# Session 3 | Quality/Safety/Value/Complications Abstracts

*Papers are listed in presentation order*

## 28. Nadir Hemoglobin is Associated with Length of Stay Following Adult Spinal Deformity Surgery, but is Unaffected by Strict Transfusion Thresholds

*Jeffrey L. Gum, MD*; Steven D. Glassman, MD; Mladen Djurasovic, MD; Justin Mathew, MD; Morgan Brown, MS; Christy L. Daniels, MS; Colleen Mahoney, BA; Leah Y. Carreon, MD

### Hypothesis

Rigid transfusion threshold (RTT) for hemoglobin (Hgb) < 7.5g/dl following ASD surgery leads to longer a longer hospital length of stay (LOS).

### Design

Retrospective chart review

### Introduction

It is common for patients to require allogenic blood transfusion(s) following adult spinal deformity (ASD) surgery. Following the COVID-19 pandemic, the American Red Cross experienced the worst blood bank shortage in history, resulting in more rigid transfusion thresholds across the United States. The high transfusion rate after ASD surgery coupled with this blood shortage provides opportunity to understand the impact rigid transfusion thresholds following ASD surgery.

### Methods

Patients undergoing > 5 level fusions for ASD from 1/1/2021-6/30/2021 (Restricted (RES)) and 3/1/2022-8/31/2022 (Unrestricted (UR)) were identified and compared with respect to demographic, operative and postoperative outcomes including LOS.

### Results

A total of ninety-four ASD patients were identified, 43 in the UR interval and 51 in the RES interval. There was no difference in any demographic or surgical parameters (Table). There was no difference in mean nadir Hgb between the cohorts. There was a higher percentage of patients that had a nadir Hgb < 7.5 g/dl in the RES interval (17 patients, 33%) vs UR (8 patients, 17%) but there was no difference the total number of patients reaching nadir values below 9.5, 8.5, or 7.5 g/dl. There was a difference in LOS between these within each cohort. Analysis of all 94 patients revealed that LOS was significantly longer with nadir Hgb values ranging from 8.2 days (<7.5g/dl; 25 patients (27%)), to 6.6 days (7.5-8.5g/dl; 18 patients (19%)), to 5.1 days (8.5-9.5g/dl; 16 patients (17%)), to 3.6 days (>9.5g/dl, 35 patients (37%)).

### Conclusion

Implementation of rigid transfusion thresholds following ASD surgery did not appear to impact nadir Hgb values nor LOS. Lower nadir postoperative Hgb values were associated with a longer LOS. Further investigation to understand this association could be beneficial for more objective transfusion recommendations with the potential to reduce length of stay.

## Session 3 | Quality/Safety/Value/Complications Abstracts

| | Transfusion Unrestricted | Transfusion Restricted | |
|---|---|---|---|
| N | 43 | 51 | |
| Sex, N (%) | | | 0.533 |
| Females | 23 (53%) | 31 (61%) | |
| Males | 20 (47%) | 20 (39%) | |
| Age, years, Mean (SD) | 56.56 (17.77) | 60.12 (16.21) | 0.317 |
| BMI, kg/m$^2$, Mean (SD) | 29.27 (7.88) | 32.07 (6.63) | 0.131 |
| Estimated Blood Loss, cc, Mean (SD) | 517.44 (316.14) | 583.24 (426.97) | 0.394 |
| Operative Time, min Mean (SD) | 266.81 (80.81) | 291.88 (101.49) | 0.186 |
| Lowest Post-Op Hb, Mean (SD) | 9.26 (1.50) | 9.03 (2.07) | 0.730 |
| Lowest Hb Categorical | | | 0.091 |
| ≤7.5 | 8 (19%) | 17 (33%) | |
| >7.5 / ≤8.5 | 10 (23%) | 8 (16%) | |
| >8.5 / ≤9.5 | 11 (26%) | 5 (10%) | |
| ≥9.5 | 14 (33%) | 21 (41%) | |
| LOS, days, Mean (SD) | 5.37 (3.71) | 5.88 (4.55) | 0.551 |

| Mean LOS Pre and Post Transfusion Restriction Stratified by Lowest Hb during Post-operative stay | | | |
|---|---|---|---|
| | Transfusion Unrestricted | Transfusion Restricted | p-value |
| N | 43 | 51 | |
| Lowest Hb Categorical | | | 0.275** |
| ≤7.5 | 7.75 (3.11) | 8.35 (6.51) | |
| >7.5 / ≤8.5 | 6.50 (5.50) | 6.75 (2.25) | |
| >8.5 / ≤9.5 | 5.36 (2.87) | 4.40 (2.79) | |
| ≥9.5 | 3.21 (1.58) | 3.90 (2.1) | |
| p-value | 0.024* | 0.016* | |

*within cohort difference (ANOVA)

**between cohort (Pre vs Post) difference

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 29. Long-Term Reoperation Risk of Thoracic to Pelvis Instrumentation for Spinal Deformity: A Longitudinal Study of 7,060 Patients

Paal Nilssen, BA; Nakul Narendran, BA; David L. Skaggs, MD, MMM; Corey T. Walker, MD; Christopher Mikhail, MD; Edward K. Nomoto, MD; *Alexander Tuchman, MD*

### Hypothesis
Reoperation rates following thoracolumbar surgery for spinal deformity are high and associated with patient factors and surgical technique.

### Design
Retrospective cohort

### Introduction
Most data on thoracolumbar deformity outcome comes from relatively small study groups of surgeons who specialize in complex deformity surgery. While these prospective registries provide high quality data, one must consider if these results align with practices across the United States. The combined ISSG and ESSG dataset, including 1151 surgical patients, reported a 2-year reoperation rate of 20%. We performed a larger-scale assessment of reoperation risk in deformity patients undergoing thoracic to pelvis surgery.

### Methods
The PearlDiver database was queried for spinal deformity patients (scoliosis, kyphosis, spondylolisthesis, sagittal plane deformity) undergoing at minimum, a T11-pelvis operation (2010-2020). CPT codes identified lumbar arthrodesis procedures that included pelvic fixation and ≥7 levels of posterior instrumentation on the same day. Minimum follow-up was 2 years. Reoperations included subsequent arthrodesis, decompression, osteotomy, device insertion, and pelvic fixation procedures. Multivariant regression analysis described associations between variables and reoperation risk.

### Results
7,060 patients met criteria (mean age: 63.6 ±11.1 years, ECI: 5.0 ±3.6, follow-up: 5.7 ±2.7 years). Overall reoperation rate was 23.2%. Reoperation rate at 2- and 5-year was 16.9% and 22.1% respectively. 10-year reoperation-free probability was 73.7% (95% CI: 72.4-74.9%). Multivariant analysis revealed higher reoperation risk for patients with kyphosis. Patients who received interbody cages had a lower reoperation risk. No association was found between the presence or absence of osteotomy procedures and reoperation risk. Age and ECI did not independently influence reoperation.

### Conclusion
This study, representing a real-world cohort of over six times the largest current prospective data set, found a 2-year reoperation rate of 17%, similar to previous studies, suggesting study group findings are applicable to a broader population. Preoperative kyphosis was associated with higher reoperation risk, while the use of interbody cages was protective. Age, medical comorbidities, and osteotomies did not predict reoperations.

## Session 3 | Quality/Safety/Value/Complications Abstracts

| Multivariant regression comparing variables with reoperation risk. | | |
|---|---|---|
| | **Odds Ratio** | **95% CI** |
| **Medical Comorbidity** | | |
| Osteopenia | 0.96 | 0.83-1.10 |
| Osteoporosis | 0.95 | 0.82-1.13 |
| Diabetes | 0.96 | 0.82-1.14 |
| Smoking | 1.06 | 0.93-1.23 |
| Myelopathy | 1.15 | 0.94-1.40 |
| Radiculopathy | 1.11 | 0.98-1.26 |
| Inflammatory | 1.12 | 0.95-1.31 |
| Infection | 1.10 | 0.81-1.49 |
| Obesity | 0.81 | 0.66-1.00 |
| Prior surgery | 1.09 | 0.96-1.24 |
| Prior trauma | 1.14 | 0.98-1.32 |
| **Diagnosis** | | |
| Scoliosis | 0.95 | 0.84-1.07 |
| Kyphosis | **1.45** | **1.00-1.31** |
| Sagittal plane deformity | 0.95 | 0.77-1.16 |
| Spondylolisthesis | 1.05 | 0.93-1.18 |
| **Surgical Characteristics** | | |
| ALIF | **0.76** | **0.65-0.88** |
| TLIF | **0.87** | **0.77-0.98** |
| No interbody | 1.23 | 0.88-1.70 |
| Posterior column osteotomy | 0.81 | 0.57-1.16 |
| Three column osteotomies | 0.81 | 0.59-1.10 |
| No Osteotomy | 0.74 | 0.51-1.18 |
| Bone morphogenic protein | 1.09 | 0.97-1.22 |

Multivariant Regression for Reoperation Risk

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 30. Higher Intraoperative Blood Loss is Associated with Increased Risk of Intraoperative Neuromonitoring Data Loss for the Type 3 Spinal Cord Shape During Spinal Deformity Surgery

Chun Wai Hung, MD; Fthimnir Hassan, MPH; Nathan J. Lee, MD; Steven G. Roth, MD; Justin K. Scheer, MD; *Joseph M. Lombardi, MD*; Zeeshan M. Sardar, MD; Ronald A. Lehman, MD; Lawrence G. Lenke, MD

### Hypothesis
For spinal deformity procedures with type 3 spinal cord shapes, there is increased risk of IONM loss with perioperative variables including larger deformities, increased degree of correction, and higher blood loss.

