Introduction
The Global Alignment and Proportion (GAP) score is a comprehensive method for defining spinal sagittal alignment, showing promising accuracy in predicting mechanical complications in adult spinal deformity (ASD) surgery (Yilgor, 2017, JBJS Am). The method is currently used to support surgical alignment planning, but it requires further validation. Postoperative mechanical failure in ASD is mainly caused by excessive forces. The investigation of spinal loads in relation to postoperative sagittal alignment may provide biomechanical support for the validity of the GAP method.

Purpose of the study
The aim of this combined clinical and computational study was to estimate proximal adjacent segment loads in patients in different GAP categories after ASD surgery. We hypothesised that higher GAP scores are related to higher loads on the adjacent segment, indicative of potential mechanical failure.

Materials and Methods
A previously validated musculoskeletal (AnyBody) model of the thoracolumbar spine with
fusion (Ignasiak, 2018, ESJ) was used to simulate postoperative spinal biomechanics. The model was modified to represent patient-specific sagittal alignment, based on measured pelvic incidence, sacral slope, global tilt, L1-S1 and L4-S1 lordoses, T10-L2, T5-T12 and T2-T12 kyphoses angles, with the assumption of a horizontal gaze. Fused levels were modelled by introducing rigid constraints between spinal segments. Compression and shear forces at the proximal adjacent segment were predicted for erect standing for individual patients using their postoperative alignment measurements and fusion details. In total, 207 patients were analysed (157 female, 50 male; age 52.1±19.1 years; follow-up 28.8±8.2 months, UIV=T2-L2, LIV=T12-Sacrum), grouped into three categories based on their GAP score: proportioned (GAP-P), N=71; moderately disproportioned (GAP-MD), N=77; and severely disproportioned (GAP-SD), N=60.

Results

The mean predicted proximal segment compression forces were 267±143 N for GAP-P, 316±141 N for GAP-MD, and 382±184 N for GAP-SD (Figure 1), with statistically significant differences found between GAP-P and GAP-SD (p<0.001) and GAP-MD and GAP-SD (p=0.044). The shear forces were not statistically different between the groups (23±44N, 16±42N and 28±40N, respectively).

Conclusion

Results suggest patients with postoperative alignment rated with higher GAP scores tend to have greater compression forces at the adjacent segment. The simulated forces show high variability in all GAP categories, indicating the need for multivariate analyses in future. To our knowledge, this is the first study of proximal junctional loads estimated for real patient-specific thoracolumbar alignments, analysing a large patient cohort. The results generally support the validity of the GAP score, and further analyses, also with more comprehensive activity simulations, may provide insights into the causes of mechanical complications after ASD.

Figure 1: Computed compressive forces for the GAP categories: proportioned (GAP-P), moderately disproportioned (GAP-MD) and severely disproportioned (GAP-SD)

Disclosures:

Use of Predictive Machine Learning Models at the Population Level Have the Potential to Save Cost by Directing Economic Resources to Those Likely to Improve Most: A Simulation Analysis Stratified by Risk in Largest Combined US/European ASD Registry

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Introduction
Increasing healthcare costs present significant economic burden, especially for management of complex diseases, such as adult spinal deformity (ASD). By using robust machine learning models to preoperatively predict optimal surgical candidates, economic resources can be directed towards patients deemed most likely to benefit from surgical correction before incurring treatment costs. The objective of this study is to assess whether predictive models can be used to simulate optimal surgical candidates using the largest combined ASD database of US and Europe.

Methods
A prospective cohort of patients treated at 17 ASD specialty centers in US and Europe from 2008-2016 was queried. Clinical outcomes including minimum clinically important difference (MCID), complication, and reoperation rates were predicted using gradient boosting classification. Thresholds for expected outcome rates were applied to simulate patients who met specific criteria for surgical utilization. Resulting percentages were then applied to public health data from both the United States (US) and Spain.

Results
Our cohort of 1,245 patients with 195 variables was used to train a predictive model (complications AUC = 0.68, MCID AUC = 0.70). Criteria of <20% expected complication rate and >50% chance of MCID corresponded to 33% of patients qualifying for surgery. Using $120,000 as average hospital cost for ASD correction and applying simulated surgical utilization rate, this translated to total hospital savings of $541 million in the US (2013) in direct cost. In Spain (2015) only 244 patients out of 740 would have received surgery, reducing surgery rate per 100,000 adults from 1.64 to 0.54.

