

- Multinomial logistic regression analyses were performed, and the respective point scores were assigned using the parameter estimates.
- The estimated surgical rate was calculated with the equation given by the fitted logistic regression.

Step 3

- The score was subsequently validated in the validation set.

-Younger age group (≤ 40 years)-

316 patients (69.6%)

110 surgical and 206 nonsurgical

Average age: 26.7 years

79.7% female

Results

Parameter estimates using multinominal logistic regression and assigned point scores

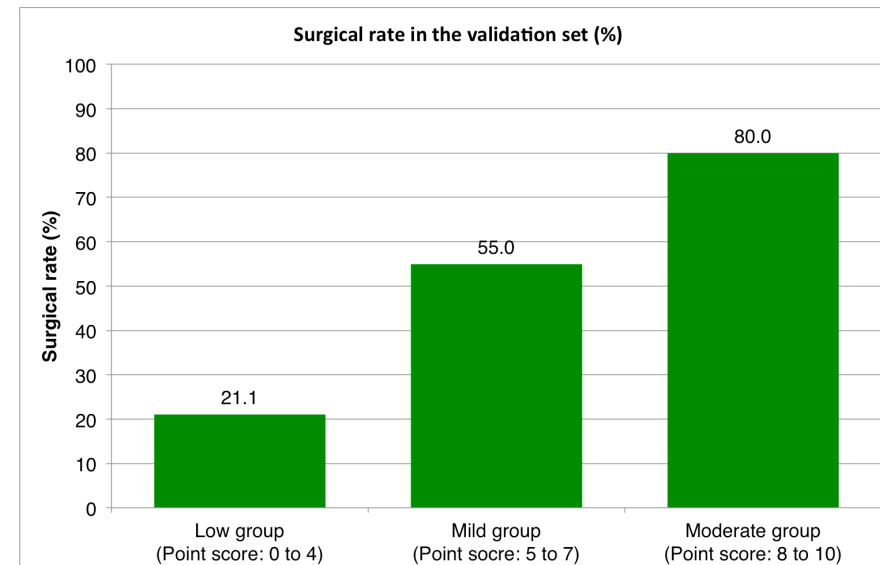
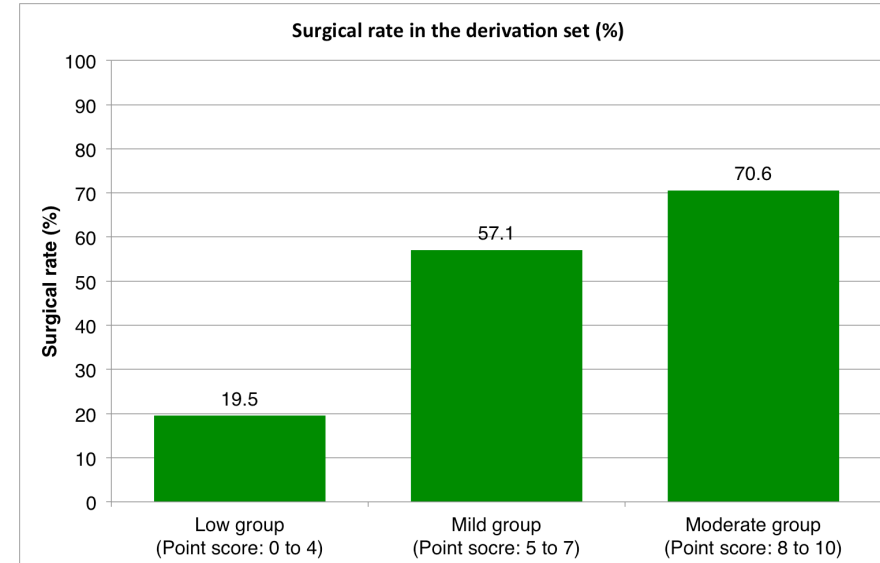
Parameter	B (SE)	OR (95% CI)	P	Score
SRS-22 SI	≥3.5	-	-	0
	2.5 to 3.5	0.523 (0.169)	2.8 (1.5-5.6)	0.002
	<2.5	0.961 (0.190)	6.8 (3.3-14.7)	<0.001
Corona Cobb angle	≤40	-	-	0
	40 to 50	0.239 (0.196)	1.6 (0.7-3.5)	0.222
	50 to 60	0.514 (0.190)	2.8 (1.3-6.0)	0.007
	>60	0.795 (0.192)	4.9 (2.3-10.6)	<0.001
PI-LL	≤15	-	-	0
	>15	0.222 (0.133)	1.6 (0.9-2.6)	0.093
RSA	≤5	-	-	0
	>5	0.516 (0.159)	2.8 (1.5-5.3)	0.001

Scores were assigned by rounding the average of two smallest parameter estimates (B) to the nearest integer.