### Design
Retrospective cohort study

### Introduction
Within the spinal cord shape classification system (SCSCS), type 3 spinal cords (actual cord deformation on apical axial MRI scan) have been shown to be associated with much higher risk of intraoperative neuromonitoring (IONM) data loss. The current study is to identify whether there are variables among type 3 cord shapes that further predicts the likelihood of IONM changes within this subgroup.

### Methods
This is a retrospective cohort study of consecutive patients with type 3 spinal cords undergoing spinal deformity surgery from a single academic institution between 2016-2023. The primary outcome examined was whether there was IONM data loss. Demographic, clinical, operative, and radiographic variables were compared in those patients with and without IONM data loss.

### Results
A total of 79 patients with type 3 spinal cords meeting the inclusion criteria were identified. Of these, 30 pts (38%) had IONM data loss, while 49 pts (62%) did not. In comparing the IONM loss group with the no IOMN change group, there were no differences between the groups in age or BMI. There were no significant differences in the mean preoperative coronal deformity angular ratio (C-DAR), sagittal DAR (S-DAR), or total DAR (T-DAR). In addition, there were no significant differences in the mean change in C-DAR, S-DAR, or T-DAR between the groups when comparing the postoperative versus preoperative measurements. There was no difference in proportion of patients with a vertebral column resection (VCR), or in the mean instrumented number of levels. However, there was a significantly higher estimated blood loss (EBL) (1320 +/- 614 vs 1049 +/- 468, p = 0.03) in the IONM loss group.

### Conclusion
In this largest reported cohort patients with type 3 spinal cords undergoing spinal deformity surgery, somewhat surprisingly, the only factor found to be significantly associated with risk of IONM data loss was higher EBL. Thus this is important for deformity surgeons to realize when treating this specific group of high risk patients.

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 31. Accurate Scoring System Predicts Cord-Level Intraoperative Neuromonitoring (IONM) Loss During Spinal Deformity Surgery: A Machine Learning Algorithm

*Nathan J. Lee, MD; Lawrence G. Lenke, MD*; Varun Arvind, MD, PhD; Ted Shi, BS; Alexandra Dionne, BS; Chidebelum Nnake, BS; Mitchell Yeary, BS; Michael Fields, MD, BS; Matthew Simhon, MD; Anastasia Ferraro, BS; Matthew Cooney, BS; Erik Lewerenz, BS; Justin Reyes, MS; Steven G. Roth, MD; Chun Wai Hung, MD; Justin K. Scheer, MD; Thomas M. Zervos, MD; Earl D. Thuet, BS; Joseph M. Lombardi, MD; Zeeshan M. Sardar, MD; Ronald A. Lehman, MD; Benjamin D. Roye, MD, MPH; Michael G. Vitale, MD, MPH; Fthimnir Hassan, MPH

### Hypothesis
Machine learning(ML) can create an accurate scoring system to preoperatively predict cord-level IONM data loss.

### Design
Retrospective review of single surgeon prospective, consecutively collected patient data

### Introduction
An accurate knowledge of a patient's risk for IONM cord-level loss prior to deformity correction is important for the informed decision-making process, but no prediction tool currently exists.

### Methods
1,106 patients (adult=735, pediatric=371) who had spinal deformity surgery from 2015-2023 were reviewed. 205 periop variables were included (demographics, diagnosis, medical history, physical exam, operative factors, labs, preop/intraop x-rays, preop MRI/CT). IONM cord-level data was reviewed with the senior member of the IONM team. A stepwise ML approach using random forest analysis and multivariate logistic regression was performed. Pts. were randomly allocated into training(50%) and testing(50%) cohorts. Threshold values for features were calculated from the trained random forest model, and feature scores were derived by rounding up feature weights from the logistic regression model. Variables in the final scoring calculator were selected to optimize predictive performance (accuracy, sensitivity, specificity and area under the receiver operating characteristic curve (AUROC)). Analysis was performed using scikit-learn(v.0.24.2) in Python(v.3.9.18).

### Results
Through the ML process, a total of 7 features were designated to be included in the scoring system: Spinal Cord Shape Type 3(score=2), Conus level below L2(score=2), Preop Upright Largest Cobb ≥75$^{o}$(score=2), Upper Instrumented Vertebra in the Cervical spine(score=2), Preop to Intraop Decrease in Hematocrit ≥12(score=1), Total Deformity Angular Ratio(TDAR)≥25(score=1), and Three Column Osteotomy(3CO)(score=1). Patients with increasing cumulative scores had dramatically increased rates of IONM cord-level loss, with a cumulative score ≤ 2 having an IONM cord-level loss rate of 0.8% vs. score ≥7 rate of 95%. When evaluated on the test cohort, the scoring system achieved an accuracy of 90.3%, sensitivity of 80%, specificity of 91%, and an AUROC of 0.85.

### Conclusion
This is the first study to provide an ML derived scoring system using perioperative variables which accurately predicted IONM cord-level loss during pediatric and adult spinal deformity surgery with over 90% reliability.

| Variables | Score |
|---|---|
| Spinal Cord Type III | 2 |
| Level of Conus Below L2 | 2 |
| Preop Upright Largest Cobb ≥75° | 2 |
| Upper Instrumented Vertebra = Cervical Level | 2 |
| Preop to Intraop Decrease in Hct ≥ 12 | 1 |
| Total Deformity Angular Ratio ≥ 25 | 1 |
| Cord Level Three Column Osteotomy | 1 |

| | Cummulative Score | Positive (Count) | Negative (Count) | Rate |
|---|---|---|---|---|
| Low Risk | 0 - 1 | 5 | 863 | 0.6% |
| | 2 | 3 | 103 | 3% |
| Moderate Risk | 3 | 7 | 47 | 13% |
| | 4 | 7 | 20 | 26% |
| | 5 | 9 | 10 | 47% |
| | 6 | 5 | 6 | 45% |
| High Risk | 7 | 3 | 1 | 75% |
| | 8 | 7 | 0 | 100% |
| | 9 | 4 | 0 | 100% |
| | 10 | 5 | 0 | 100% |
| | 11 | 1 | 0 | 100% |

Fig.

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 32. Complementary Performance of Somatosensory Evoked Potential (SSEP) as Intraoperative Neuromonitoring in Spinal Deformity Surgery - Results from a Prospective Multicenter Study ‡

*So Kato, MD, PhD*; Lawrence G. Lenke, MD; Kristen E. Jones, MD, FAANS; Sigurd H. Berven, MD; Christopher J. Nielsen, MD; Saumyajit Basu, MS(orth), DNB(orth), FRCSEd; Michael P. Kelly, MD; Justin S. Smith, MD, PhD; Samuel Strantzas, MSc, DABNM; Stephen J. Lewis, MD, FRCS(C)

### Hypothesis
The utilization of somatosensory evoked potential (SSEP) enhances the sensitivity of intraoperative neuromonitoring (IONM) for predicting postoperative neurological deficits.

### Design
Prospective international multicenter cohort study.

### Introduction
The use of multimodal IONM has been advocated for ensuring safety in spinal deformity surgery. SSEPs monitor the functional integrity of the dorsal column pathways. The significance of incorporating SSEP alongside motor evoked potential (MEP) and/or electromyography (EMG) in preventing neurological deficits remains unclear.

### Methods
Twenty international centers prospectively documented IONM, demographic details, radiographic findings, and surgical events for complex spinal deformity surgery. Patients aged 10-80 years, with a coronal or sagittal major Cobb>80°, or undergoing posterior column or 3-column osteotomy, were included. SSEPs were predominantly recorded after simulation of posterior tibial and/or peroneal nerves. Ulnar nerves were used as controls. An IONM alert was defined as a >50% loss of amplitude in SSEP or MEP from baseline or sustained EMG activity >10 seconds. Neurological examinations were performed pre- and post-operatively, with the occurrence of new neurological deficits being meticulously recorded.