Conclusions
Accurate prognostic models that predict clinical outcomes for potential ASD patients can be used to guide clinical decision making by preoperatively identifying patients who would benefit most from surgery prior to incurring the expense of their intervention. Given the large number of surgeries conducted around the world, better candidate selection can result in significant cost savings and maximize post-op outcomes.

Disclosures:
author 1: grants/research support=DePuy Spine Synthes, Medtronic, consultant=Medtronic, Stryker, Nuvasive; author 2: none; author 3: grants/research support=Horizon 2020, EIT Health, European Commission; author 4: none; author 5: grants/research support=DePuy Synthes/ISSGF, AO Spine, NREF, consultant=Zimmer Biomet, Nuvasive, Stryker, Cerapedics, Astura, Carlsmed, stock/shareholder=Alphatec, royalties=Zimmer Biomet, Nuvasive; author 6: grants/research support=ISSG, SSSF; author 7: grants/research support=Depuy Synthes, Medtronic, consultant=Globus; author 8: grants/research support=DePuy
INTRODUCTION

There is still no evidence of whether congenital deformity remains an issue after the pediatric age. No reports have been found in the literature analyzing this cohort of patients. The aim of the study was to define the characteristics and concerns of adult congenital deformity (ACD) patients, and to establish their motivations for surgical intervention.

METHODS

We conducted a retrospective comparative analysis of data collected prospectively in an adult spinal deformity multicenter database. Only ACD patients were selected from the registry. Demographic and radiographic data, as well as PROMs were assessed to describe the whole sample. Conservative (C) vs Surgical (S) cohorts were compared using Student-t test, Chi² and Mann Whitney-U.

RESULTS

52 patients were found and included. They were young adults (mean age 37.7 yrs), mostly female (71%). 60% had single hemivertebrae (HV), 35% multiple HV, and 5% segmentation defects. 75% had mainly coronal deformity (Cobb 57º±32), 25% suffered sagittal deformity (TL kyphosis 19.8º±33, GT 20.3º±15 and SVA 17.5 mm±51). 32.7% had undergone previous surgery.

Mean ODI was 29.6%±17; mean SRS-22 Total score 3.23±0.8; worth noticed was self image scoring (SRS-22 SI=2.83±0.9) and physical function (SF-36 PCS=40.87±11). 30 were treated conservatively (C) while 22 underwent surgery (S). No differences were found regarding: age, type or location of the deformity, comorbidities, or radiographic parameters (Table). Operated patients had worse COMI-back scores (C:3.78±2.4 vs S:6.7±2.4;P=0.004); worse SRS-22 self image (C:3.03±0.9 vs S:2.47±0.98;P=0.047), and SRS-22 Total scores (C:3.43±0.8 vs S:2.88±0.78;P=0.01); worse SF-36 PCS (C:43.31±10.8 vs S:36.7±10.4;P=0.048), and worse SF-36 physical role, function, and social function, with mean values under 38 points (range=33-38). In both SF-36 physical and SRS-22 self-image scores, differences between groups were higher than the MCID.

CONCLUSIONS

Congenital deformities are still a concern among the adult spinal deformity population. Patients were mainly female young adults, with formation defects (hemivertebrae). 1/3 had undergone previous surgery, were worried about their image and presented some degree of functional impairment. These last two factors were the essential drivers for surgery, rather
than the radiographic deformity itself. 40% of them accept surgery searching to improve their quality of life.

<table>
<thead>
<tr>
<th>Adult patients with congenital deformity. Comparison between those treated conservatively and those undergoing surgery</th>
</tr>
</thead>
</table>
| Parametrics: Mean ± Standard deviation
Non parametrics: Median (Interquartile range)                                                                |