Surgical rate in the validation set

Point score	Derivation set		Validation set	
	Observed surgical rate (%)	Estimated surgical rate	Surgical rate (%)	
0	6.7 (1/15)	Low (0-33.3%)	0 (0/9)	21.1 (8/38)
1	9.4 (3/32)		25.0 (1/4)	
2	11.8 (4/34)		12.5 (1/8)	
3	25.0 (10/40)		25.0 (3/12)	
4	34.2 (13/38)	Moderate (33.4-66.6%)	60.0 (3/5)	55.0 (11/20)
5	55.2 (16/29)		44.4 (4/9)	
6	55.6 (15/27)		71.4 (5/7)	
7	61.9 (13/21)	High (66.7-100%)	50.0 (2/4)	80.0 (4/5)
8	62.5 (5/8)		100 (1/1)	
9	66.7 (2/3)		100 (3/3)	
10	83.3 (5/6)		0 (0/1)	

AUC: 0.789 (95% CI: 0.655-0.880); $P < 0.001$
 Comparable to the estimated surgical rate



-Older age group (>40 years)-

702 patients (76.9%)

378 surgical and 324 nonsurgical

Average age: 63.3 years

83.9% female

Parameter estimates and assigned point scores

	Parameter	B (SE)	OR (95% CI)	P	Score
NRS leg pain	≤1	-	-	-	0
	2 to 5	0.336 (0.104)	3.7 (2.5-5.3)	0.001	1
	≥6	0.651 (0.094)	3.0 (1.9-4.0)	<0.001	2
SRS-22 SI	≥3.5	-	-	-	0
	3 to 3.5	0.333 (0.143)	1.9 (1.1-3.5)	0.018	1
	2.5 to 3	0.669 (0.148)	3.8 (2.2-6.9)	<0.001	2
	<2.5	0.971 (0.141)	7.0 (4.2-11.9)	<0.001	3
SRS-22 Pain	≥3.5	-	-	-	0
	3 to 3.5	0.376 (0.128)	2.1 (1.3-3.5)	0.003	1
	<3	0.735 (0.120)	4.4 (2.7-7.1)	<0.001	2
Corona Cobb angle	>40	-	-	-	0
	20 to 40	0.360 (0.085)	2.1 (1.5-2.9)	0.001	1
	≤20	1.094 (0.136)	8.9 (5.3-15.6)	<0.001	3
RSA	<5	-	-	-	0
	5 to 25	0.345 (0.104)	2.0 (1.1-3.0)	0.009	1
	≥25	0.724 (0.122)	4.3 (2.7-6.9)	<0.001	2