### Results
Among 546 cases, SSEP alerts were identified in 20 (3.7%), either alone (4/20), or in combination with MEP/EMG (16/20), whereas MEP/EMG alerts occurred in 75 cases (13.7%). Post-operative new motor deficits were observed in 60 (11.0%), and new sensory deficits were recorded in 17 of 523 valid data (3.3%). All cases with post-operative motor or sensory deficits with intra-operative SSEP alerts (8 and 4 cases, respectively) were also associated with MEP/EMG alerts, while no neurological deficits were documented after isolated SSEP alerts (4 cases, 0.7%). Consequently, the addition of SSEP to MEP/EMG did not result in an enhancement of the sensitivity in predicting post-operative neurological deficits.

### Conclusion
Although multimodal IONM has been deemed beneficial for predicting post-operative neurological deficits by comprehensively assessing spinal cord function, it was revealed that the current protocol and threshold of SSEP did not contribute to improved safety in complex spinal deformity surgery. Further studies are warranted to establish the optimal protocol for IONM.

‡ = SRS Funded Research Grant

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 33. Intraoperative Neuromonitoring Has Poor Correlation with Postop Neurological Deficits in Non-Cord Level Adult Deformity Surgery

*Zeeshan M. Sardar, MD*; Alekos A. Theologis, MD; Ganesh Swamy, MD, PhD; Go Yoshida, MD, PhD; Michael P. Kelly, MD; Thorsten Jentzsch, MD, MSc; Samuel Strantzas, MSc, DABNM; Saumyajit Basu, MS(orth), DNB(orth), FRCSEd; Kenny Y. Kwan, MD; Justin S. Smith, MD, PhD; Ferran Pellisé, MD, PhD; So Kato, MD, PhD; Munish C. Gupta, MD; Christopher P. Ames, MD; Kristen E. Jones, MD, FAANS; Anastasios Charalampidis, MD; Brett Rocos, MD, FRCS; Lawrence G. Lenke, MD; Stephen J. Lewis, MD, FRCS(C)

**Hypothesis**
In non-cord level spinal deformity surgery, postop neural deficits are incompletely associated with intraop neuromonitoring (IONM) alerts.

**Design**
Prospective, international, multi-center cohort

**Introduction**
The purpose of this study is to evaluate rates of new neural deficits relative to IONM alerts in non-cord-level spinal deformity surgery.

**Methods**
20 international centers prospectively documented IONM (EMG, SSEP and MEP), demographics, radiographic findings, and surgical events of adult patients undergoing spinal deformity surgery. Inclusion criteria: neurologically intact, major Cobb>80° or surgery involving any osteotomy. IONM change was defined as loss of amplitude>50% in SSEP or MEP from baseline or sustained EMG activity lasting>10 seconds

**Results**
Of 197 patients, 22(11.2%) had an IONM alert. More patients were undergoing revision surgery during an alert compared to those with no alert (40.9% vs. 18.9%, p = 0.026). IONM alerts did not correlate with cobb angle, deformity angular ratio, sagittal vertical axis, or coronal vertical axis. There were a total of 26 alerts in 22 patients - 4 (18.2%) had 2 IONM alerts, while the other 18(81.8%) had 1 alert. MEPs were affected in 21 of 26 alerts (80.8%) and 15(71.4%) of those were recovered. SSEPs were affected in 8 of 26 alerts (30.7%). Lastly, EMGs were affected in only 2(7.7%). 5 of 21 MEP alerts (23.8%) were bilateral, whereas 16(76.2%) were unilateral. The most frequent event preceding an MEP change was an osteotomy in 6(28.6%) of 21 patients. The most frequent non-surgical event preceding an MEP alert was technical in 5(23.8%), followed by systemic (low blood pressure/anemia) and anesthetic in 3 patients each (14.3%). 33 of 197 patients (16.8%) developed a new postop neural deficit. Of these patients, 24(72.7%) had no IONM alert. In the presence of an IONM alert 9 of 22 (40.9%) had a new neural deficit. IONM alert had a crude negative predictive value (NPV) of 86.1%

**Conclusion**
In non-cord level spinal deformity surgery, IONM alerts occurred in 11.2% of patients with osteotomy being the most frequent preceding surgical event. A new postop neural deficit was observed in 16.8% of all patients, and in 41% of patients with a IONM alert. A surprisingly high 73% of postop neural deficits occurred in patients who did not have an alert. This highlights the need for further refinement of IONM techniques for non-cord level surgery

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 34. Cost-Effectiveness of Operative Vs Nonoperative Treatment of Adult Symptomatic Lumbar Scoliosis with Eight Year Follow-Up ‡

*Leah Y. Carreon, MD*; Steven D. Glassman, MD; Justin S. Smith, MD, PhD; Michael P. Kelly, MD; Elizabeth L. Yanik, PhD; Christine Baldus, RN; Vy Pham, MD, MPH; David Ben-Israel, MD; Jon D. Lurie, MD, MS; Charles C. Edwards, MD; Lawrence G. Lenke, MD; Oheneba Boachie-Adjei, MD; Jacob M. Buchowski, MD; Charles H. Crawford III, MD; Stephen J. Lewis, MD, FRCS(C); Tyler Koski, MD; Stefan Parent, MD, PhD; Virginie Lafage, PhD; Munish C. Gupta, MD; Han Jo Kim, MD; Christopher P. Ames, MD; Shay Bess, MD; Frank J. Schwab, MD; Christopher I. Shaffrey, MD; Keith H. Bridwell, MD

### Hypothesis
Operative treatment for Adult Symptomatic Lumbar Scoliosis (ASLS) is more cost-effective than non-operative treatment.

### Design
Secondary data analysis of the NIH sponsored study on ASLS.

### Introduction
The appropriate treatment approach for ASLS is still widely debated. While nonoperative care has not been shown to reliably improve outcomes, operative treatment is costly with high revision rates. The purpose of this study is to perform a cost-effectiveness analysis comparing operative versus nonoperative care for ASLS eight years after enrollment.

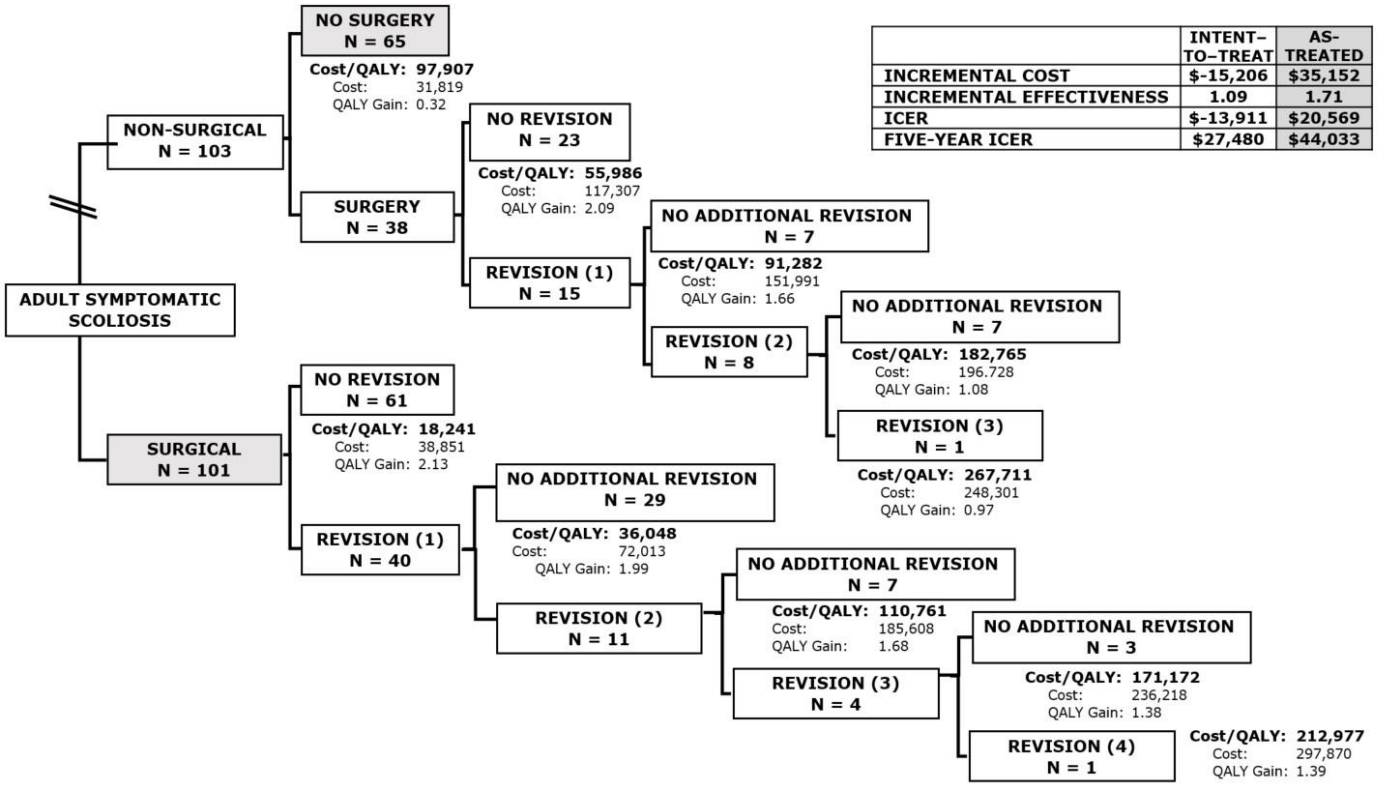
### Methods
Patients with eight-year follow-up data were identified. Costs for index and revision surgeries and non-operative modalities were determined using Medicare Allowable rates. Medication costs were determined using the RedBook and indirect costs were calculated based on reported employment status and income. Quality Adjusted Life Years (QALYs) were determined using the SF6D.