<table>
<thead>
<tr>
<th>Preoperative data</th>
<th>Surgical</th>
<th>Conservative</th>
<th>Student-t/ Chi2</th>
<th>Mann-Whitney-U</th>
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<tr>
<td>Demographic parameters</td>
<td></td>
<td></td>
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<tr>
<td>Age (yrs)</td>
<td>36.45±10.6</td>
<td>38.6±14.2</td>
<td>0.55</td>
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<tr>
<td>Gender</td>
<td>Female 86.4%</td>
<td>F 60%</td>
<td>0.038*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Male 13.6%</td>
<td>M 40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td>151.7±10.1</td>
<td>157.9±11.6</td>
<td>0.07</td>
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<td>Weight (Kg)</td>
<td>59.2±14.5</td>
<td>65.9±16.1</td>
<td>0.15</td>
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<tr>
<td>BMI</td>
<td>25.9±4.8</td>
<td>26.4±5.2</td>
<td>0.76</td>
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<td>Comorbidities</td>
<td>Si 54.5%</td>
<td>Si 33.3%</td>
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<tr>
<td>Previous surgery</td>
<td>Si 45.5%</td>
<td>Si 23.3%</td>
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<td>Deformity type 1</td>
<td>Scoli 77.3%</td>
<td>Scoli 73.3%</td>
<td>0.746</td>
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<tr>
<td></td>
<td>Kyphosis 22.7%</td>
<td>Kyphosis 26.7%</td>
<td></td>
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<tr>
<td>Deformity type 2</td>
<td>simple HV 64%</td>
<td>simple HV 56%</td>
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<tr>
<td></td>
<td>multiple HV 30%</td>
<td>multiple HV 39%</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Seg defects 6%</td>
<td>Seg defects 4%</td>
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<td></td>
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<tr>
<td>Deformity Location</td>
<td>PT- 4.5%</td>
<td>PT- 16.7%</td>
<td>0.166</td>
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<tr>
<td></td>
<td>MT- 36.4%</td>
<td>MT- 46.7%</td>
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<tr>
<td></td>
<td>TL- 31.8%</td>
<td>TL- 10%</td>
<td></td>
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<tr>
<td></td>
<td>L- 27.3%</td>
<td>L- 26.7%</td>
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<td>Radiographic parameters</td>
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<tr>
<td>Main Cobb (º)</td>
<td>59.3±33.4</td>
<td>64.8±27.1</td>
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<td>Coronal balance (mm)</td>
<td>-9.3±36.9</td>
<td>-0.8±26.3</td>
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<td>SVA (mm)</td>
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<td>19.6±56.1</td>
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<td>Global Tilt (º)</td>
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<td>T10-L2 kyphosis (º)</td>
<td>13.7±31.2</td>
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<td>PROMs</td>
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<tr>
<td>NRS Back pain</td>
<td>5.2±3.2</td>
<td>5.6±3</td>
<td>0.61</td>
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<tr>
<td>NRS Leg pain</td>
<td>3.6±3.2</td>
<td>2.6±3.3</td>
<td>0.233</td>
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<td></td>
<td>4(0-6)</td>
<td>0.5(0-4.25)</td>
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<tr>
<td>COMI Back</td>
<td>6.7±2.4</td>
<td>3.78±2.4</td>
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<td>COMI Neck</td>
<td>3.3±2.1</td>
<td>2.6±2.4</td>
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<td>ODI (%)</td>
<td>34.6±19.2</td>
<td>26.9±15.9</td>
<td>0.15</td>
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<td>SRS-22</td>
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<tr>
<td>SRS-22 Function</td>
<td>3.12±0.8</td>
<td>3.57±1.1</td>
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<td>3(2.5-4)</td>
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<tr>
<td>SRS-22 Pain</td>
<td>2.9±1.2</td>
<td>3.13±1</td>
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<td>SRS-22 Self-image</td>
<td>2.47±0.9</td>
<td>3.03±0.9</td>
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<td>2(2-3)</td>
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<tr>
<td>SRS-22 Mental health</td>
<td>2.94±0.97</td>
<td>3.47±0.8</td>
<td>0.083</td>
<td></td>
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<td></td>
<td>3(2-4)</td>
<td>3.5(3-4)</td>
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<tr>
<td>SRS-22 Satisfaction</td>
<td>3.25±1.3</td>
<td>3.6±1</td>
<td>0.533</td>
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<td>3.5(2.25-4)</td>
<td>4(3-4)</td>
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<tr>
<td>SRS-22 Subtotal</td>
<td>2.82±0.7</td>
<td>3.37±0.8</td>
<td>0.020*</td>
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<td>3(2-3)</td>
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<tr>
<td>SRS-22 Total</td>
<td>2.88±0.7</td>
<td>3.43±0.8</td>
<td>0.014*</td>
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<td>3(2-3)</td>
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SURGICAL CORRECTION OF ADULT SPINAL DEFORMITY IN ACCORDANCE TO THE ROUSSOULY CLASSIFICATION: EFFECT ON POSTOPERATIVE MECHANICAL COMPLICATIONS