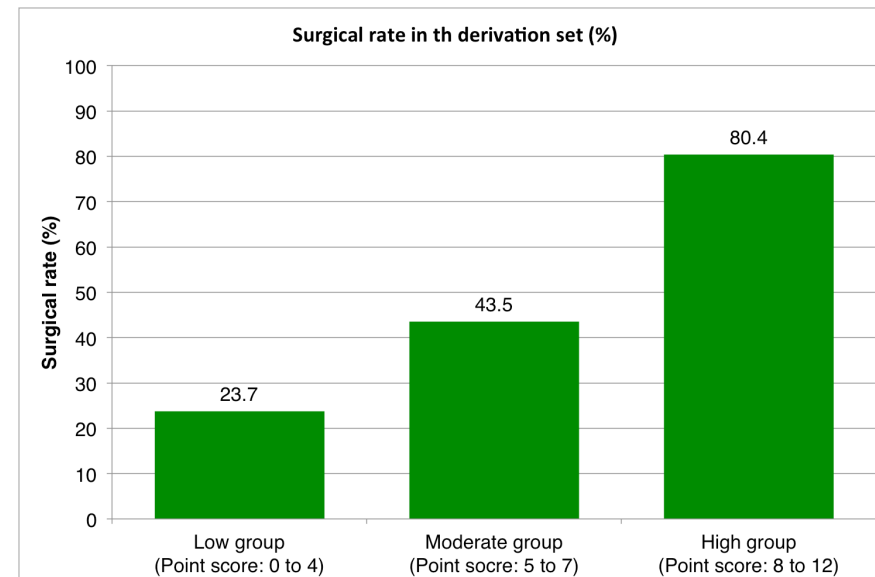
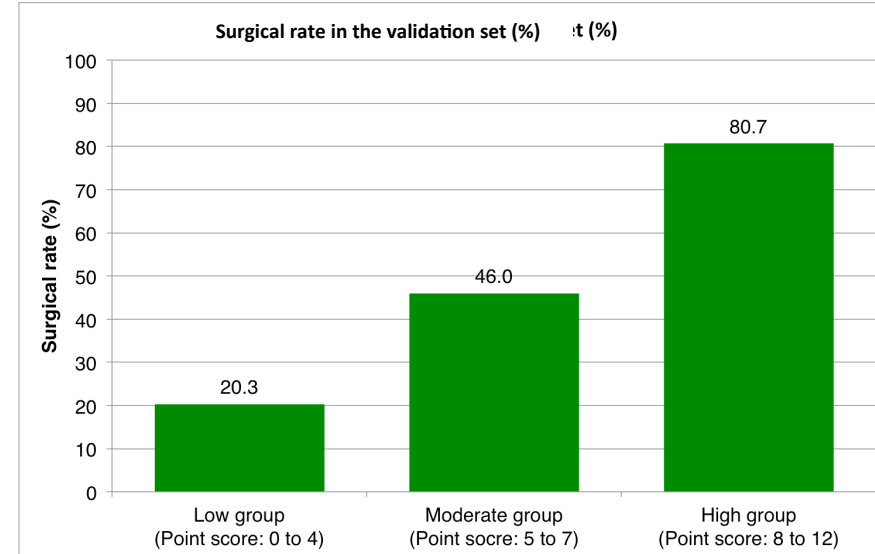
Scores were assigned by rounding the average of five smallest parameter estimates (B) to the nearest integer.

Surgical rate in the validation set

Point score	Derivation set		Validation set	
	Observed surgical rate (%)	Estimated surgical rate	Surgical rate (%)	
0	0 (0/4)	Low (0-33.3%)	0 (0/3)	23.7 (9/38)
1	25.0 (4/16)		50.0 (1/2)	
2	10.7 (3/28)		27.3 (2/11)	
3	25.0 (8/32)		0 (0/9)	
4	23.7 (9/38)		38.5 (5/13)	
5	31.5 (17/54)	Moderate (33.4-66.6%)	23.1 (3/13)	43.5 (20/46)
6	44.2 (38/86)		44.4 (8/18)	
7	57.0 (49/86)		60.0 (9/15)	
8	72.2 (57/79)		63.2 (12/19)	
9	77.8 (49/63)	High (66.7-100%)	89.5 (17/19)	80.4 (45/56)
10	91.9 (34/37)		81.8 (9/11)	
11	94.7 (18/19)		100 (3/3)	
12	90.0 (18/20)		100 (4/4)	

AUC: 0.797 (95% CI: 0.714-0.861); $P < 0.001$

Comparable to the estimated surgical rate



Disclosure declaration

Cawley DT: Irish Orthopaedic Association, Irish Institute of Trauma and Orthopaedic Surgery, Société Française de Chirurgie Orthopédique et Traumatologique; Pellise F: Depuy Synthes, K2M; Perez-Grueso F.S: Depuy Synthes, K2M; Acaroglu E: Fondation Cotrel, Deputy Synthes, Medtronic, Consultant: Medtronic, AOSpine; Alanay A; Depuy Synthes Consultant: Depuy Spine, Stryker, Medtronic; Obeid I: Depuy Synthes; ESSG: Depuy Synthes.