### Results
There were 101 cases in the Operative (Op) and 103 in the Non-operative (Non-Op) group with complete eight year data. Thirty-eight patients (37%) in the NonOp group had surgery from 3 to 72 months after enrollment. An As-Treated analysis including only cases who never had surgery (N=65) or cases with complete eight-year post-operative data (N=101) showed that operative treatment was favored with an ICER of $20,569 per QALY gained which is within Willingness-to-Pay (WTP) thresholds. An Intent-to-treat analysis demonstrated greater QALY gains and lower cost in the Op group (ICER = $-13,911). However, Intent-to-treat analysis may be confounded by crossovers to operative treatment as well as the variability in the timing of surgery in the NonOp group.

### Conclusion
Operative treatment was more cost-effective than non-operative treatment for ASLS at eight-year follow-up. The ICER continued to improve as compared to the five-year values ($20,569 vs. $44,033).

‡ = SRS Funded Research Grant

# Session 3 | Quality/Safety/Value/Complications Abstracts




| | INTENT–TO–TREAT | AS-TREATED |
|---|---|---|
| INCREMENTAL COST | $-15,206 | $35,152 |
| INCREMENTAL EFFECTIVENESS | 1.09 | 1.71 |
| ICER | $-13,911 | $20,569 |
| FIVE-YEAR ICER | $27,480 | $44,033 |

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 35. Opioid Usage in Adult Spinal Deformity: Can We Move the Needle Before Incision?

*Michelle Gilbert, PA-C*; Aiyush Bansal, MD; Rakesh Kumar, MBBS; Joseph Strunk, MD; Daniel Warren, MD; Jennifer Kelly, PhD; Murad Alostaz, BS; Venu M. Nemani, MD, PhD; Jean-Christophe A. Leveque, MD; Philip K. Louie, MD; Rajiv K. Sethi, MD

### Hypothesis
The application of a standardized preoperative opioid program can reduce opioid consumption after adult spinal deformity surgery even in chronic opioid users.

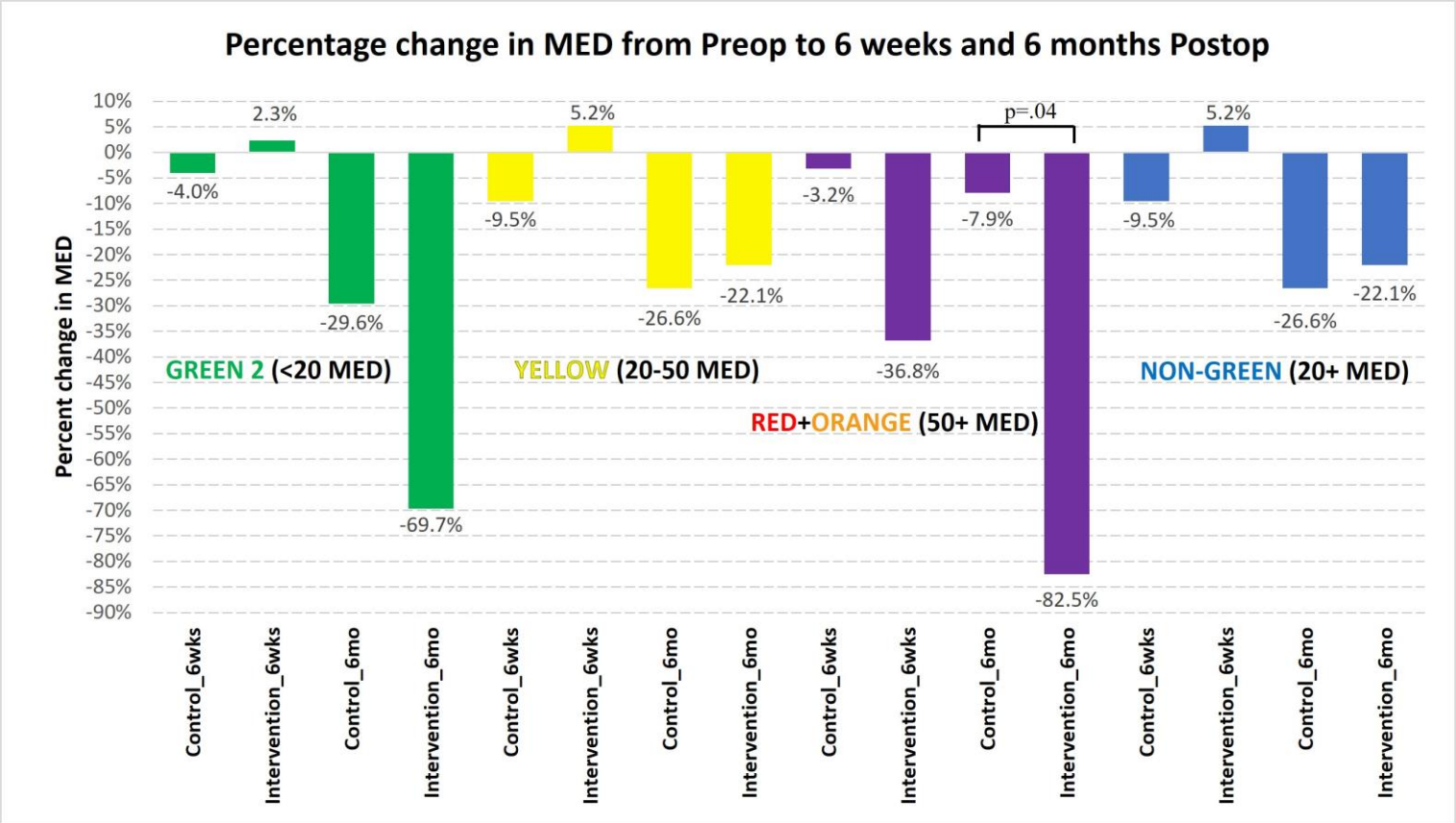
### Design
Prospective cohort study.

### Introduction
High opioid utilization prior to adult spinal deformity (ASD) surgery has been associated with poor surgical/functional outcomes and persistent elevated postoperative opioid usage. No studies have described the effect of preoperative weaning or opioid-reduction strategies on postoperative opioid use. The purpose of our study is to evaluate the impact of a standardized preoperative opioid program on postoperative opioid usage in patients undergoing thoracolumbar spinal deformity surgery.

### Methods
A control group of 75 patients undergoing elective thoracolumbar fusion for adult spinal deformity from October 2020 to 2021 were compared with an intervention group of 98 surgical patients from November 2022 to 2023. Preoperative opioid use was assessed using a color-coded system based on morphine equivalent dosages (MEDs), benzodiazepine (BZD) use, and substance use disorder history: GREEN 1 (0 MED), GREEN 2 (0-20 MED), YELLOW (20-50 MED), ORANGE (50-120 MED), and RED (>120, or >50 with +BZD or a substance disorder). Chronic users (YELLOW, ORANGE, or RED patients) received a pre-surgery program including pain clinic consultation and a virtual pain coping course. RED category patients needed to demonstrate a 50% MED reduction before surgery. Data on six-week and six-month post-operative MED, patient outcomes, length of stay (LOS), opioid use, demographics, psychiatric diagnoses, and ASA classification were gathered.

### Results
The intervention group showed a significant reduction in MED at six months post-op in the highest use categories (RED and ORANGE, preoperative MED > 50), with a mean decrease of -237 MED (P=.04) versus the control non-intervention ORANGE/RED groups. This reduction was not associated with any change in hospital LOS or increase in post-discharge phone calls.