Tanvir Johanning Bari, Lars Valentin Hansen, Martin Gehrchen
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Introduction
Surgical correction of Adult Spinal Deformity (ASD) is both challenging and complex. The risk of postoperative complications is considerable, especially mechanical complications requiring revision surgery. Attention has been directed toward defining alignment targets in attempts to minimize these risks. The Roussouly Classification of normal sagittal variation has, to our knowledge, not been assessed in this context.

Purpose
To assess if correction of ASD in accordance to the Roussouly Classification can decrease postoperative mechanical complications.

Materials and Methods
All patients undergoing ASD surgery from 2013-2016 were retrospectively screened for inclusion at a single tertiary institute for spine surgery. Using full-spine pre- and postoperative radiographs, successful restoration of Roussouly spine shape was retrospectively assessed, and patients were classified as either „restored“ or „non-restored“. Electronic medical records were used to obtain demographic and surgical data in addition to events of postoperative complications. Cumulative incidence of revision surgery due to mechanical failure was estimated using the Aalen-Johansen estimator, with death as competing risk. A multivariable proportional odds model was used to estimate the effect of the Roussouly algorithm on revision surgery due to mechanical failure. The model was adjusted for 3-column osteotomy, age, sex, number of instrumented levels, correction in lumbar lordosis, comorbidity, and postoperative pelvic incidence minus lumbar lordosis, pelvic tilt and sagittal vertical axis.

Results
We identified a complete and consecutive cohort of 233 patients with a mean age of 58 years.
Patients were followed for a mean of 36 (±14) months and 45% had a history of previous surgery. Out of 233 patients, 147 (63%) were classified as “restored” according to the Roussouly Classification. Mechanical complications were recorded in 43% of patients in any time in follow-up, and 2-year cumulative incidence of revision surgery was 28%. Results of the proportional odds model demonstrated an almost 5-fold increased odds of revision due to mechanical failure in the “non-restored” group (p=0.036).

Conclusion
Surgical correction of ASD in accordance to the normal spine shapes of the Roussouly Classification was correlated to a marked and significant decrease in the risk of revision surgery due to mechanical failure. We suggest further validation before clinical implementation.

Disclosures:
author 1: none; author 2: none; author 3: grants/research support=K2M/Stryker, Medtronic

48 QUALITY METRICS IN ADULT SPINAL DEFORMITY (ASD) SURGERY OVER THE LAST DECADE. A COMBINED ANALYSIS OF THE LARGEST PROSPECTIVE MULTICENTRIC DATASETS

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Introduction: The reported rate of complications and cost of Adult Spinal Deformity surgery, associated with an exponential increase in the number of surgeries, cause alarm among healthcare payers and providers worldwide. The aim of this study was to analyze conjointly, the largest prospective available ASD datasets (5 countries, 17 sites, 57 surgeons, >75% 2years follow up) to define trends in quality of care indicators (Complications, Reinterventions, HRQL) since 2010.

Methods:
Patients operated between Jan 2010 and Dec2016 with more than 2years of follow-up were included in the study. Demographic, surgical, radiological and HRQL (ODI, SF36, SRS22) data obtained preoperatively, at 3, 6, 12 and 24 months after surgery were evaluated. Trends and changes in indicators were analyzed using local regression (LOESS) and adjusted Odds Ratio (OR).

Results:
Of the 2286 patients included in the 2 registries, 1520 underwent surgery between 2010-2016. 1151 (75.7%), operated in 17 centers (5 countries, 54 surgeons), met inclusion criteria. Patient recruitment increased progressively (2010-11 vs 2015-16: OR 1.64 p <0.01), while baseline clinical characteristics (age, ASA, HRQL scores, sagittal deformity) did not change. Since 2010 there is a sustained reduction in major (M) and minor (m) postoperative complications, observed at 90 days (OR M0.54; m0.48; p <0.01), 1 year (OR M0.59; m0.59 p <0.01) and 2 years of follow-up (OR M0.55; m0.66 p <0.01) as well as the two-year reintervention rate (OR 0.51 p <0.01). Simultaneously, there is a slight improvement in the
correction of sagittal deformity (PI-LL) (OR 1.11, p = 0.19) and greater gain in quality of life (ODI 26% vs 40%, p = 0.02 / SRS22 SI OR 1.16 p = 0.13), associated with a progressive reduction of surgical aggressiveness (N fused segments OR 0.81 p <0.01, % pelvic fixation OR 0.66 p <0.01, % 3CO OR 0.63 p <0.01).