### Conclusion
The preoperative opioid reduction program had the greatest effect on opioid consumption in patients with high preoperative opioid use (MED > 50). Contrary to previous reports demonstrating continued high postoperative usage in patients with high preoperative opioid use, this result suggests another avenue for preoperative surgical optimization.




Percentage change in MED from preop for each ppioid category at 6 weeks and 6 months postop.

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 36. Durability of Substantial Clinical Benefit Leading to Optimal Outcomes in Adult Spinal Deformity Corrective Surgery: A Minimum 5-Year Analysis

Jamshaid Mir, MD; Ankita Das, BS; Tobi Onafowokan, MBBS; Nima Alan, MD; Matthew Galetta, MD; Nathan Lorentz, MD; Renaud Lafage, MS; Bassel G. Diebo, MD; M. Burhan Janjua, MD; Dean Chou, MD; Justin S. Smith, MD, PhD; Virginie Lafage, PhD; Andrew J. Schoenfeld, MD; Daniel M. Sciubba, MD; *Peter G. Passias, MD*

### Hypothesis
PFactors associated with the long-term durability of outcomes in ASD patients can give insight into improving patient care.

### Design
Retrospective cohort

### Introduction
Clinical outcomes for adult spinal deformity patients has been extensively reported on, however factors associated with sustaining two year (2Y) substantial clinical benefit (SCB) till five year (5Y) remains unclear.

### Methods
Operative ASD patients fused from at least L1 to sacrum with baseline (BL) to 5-year (5Y) follow-up were included. Substantial clinical benefit (SCB) for ODI, PCS, NRS-back, NRS-leg, SRS-22r were assessed based on previously published values. Factors were evaluated based on meeting optimal outcomes (OO) at 2Y (2+) and 5Y (5+). Furthermore, 2+ was isolated and evaluated based on meeting 5+ OO (2+5+) or not 5- (2+5-). Optimal Outcome (OO) was defined as: no reoperation, major mechanical failure, proximal junctional failure (PJF), and [meeting either: (1) substantial clinical benefit (SCB) for Oswestry Disability Index (ODI) (decrease of >18.8), or (2) ODI <15 and Scoliosis Research Society (SRS-22r) Total>4.5].

### Results
330 ASD patients met inclusion, with 46% meeting SCB for ODI at 2Y and at 5Y. 78.5% of those who achieved 2Y SCB went on to achieve 5Y SCB. This rate was lower for optimal outcomes, with 41% achieving OO at 2Y (2+), while 37% met at 5Y (5+). 80% of the 2+ cohort meeting 5+ (32% of the total cohort). Regaining activity postoperatively had 4x higher odds of maintaining OO from 2Y to 5Y ($p<.05$). Osteoporosis rates, although equivocal at baseline, were higher at the last follow-up in those who met 2Y OO but failed to meet 5Y. The odds of achieving OO at 5Y in 2+ decreased by 47% for each additional comorbidity and decreased by 74% in those that had lower extremity paresthesias at BL (both $p<.05$). Controlling analysis depicted decreased number of levels fused, decreased correction of SVA and increased correction in PI-LL to be predictive of maintaining 2Y OO till 5Y.

### Conclusion
Substantial clinical benefit was met 46% of ASD patients at 5Y, with the durability of optimal outcomes seen in 30% of patients till 5 years postoperatively. Higher rates of medical complications were seen in those who failed to achieve and maintain optimal outcomes till 5Y. Frailty and comorbidity burden were significant factors associated with the achievement of OO at 2Y and its durability till 5Y.

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 37. Optimizing Bone Health for the Prevention of Revision Adult Spinal Deformity Surgery: A Break-Even Analysis

*Andrew Kim, BS*; William G. Elnemer, BS; Marc Greenberg, MD; Khaled M.Kebaish, MD

### Hypothesis

Preoperative bone health optimization will be cost-effective in the prevention of revision surgery among adult spinal deformity (ASD) patients, regardless of treatment modality.

### Design

Break-even economic analysis

### Introduction

Before spinal reconstructive surgery, all patients over the age of 65 and those under the age of 65 with certain risk factors, such as chronic glucocorticoid use or high fracture risk, are recommended to undergo bone health evaluation. Despite increased risk of complications and worse outcomes in patients with osteoporosis, minimal research has examined the cost-effectiveness of preoperative bone optimization in the prevention of revision ASD surgery.

### Methods

The product cost of a DXA scan and the total 2-year cost of revision ASD surgery were obtained from institutional records. 2-year ASD revision rates among patients with osteoporosis were obtained from the literature. An open-access database was used to determine the mean retail price for Teriparatide, Denosumab, and Zoledronic acid. Total optimization costs included the costs of a DXA scan and treatment modality. Costs were adjusted for inflation using the Consumer Price Index to 2023 U.S. dollars. A break-even economic analysis was performed to determine the absolute risk reduction (ARR) to economically justify each treatment. ARR was then used to calculate the number needed to treat (NNT) to prevent a single revision ASD surgery while remaining cost-effective.

### Results

The cost of a DXA scan and revision ASD surgery was $349.28 and $147,731.78 using institutional values. The cost of treating revision ASD surgery with DXA and Teriparatide, Denosumab, and Zoledronic acid was $4,410.32, $3,832.78, and $1,552.61, respectively. Each treatment modality was cost-effective at literature low, literature high, and the weighted average rates for revision ASD surgery. Teriparatide was economically justified if the initial revision decreased by 2.99% (NNT=34), Denosumab with an ARR of 2.59% (NNT=39), and Zoledronic Acid with an ARR of 1.05% (NNT=96).

### Conclusion

Preoperative bone health optimization among ASD patients undergoing surgery is highly cost-effective in the prevention of revision surgery due to osteoporosis.

| Drug | Dose | Frequency | Mean Unit Cost, $ | DXA Unit Cost, $ | Total Cost, $ |
|---|---|---|---|---|---|
| Teriparatide | 20 mcg/dose | Daily (2 months preop) | 2,030.52 (28 doses) | 349.28 | 4,410.32 |
| Denosumab | 60 mg/mL | Biannually | 1741.75 | 349.28 | 3,832.78 |
| Zoledronic Acid | 5 mg/100 mL | Annually | 1203.33 | 349.28 | 1,552.61 |
| [a]All prices obtained from an online drug database; [b]Costs represented in U.S. dollars | | | | | |

**Table 1.** Total cost of bone optimization strategy by treatment

| Drug | Initial ASD Revision Rate, % | Final ASD Revision Rate, % | ARR, % | NNT |
|---|---|---|---|---|
| Teriparatide | 19.71[a] | 16.72 | 2.99 | 34 |
| | 22.05[b] | 19.03 | 2.99 | 34 |
| | 40.50[c] | 37.51 | 2.99 | 34 |
| Denosumab | 19.71[a] | 17.12 | 2.59 | 39 |
| | 22.05[b] | 19.46 | 2.59 | 39 |
| | 40.50[c] | 37.91 | 2.59 | 39 |
| Zoledronic Acid | 19.71[a] | 18.66 | 1.05 | 96 |
| | 22.05[b] | 21.00 | 1.05 | 96 |
| | 40.50[c] | 39.45 | 1.05 | 96 |
| *Presumes cost of revision ASD surgery is $147,731.78 (U.S. dollars); *ASD* = adult spinal deformity; *ARR* = absolute risk reduction; *NNT* = number needed to treat; [a]Low revision rate obtained from literature; [b]Weighted literature revision rate; [c]High revision rate obtained from literature | | | | |

**Table 2.** Cost-effectiveness of bone optimization strategies in the prevention revision adult spinal deformity surgery

$$S_{total} \times C_r \times IR_i = (S_{total} \times C_d) + (S_{total} \times C_r \times IR_f)$$

Solving for $IR_f$ yields:

$$IR_f = \frac{(IR_i \times C_r) - C_d}{C_r}$$

$S_{total}$ = total annual surgeries; $C_r$ = cost of revision ASD surgery; $C_d$ = total cost of bone health optimization strategy; $IR_i$ = initial revision rate; $IR_f$ = break-even revision rate

**Figure 1.** Equation used to calculate the break-even revision rate (Adapted from Hatch MD, Daniels SD, Glerum KM, Higgins LD. The cost-effectiveness of vancomycin for preventing infections after shoulder arthroplasty: a break-even analysis. *J Shoulder Elbow Surg.* 2017;26(3):472-477)

Table 1. Total cost of bone optimization strategy by treatment

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 38. Preoperative Anabolic Bone Therapy Significantly Reduces Spinopelvic Mechanical Complications and Pseudarthrosis in Adult Spinal Deformity Surgery

Omar Zakieh, MBBS; Hani Chanbour, MD; Ambika Paulson, MD; Walter Navid, BS; Mitchell Bowers, MD; Iyan Younus, MD; David C. Liles, MD; Ranbir Ahluwalia, MD; Julian Lugo-Pico, MD; Amir M. Abtahi, MD; Scott Zuckerman, MD, MPH; *Byron F. Stephens, MD*

### Hypothesis
A longer regimen of anabolic bone medication for adult spinal deformity (ASD) surgery prevents mechanical complications and improves postoperative outcomes in patients with osteopenia and osteoporosis.