Conclusions:
This international longitudinal conjoined effort shows a progressive and robust global improvement in ASD surgery quality metrics over the last decade. Surgical complications and reoperations have been progressively reduced by 50%, while improvement in disability increased and correction rates were maintained, in patients with similar baseline characteristics. Quality-metrics trends show we are facing the ASD epidemic more efficiently.

Disclosures:
PREDICTOR OF MECHANICAL FAILURES IN ADULT SPINAL DEFORMITY SURGERY WITH LONG LUMBOPELVIC FIXATIONS


Spine Surgery Unit, Dept of Orthopedic Surgery and Traumatology, Vall d’Hebron University Hospital, Barcelona - Spain

Introduction:
Adult Spinal Deformity (ASD) patients with long lumbopelvic fixation are especially vulnerable to poor and rigid postoperative alignment. Their compensatory capacity is mainly limited to the remaining free lumbar segments and pelvic retroversion, which is in turn limited by pelvic incidence. The objective of this study is to analyse the incidence of mechanical complications (including pseudoarthrosis and PJK) in ASD surgery as well as its risk factors with special emphasis on spinopelvic morphology.

Methods:
A retrospective analysis of a prospective international and multicentre ASD database was performed. All patients with ASD; with more than 2 years of follow-up, older than 55 years, and with UIV at L2 and LIV at pelvis were included in the analysis. A bivariate analysis was performed using demographic, radiological (baseline and first standing X-Ray), surgical and functional parameters. The potential risk factors identified were then introduced in a linear stepwise regression model.

Results:
261 patients met the inclusion criteria (age 67, 82% women). 47% (126/261) had a mechanical failure. This was much higher than in patients not meeting instrumentation criteria (22% p 0.001) (Kaplan-Meier Curve). Bivariate analysis identified several potential risk factors such as: BMI, Rod (Type, Number and diameter), postoperative bracing and the following radiological parameters: SVA; T1-Sagittal Tilt; Lumbar Lordosis; PI-LL, GAP parameters (Global Score, RPV, RLL, LDI), Thacolumbar curve; Roussouly postoperative type (Types 1 and 2). Surgical parameters such as UIV, 3-column osteotomies or addition of anterior approach were not found to be significant. The independent risk factors finally retained by the linear regression model were: use of double rods (OR 3.2 protective), Roussouly type (OR 4 for Type 1-2 Vs. Type 4) and SVA.

Conclusion:
The restoration of personalised sagittal balance is extremely important in rigid lumbopelvic constructs, especially in patients with low pelvic incidence whose compensatory capacity is constitutionally reduced. We could identify different potential risk factors for mechanical
complications including BMI, rod characteristics and sagittal alignment. UIV vertebra, the use of osteotomies or addition of an anterior approach were not significant. Low PI increases risk independently.

Disclosures:

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RADIOGRAPHIC OUTCOMES AND COMPLICATIONS AFTER L4 OR L5 PEDICLE SUBTRACTION OSTEOTOMY FOR FIXED SAGITTAL MALALIGNMENT IN 102 ADULT SPINAL DEFORMITY PATIENTS WITH A MINIMUM 2 YEARS FOLLOW-UP
Anouar Bourghli, Louis Boissiere, Thomas Chevillotte, Maxime Huneidi, Clement Silvestre, Kariman Abelin-Genevois, Pierre Grobost, Javier Pizones, Pierre Roussouly, Ibrahim Obeid
Clinique du Dos, Bordeaux-Bruges, France

Background: Pedicle subtraction osteotomy (PSO) has been widely described as a good option for fixed sagittal malalignment in adult spinal deformities (ASD) but different mechanical complications have been described in the postoperative period such as proximal junctional kyphosis (PJK).

Purpose: The objective of this retrospective study was to provide the radiographic outcomes and complications for PSO performed at the low lumbar spine i.e L4 or L5 for ASD patients with fixed sagittal malalignment.