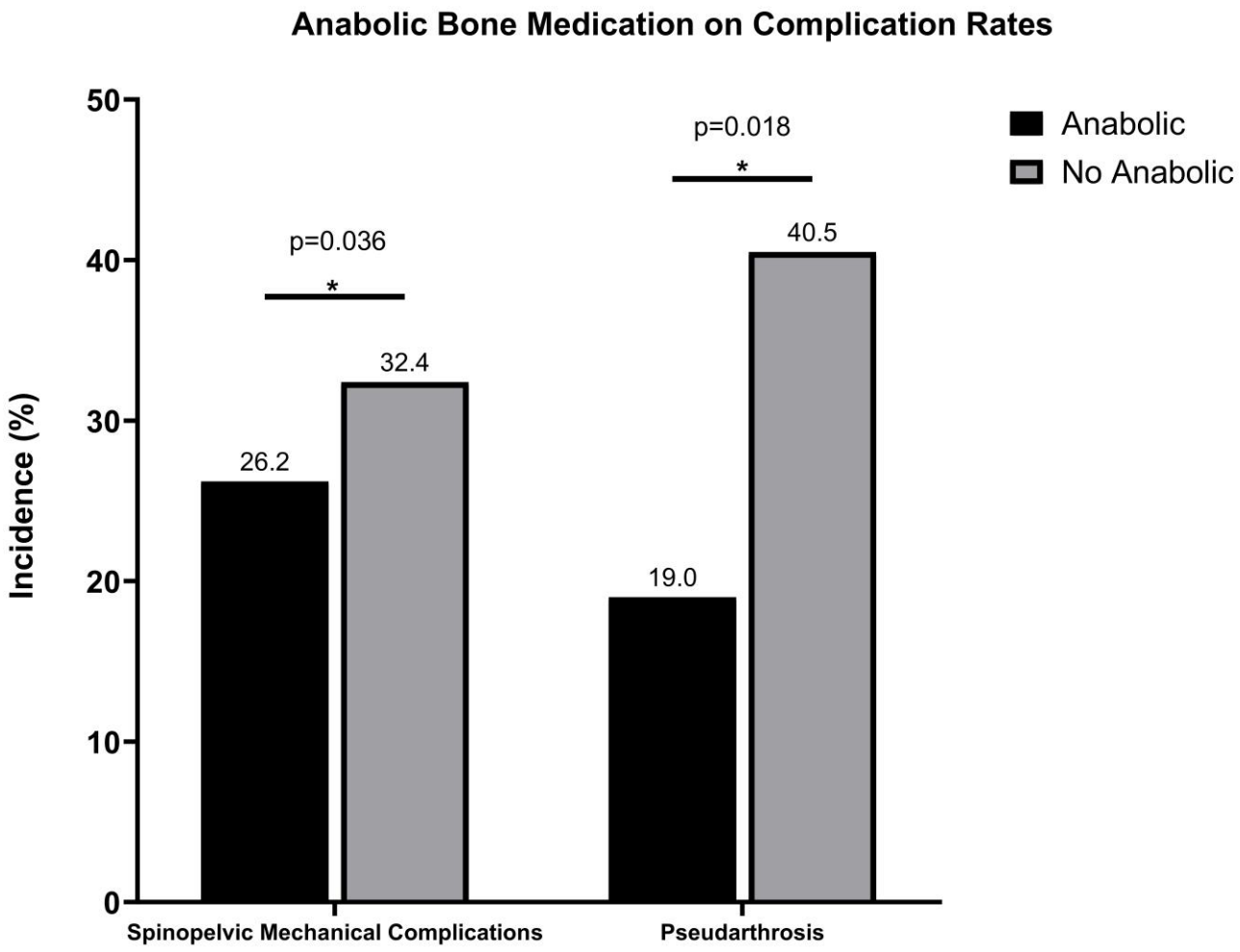
### Design
Retrospective cohort study

### Introduction
A paucity of research exists regarding benefits of longer anabolic bone therapy on ASD surgery outcomes. In a cohort of osteopenic and osteoporotic patients undergoing ASD surgery, we sought to determine the impact of anabolic bone therapy on: 1) mechanical complications, 2) reoperations, and 3) patient-reported outcome measures (PROMs).

### Methods
A single-institution, retrospective cohort study was performed for osteopenic and osteoporotic patients undergoing ASD surgery from 2009-21. Inclusion criteria were: ≥5-level fusion, sagittal/coronal deformity, and 2-year follow-up. Osteopenia/osteoporosis were defined as t-score <-1.5 and <-2.5, respectively. The primary exposure was length of anabolic bone medication administration (days). Postoperative outcomes included mechanical complications, reoperations, and PROMs. Multivariable regression analysis controlled for age, BMI, and t-score.

### Results
Among 116 patients with osteopenia (66.4%) or osteoporosis (33.6%) undergoing ASD surgery, 42 (36.2%) were administered an anabolic bone agent, including teriparatide (85.7%), abaloparatide (11.9%) or romosozumab (2.4%), with a mean duration of 457.0±591.0days. Anabolics: patients administered anabolic bone medication had significantly fewer spinopelvic mechanical complications (26.2% vs. 32.4%, p=0.036), and pseudarthrosis (19.0% vs. 40.5%, p=0.018) than patients who did not receive anabolic medications, with no difference in reoperations or PROMs. On multivariable regression, anabolic medication administration decreased the odds of pseudarthrosis (OR=0.31, 95%CI=0.12-0.80, p=0.015), and spinopelvic mechanical complications (OR=0.40, 95%CI=0.17-0.96, p=0.040). Duration: no association was found between the duration of anabolic medication and mechanical complications, reoperations, or PROMs (all p>0.05).

### Conclusion
In a cohort of osteopenic and osteoporotic patients undergoing ASD surgery, patients administered anabolic bone therapy had a significantly lower pseudarthrosis rate and fewer spinopelvic complications. This reduction in mechanical complications did not translate to a significant difference in patient reported outcomes.


Anabolic Bone Medication on Complication Rates
Incidence (%)
50
40
30
20
10
0
p=0.036
*
p=0.018
*
26.2
32.4
19.0
40.5
Anabolic
No Anabolic
Spinopelvic Mechanical Complications
Pseudarthrosis

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 39. Impact of Advanced Hemodynamic Monitoring on Post-Operative Complications in Multi-Level Posterior Thoracolumbar Fusions

*Leah Y. Carreon, MD; Steven D. Glassman, MD*; Desiree Chappell, CRNA; Steven Garvin, CRNA; Anna Lavelle, MSN, CRNA; Jeffrey L. Gum, MD; Mladen Djurasovic, MD; Wael Saasouh, MD

### Hypothesis
Intra-op advanced hemodynamic monitoring decreases post-op complications in thoracolumbar fusions

### Design
Observational comparative cohort

### Introduction
Intra-Operative Hypotension (IOH) is a widely accepted factor in triggering neuro-monitoring alerts during deformity correction. Its impact on post-op complications is less well studied. The Hypotension Prediction Index (HPI) uses AI to predict hypotension and its possible causes, helping the anesthesia team make timely decisions to administer vasopressors, inotropes or fluids. This study determines if HPI software decreases episodes of IOH resulting in a decrease in post-op complications.

### Methods
Adult patients undergoing elective, multi-level posterior thoracolumbar fusion, with BP monitoring with an a-line using HPI software were identified. A similar set of patients in whom the HPI software was not used were also identified. Demographic and surgical data, minutes of IOH and hypertension, volume of IVF, colloids, blood products and vasopressors administered intra-op; urine output, volume of IVF, colloids and blood products administered 4 hours post-op; number and type of post-op complications were collected.

### Results
The HPI and Non-HPI groups were similar in sex, age, BMI, ASA grade, number of surgical levels, estimated blood loss and operative time. A longer duration of IOH was seen in the Non-HPI group (13.3mins) compared to the HPI group (8.1mins, p=0.032). Longer duration of hypertension in the Non-HPI group (1.4mins) was also seen compared to the HPI group (0.5mins, p=0.029). Except for colloids intra-op, the volume of IVF and blood products administered intra-op and 4 hours post-op were similar. Urine output 4 hours post-op was greater in the HPI group (819.1mL) compared to the Non-HPI group (619.8mL, p=0.022). There was a greater number of patients in the Non-HPI group who had a surgical site infection requiring return to the operating room (13% vs 2%, p=0.027), post-op nausea and vomiting requiring medication (14% vs 0, p=0.004) and post-op cognitive dysfunction (19% vs 6%, p=0.049).

### Conclusion
The use of HPI to predict IOH before its actual occurrence allows the anesthesia team to proactively prevent it. Using advanced hemodynamic monitoring may also decrease intra-op hypertensive events. This is associated with a lower prevalence of post-op complications and decreased length of stay.

## Session 3 | Quality/Safety/Value/Complications Abstracts

| Table 1 | Non-HPI | HPI | |
|---|---|---|---|
| | 70 | 47 | |
| Males, N (%) | 38 (54%) | 24 (51%) | 0.850 |
| Age, Mean (SD) | 62.0 (11.9) | 61.1 (13.0) | 0.358 |
| Body Mass Index, kg/m2, Mean (SD) | 31.9 (6.4) | 32.6 (7.2) | 0.216 |
| ASA Grade, Mean (SD) | 2.8 (0.6) | 2.9 (0.5) | 0.210 |
| Number of Surgical Levels, Mean (SD) | 4.6 (2.6) | 4.4 (2.4) | 0.593 |
| Estimated Blood Loss, mL, Mean (SD) | 556.3 (445.2) | 611.3 (619.0) | 0.601 |
| Operative time, minutes, Mean (SD) | 260.2 (87.2) | 267.8 (88.0) | 0.649 |

| Table 2 | Non-HPI | HPI | |
|---|---|---|---|
| | Mean (SD) | Mean (SD) | |
| Duration of hypotension, mins | 13.5 (19.1) | 8.1 (10.7) | **0.029** |
| Duration of hypertension (MAP≥140mmHg), mins | 1.4 (3.23, 0-17) | 0.5 (1.0, 0-5) | **0.032** |
| Intra-operative | | | |
| Intravenous Fluids, mL | 2644.1 (858.7) | 2780.0 (751.0) | 0.184 |
| Colloids, mL | 357.1 (293.6) | 457.4 (326.9) | **0.047** |
| pRBC transfused, mL | 96.0 (200.9) | 116.8 (231.4) | 0.348 |
| Cell Saver Infused, mL | 192.4 (237.1) | 206.1 (235.5) | 0.123 |
| Fresh Frozen Plasma, mL | 0 | 7.2 (49.3) | 0.161 |
| Vasopressors, mcg | 912.2 (2671.4) | 530.2 (453.2) | 0.294 |
| Post-operative | | | |
| Intravenous Fluids, mL | 251.4 (194.2) | 183.3 (165.2) | 0.179 |
| Colloids, mL | 57.5 (362.5) | 16.0 (80.8) | 0.161 |
| pRBC transfused, mL | 48.0 (125.9) | 59.6 (174.5) | 0.383 |
| Fresh Frozen Plasma, mL | 0 | 23.8 (163.4) | 0.169 |
| Urine Output, mL | 619.8 (475.5) | 819.1 (542.5) | **0.022** |
| Urine Output, mL/Kg/Hr | 1.7 (1.3) | 2.3 (1.7) | **0.020** |
| Length of Hospital stay, days | 6.0 (4.4) | 4.6 (2.4) | **0.017** |

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 40. Posterior Spinal Fusion Outcomes in Boys and Girls: Should We Be Treating Them the Same?

Julia Todderud, BA; Harms Study Group; Michelle Claire Marks, PT; *Nicholas D. Fletcher, MD*; Peter O. Newton, MD; A. Noelle Larson, MD

### Hypothesis

Female patients will have better post-operative outcomes such as curve correction and rates of complications when compared to male patients.

### Design

Prospective, multicenter study.

### Introduction

Posterior spinal fusion for management of adolescent idiopathic scoliosis has continued to advance and improve outcomes for pediatric patients. With this study, we aim to compare and provide current evaluations regarding the perioperative outcomes of spinal fusion for girls and boys.

### Methods

This study employed a review of prospectively collected data for patients who underwent posterior spinal fusion at 23 sites between 2002 and 2021. All patients had preoperative and two-year follow-up and were evaluated for curve correction, complications, surgery metrics, and patient reported outcomes. We only included patients with Cobb angles between 40-60 degrees in order to achieve matched cohorts.

### Results

A total 2269 patients were included in this study: 1833 girls, 436 boys. At time of surgery, mean age was 15.1 years for girls and 16.3 years for boys. Boys were significantly taller and heavier than the girls. Preoperative curve magnitude was similar between the two groups (major Cobb 50.3 in girls and 50.8 in boys, p=0.09). Boys had a greater number of levels fused (10.8 vs 10.6), longer operative times (275.2 minutes versus 256.8 minutes), shorter post-operative stays (4.3 days vs 4.7 days), and greater estimated blood loss (1023 ml versus 678.9 ml) compared to girls. At two-year follow-up, there was no significant difference between girls and boys for proximal thoracic, thoracic, and lumbar Cobb values. SRS scores for patient reported outcomes were similar in boys and girls. 236 girls experienced complications compared to 47 boys (12.9% versus 10.8% of their cohorts, p=0.23). Boys had higher complication rates related to medical and transfusion complications, while in all other categories girls had higher rates.

### Conclusion

At two-years following spinal fusion for AIS, boys and girls exhibit similar percent curve correction and SRS scores. Boys have greater body habitus, longer surgeries, and greater blood loss, but shorter post-operative stays.

## Session 3 | Quality/Safety/Value/Complications Abstracts

| | | Girls | Boys | P -Value |
|---|---|---|---|---|
| **N of Patients** | | **1833** | **436** | - |
| Age at Surgery | | 15.1 | 16.3 | **<0.001** |
| Height Initial (cm) | | 160.8 | 172.0 | **<0.001** |
| Weight Initial (kg) | | 55.2 | 64.4 | **<0.001** |
| N Levels Instrumented | | 10.6 | 10.8 | **0.019** |
| Stay (Days) | | 4.7 | 4.3 | **<0.001** |
| Surgery Time (min) | | 256.8 | 275.2 | **<0.001** |
| EBL (mL) | | 678.9 | 1023.0 | **<0.001** |
| Initial Cobb | Prox Thoracic | 23.6 | 25.4 | **0.002** |
| | Thoracic | 46.8 | 47.5 | 0.171 |
| | Lumbar | 36.9 | 34.6 | **<0.001** |
| Initial Cobb | Major Curve | 50.3 | 50.8 | 0.09 |
| 2 Year Cobb | Prox Thoracic | 15.4 | 14.9 | 0.232 |
| | Thoracic | 20.1 | 19.6 | 0.278 |
| | Lumbar | 16.0 | 16.0 | 0.989 |
| 2 Year Cobb | Major Curve | 22.8 | 22.5 | 0.45 |
| % Correction | Thoracic | 52.4% | 55.0% | 0.089 |
| | Lumbar | 51.3% | 46.7% | **0.028** |
| SRS Score at 2 Years | Pain | 4.4 | 4.4 | 0.985 |
| | Self-Image | 4.4 | 4.4 | 0.210 |
| | Function | 4.5 | 4.5 | 0.815 |
| | Mental Health | 4.2 | 4.1 | 0.612 |
| | Satisfaction | 4.6 | 4.6 | 0.786 |

Table 1: Perioperative values for population characteristics, operative metrics, curve measurements, correction, and patient-reported outcomes.

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 41. Artificial Intelligence and Pediatric Scoliosis Education: A Comparative Analysis Assessing the Accuracy of AI-Generated Information

Xochitl M. Bryson, BA; Marleni Albarran, BS; Nicole S. Pham, MPH; Taylor R. Johnson, MD; Grant D. Hogue, MD; Jaysson T. Brooks, MD; Kali R. Tileston, MD; Craig R. Louer, MD; Ron El-Hawary, MD; Meghan N. Imrie, MD; James F. Policy, MD; Daniel Bouton, MD; Arun R. Hariharan, MD; Sara Van Nortwick, MD; Vidyadhar V. Upasani, MD; Jennifer M. Bauer, MD; Andrew Tice, MD; *John S. Vorhies, MD*

### Hypothesis
Artificial intelligence language models provide reliable responses to frequently asked questions about pediatric scoliosis

### Design
Survey

### Introduction
Artificial intelligence(AI) large language models (LLM) are increasingly popular. Patients and families are increasingly likely to use LLM when conducting internet-based research, so it is important to understand the abilities and limitations of this technology in disseminating accurate medical information. We used an expert panel to compare LLM-generated and society-authored responses to frequently asked questions about pediatric scoliosis.