Materials and methods: ASD patients who underwent L4 or L5 PSO (consisting of Schwab grade 3 or grade 4 osteotomy) with a minimum 2 years follow-up were included. Preoperative
and postoperative radiographs, and complications were collected. Radiographic analysis included lumbar lordosis (LL), pelvic incidence (PI), pelvic tilt (PT), thoracic kyphosis (TK), sagittal vertical axis (SVA), and global tilt (GT) on standing long-cassette radiographs.

Results: A total of 102 patients were included in this study, with 76 females and 26 males. 66 patients underwent PSO at L4 and 36 patients at L5. Mean age at the index surgery was 59 years, with a mean follow-up period of 49 months. The mean number of fused segments was 8. Mean operative time and surgical bleeding were 207 minutes and 1800 mL respectively. From preoperatively to the final follow-up, significant improvements occurred in LL (from -31° to 52°), SVA (from 13 cm to 5 cm), and GT (from 44° to 27°) (all, p<0.05). Six patients had transient neurological deficits, and three patients had persistent neurological deficit. 12 patients underwent revision for PJK (6), pseudarthrosis (4), epidural hematoma (1), or deep surgical site infection (1). No PJK was observed in any of the patients with L5 PSO.

Conclusion: PSO at the level of L4 or L5 is a safe and effective technique to correct fixed sagittal malalignment in ASD patients. In comparison to L4 PSO, L5 PSO patients did not show PJK as a mechanical complication. Distal lumbar PSO at the level of L5 may be the solution to the proximal junctional kyphosis complication.

Disclosures:

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EFFICACY OF ADULT SPINAL DEFORMITY SURGICAL DECISION MAKING (ASD-SDM) SCORE IN PATIENTS OVER 40 YEARS AS AN INDICATION FOR SURGICAL MANAGEMENT
Sreenath Jakinapally, Louis Boissiere, Ibrahim Obeid
Dept of Orthopaedics, CHU Pellegrin, Bordeaux, France

Introduction: The recently developed Adult spinal deformity surgical decision making (ASD-SDM) score is the only scheme that is specific to the decision-making process for ASD. The ASD-SDM score was developed separately for Adult spinal deformity (ASD) populations aged above and below 40 years, and it consists of baseline symptomatology, Health related quality of life (HRQoL) measures, and radiographic parameters. The purpose of this study is to investigate whether ASD-SDM score is a proper surgical indication.

Purpose of the study: If the ASD-SDM score used as an Indication for Surgical management in patients over 40 years is correlated to patient improvement after surgery.

Materials and Methods: A multi-center prospective database was retrospectively reviewed in patients > 40 years. Analyzed variables were baseline symptomatology, HRQOL measures, major clinical and radiographic values in addition to demographic data of ASD patients, complications and follow up (min 2 yrs). Operated and non-operated patients were compared in low surgical indication (LSI) and high surgical indication (HSI) groups.

Results: A total of 913 patients was enrolled in this cohort, and 750 (82.1%) met the inclusion criteria. Included were 118 males and 632 females, with a mean age of 63.5 yrs. A total of 410 cases (54.7%) selected surgical management. In LSI group (score 0-4) at the baseline visit, non-operated patients have better HRQoL values, but at the last visit, operated patients have better cobb angle and improved HRQoL values to the level of non operated
patients. (p<0.01, OR 1.91). In the HSI group (score 8-12) the baseline values are similar but at the last visit operated patients have significant improvement of NRS back and leg pain, HRQoL with p< 0.001, p<0.001 and OR 1.96 respectively compared to no improvement in non-operative patients. The patients with minor complications have three times improvement compared to patients with major complications.

Conclusion: The Adult Spinal Deformity Surgical Decision-Making score is highly effective when used as an indication for surgical management with high correlation to patient improvement and satisfaction after surgery.

Disclosures:
author 1: none; author 2: consultant=Spineart, Medicrea; author 3: grants/research support=DePuy Synthes, consultant=DePuy Synthes, Medtronic, royalties=Clariance alphatec spineart

52 BACKPAIN PROFILE AND PSYCHOSOCIAL RELATED FACTORS IN ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS
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Introduction:
The hypothesis that back pain (BP) in AIS patients is caused by the deformity is not supported by the evidence. BP in adolescents is highly prevalent (39%; 90% reporting negligible disability) and has been related with psychosocial factors. The role of these factors in AIS has not been fully analyzed. Our study aims to identify psychosocial factors (depression, anxiety, family dysfunction) associated with BP in adolescents with AIS.