### Methods
We used 3 publicly available LLMs to answer 15 frequently asked questions (FAQs) regarding pediatric scoliosis. The FAQs were from the Pediatric Orthopedics Society of North America, Scoliosis Research Society, American Academy of Orthopaedic Surgeons, and the Pediatric Spine Foundation. We gave minimal training to LLM, only specifying the response length and requesting answers at a 5th-grade reading level. A 15-question survey was distributed to an expert panel, who were given an AI and a physician-generated response and asked to select which they preferred or neither. They were asked to individually grade their agreement with their responses on a Likert scale.

### Results
Panel members had a mean of 9.9 years of experience post-fellowship (range: 3-23 years). Overall the panel reported equivalent agreement with AI generated vs physician-generated responses (Figure 1). For 40% of questions the panel favored physician written responses and for 33% it favored AI. For 20% of questions the panel felt responses were equally good and for 7% there was a tie between AI and "equally good". For one physician-generated response and one AI-generated response, the error bars of the expert panel mean score for accuracy and appropriateness fell below neutral, indicating a consensus near disagreement with the response.

### Conclusion
The expert panel review, AI delivered accurate and appropriate responses as frequently as physician-authored FAQ responses from professional Society websites. In two instances, AI responses were perceived as more appropriate and favorable. Further research and greater sample size are needed to assess the reliability and precision of AI in addressing commonly asked questions.

## Session 3 | Quality/Safety/Value/Complications Abstracts

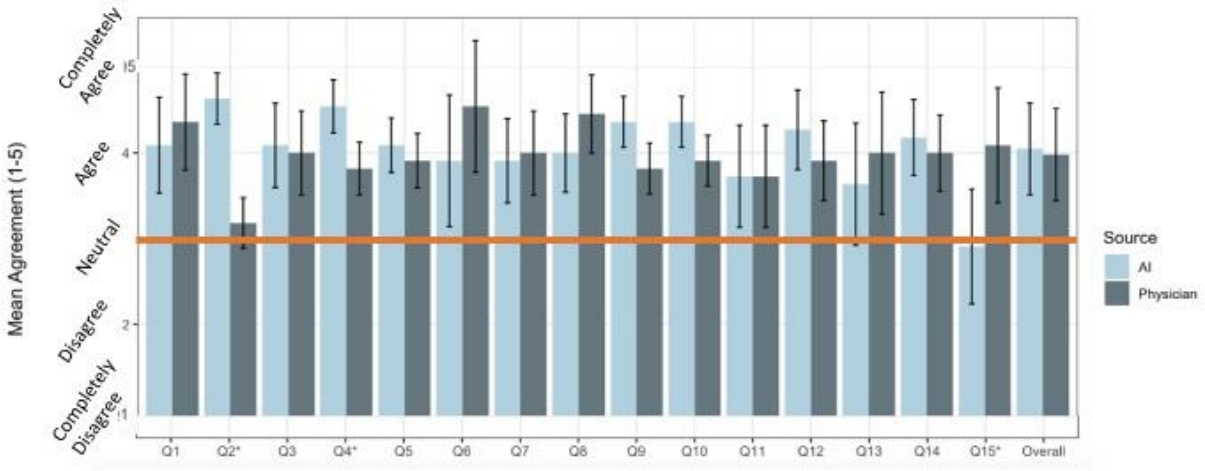



Figure 1A

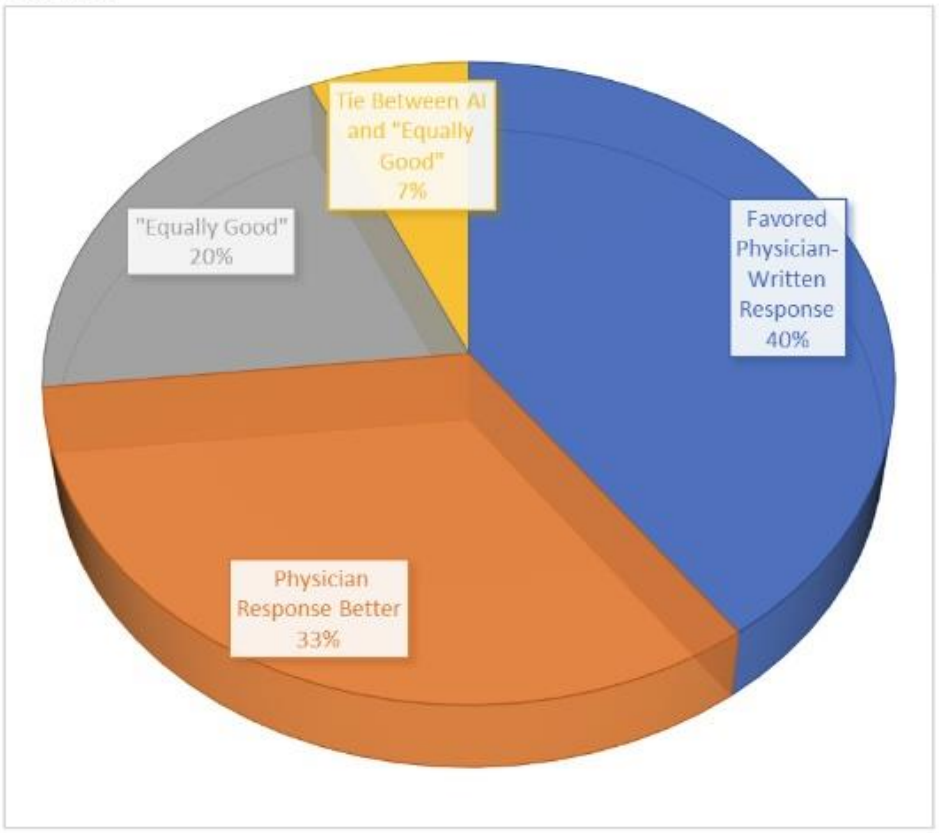



Figure 1B

Figure1A: Panelist agreement with FAQ responses 1- 5 1B: preference for AI versus physician responses

# Session 3 | Quality/Safety/Value/Complications Abstracts

## 42. Risk Stratification for Early Postoperative Infection in Pediatric Spinal Deformity Correction: Development and Validation of the Pediatric Scoliosis Infection Risk Score (PSIR Score)

*Vivien Chan, MD, MS, FRCS(C)*; Geoffrey Shumilak, MD, FRCPC, MPh; Matiar Jafari, MD, PhD; Michael G. Fehlings, MD, PhD, FRCS(C); Michael Yang, MD, MS, FRCS(C), MBiotech; David L. Skaggs, MD, MMM

### Hypothesis
The objective of this study was to investigate factors associated with 30-day postoperative infection in pediatric patients who received posterior spinal deformity correction to create and validate a predictive model.

### Design
Retrospective review of prospectively collected data.

### Introduction
Postoperative infection after spinal deformity correction in pediatric patients is associated with significant costs. Identifying risk factors associated with postoperative infection would help surgeons identify high-risk patients that may require interventions to minimize infection risk.

### Methods
The NSQIP Pediatric database for years 2016-2021 was used for this study. Patients were included if they received posterior arthrodesis for scoliosis or kyphosis correction. The outcome of interest was 30-day postoperative infection. Multivariable logistic regression analysis using likelihood ratio backward selection method was used to identify significant risk factors for 30-day infection to create the Pediatric Scoliosis Infection Risk Score (PSIR Score). ROC curve analysis, predicted probabilities, and Hosmer Lemeshow goodness-of-fit test were done to assess the scoring system on a validation cohort.

### Results
A total of 31,742 patients were included in the study. The 30-day infection rate was 2.2%. Reoperation rate in patients who had a post-operative infection was 59.4%. In our multivariable regression analysis, high BMI (OR=1.01, p<0.001), presence of open wound (OR=3.18, p<0.001), presence of ostomy (OR=1.51, p<0.001), neuromuscular etiology (OR=1.56, p=0.009), previous operation (OR=1.74, p<0.001), increasing ASA class (OR=1.43, p<0.001), increasing operation time in hours (OR=1.11, p<0.001), and use of only minimally invasive techniques (OR=4.26, p<0.001) were associated with increased risk of 30-day post-operative infection. Intraoperative antibiotics (B=0.71, p=0.003) were associated with reduced risk of 30-day postoperative infection. The area under the curve was 0.780 and 0.740 for the derivation cohort and validation cohort, respectively.

### Conclusion
We found 5 patient factors and 3 surgeon-controlled factors associated with risk. The Pediatric Scoliosis Infection Risk Score (PSIR) Score can be applied for risk stratification and to investigate implementation of novel protocols to reduce infection rates in high-risk patients.