Methods: 207 AIS non-operated patients who met inclusion criteria (12-18 years; Cobb>30°) were prospectively enrolled. They were asked about the location and intensity of BP. Pain was quantified with a numerical rating scale (NRS) and the SRS22 pain domain. In addition, the social and family environment was assessed by means of the APGAR questionnaire. The HAD questionnaire was used to detect anxiety/depression. COMI questionnaire item 7 was used to assess the impact of pain on school and/or work activities.

Results: Mean age was 14.8 year, 83.1% females. Mean main Cobb 44.9° (range 30° to 88°). 43.7% were under observation, 39.3% were braced and 17% were scheduled for surgery. BP was located in mid-line low back (32.5%), right trapezoid (20.7%) and mid-line (22%). Mean BP on NRS was 2.2 with 29.1% reporting pain >3 while SRS22 pain mean was 3.4 with 52% of the patients scoring < 3.8. Both figures represent a non-acceptable symptomatic state. However, 91.1% reported not missing a single day of their daily activities. HAD-anxiety scale mean was 5.04 with 21.4% showing abnormal levels of anxiety; HAD-depression scale mean was 2.1 with only 2.4% showing abnormal levels. 13.2% reported some type of family dysfunction. Anxiety was significantly correlated with back pain (r:0.4;p<0.05).

Conclusions: Even though mean BP intensity scores in adolescent AIS patients is not clinically relevant, 30 to 50% of them report significant BP. One in five patients showed traces of anxiety which was significantly correlated with BP; however, the presence of depression was almost negligible.

Disclosures:
author 1: grants/research support=Nuvasive; author 2: none; author 3: grants/research support=DePuySpine Synthes, Medtronic, consultant=Medtronic, Stryker, Nuvasive; author 4: grants/research support=Europine; author 5: none; author 6: none
Background context:
Accurate placement of pedicle screws in fixation surgeries is essential to avoid vascular and neural injuries as well as reoperations. Despite the known advantages of navigated surgery, the development of solutions for spine surgery has been somewhat slower than for corresponding cranial applications. One reason for this could be attributed to the relatively complicated and time-consuming setup of spinal navigation devices and the need for placement of dynamic reference frames in the surgical field. Whereas reference frames for cranial surgery are easily attached to the headrest and kept out of the surgical area, spinal reference frames need to be directly attached to the spinous process of a vertebra in most cases. This, often bulky, piece of equipment in the surgical field can interfere with the surgical process by being in the surgeon's way and should optimally be repositioned for each vertebral level operated on, resulting in prolonged operating room time.

Purpose:
To evaluate a new frameless reference marker system for spinal navigation regarding overall technical accuracy, as well as the effect of vertebral position in the surgical field, on accuracy.

Methods:
An augmented reality surgical navigation (ARSN) system was installed in a hybrid operating room (OR). A motorized ceiling-mounted C-arm system enabled intraoperative cone beam computed tomographies (CBCT). The ARSN system used input from four video cameras mounted in the frame of the C-arm detector for patient tracking and navigation. The video cameras were part of an optical tracking system (OTS) that recognized the adhesive skin markers, which were placed in a random pattern around the surgical field. This frameless reference marker system was evaluated in a series of experiments where Jamshidi needles or pedicle screws were placed: first in 4 human cadavers, and then in a clinical study on 20 patients undergoing navigated spinal surgery. The technical accuracy of the inserted pedicle devices was determined by measuring the distance between the planned device position at the bone entry point and the placed pedicle device. The technical accuracy was also compared for the different spinal levels within each CBCT, to analyze the impact of vertebral position relative to the reference markers.

Results:
The overall mean technical accuracy was 1.65±1.24 mm at bone entry point (n = 366). There were no statistically significant differences in technical accuracy between the levels within a CBCT (p > 0.12 for all comparisons). Pearson’s r showed null- to negligible correlation between the technical accuracy and the number of absolute levels away from the index vertebrae (r < 0.086 for all).

Conclusions:
The frameless reference marker system based on adhesive skin markers is unobtrusive and affords the ARSN system a high accuracy throughout the navigated surgical field, independent of vertebral position relative to the reference markers.

Disclosures: