Full Text Abstracts: BEST PAPERS

PAPER #1

Spinal Surgery Complications: An Unsolved Problem. Is the World Health Organization Safety Surgical Checklist a Useful Tool to Reduce Them?

Giovanni Barbanti Brodano[1], Cristiana Griffoni[1], Jarkko Halme[2], Giuseppe Tedesco[1], Silvia Terzi[1], Stefano Bandiera[1], Riccardo Ghermandi[1], Gisberto Evangelisti[1], Marco Girolami[1], Valerio Pipola[1], Alessandro Gasbarrini[1], and Asdrubal Falavigna[3]

[1]Department of Oncological and Degenerative Spine Surgery, IRCCS Istituto Ortopedico Rizzoli, [2]Department of Orthopaedic Trauma and Hand Surgery, Kuopio University Hospital, [3]Department of Neurosurgery, University of Caxias do Sul

Disclosures: G. Barbanti Brodano: None. **C. Griffoni:** None. **J. Halme:** None. **G. Tedesco:** None. **S. Terzi:** None. **S. Bandiera:** None. **R. Ghermandi:** None. **G. Evangelisti:** None. **M. Girolami:** None. **V. Pipola:** None. **A. Gasbarrini:** None. **A. Falavigna:** None.

INTRODUCTION: To face the problem of surgical complications, which is generally relevant in surgical fields, an intraoperative checklist (Safety Surgical Checklist, SSC) was elaborated and released by the World Health Organization in 2008, and its use has been described in 2009. In our Institution, the WHO SSC was introduced in 2011. In spinal surgery, many preventive measures were investigated to reduce complications, but there is no report on the effectiveness of the WHO checklist in reducing complications.

AIMS/OBJECTIVES: The aim of this study was to compare the incidence of complications between the two periods, from January to December 2010 (without checklist) and from January 2011 to December 2012 (with checklist), in order to assess the checklist effectiveness.

METHODS: A retrospective and single center study was carried out on patients who underwent spinal surgery during the three-year period from January 2010 to December 2012. Patients were classified according to the spine pathology and the different presentation of the complication. We registered the complications arising in patients treated from 2010 to 2012 during a 3 years follow up period for each patient, assessing the possible differences before and after the checklist's introduction.

RESULTS: The sample size was 917 patients, the mean age was 52.88 years. The majority of procedures were performed for oncological diseases (54.4%) and degenerative diseases (39.8%). 159 complications in total were detected (17.3%). The overall incidence of complications for trauma, infectious pathology, oncology, and degenerative disease was 22.2%, 19.2%, 18.4%, and 15.3%, respectively. No correlation was observed between the type of pathology and the complication incidence. We observed a reduction of the overall incidence of complications following the introduction of the SSC: in 2010 without checklist, the incidence of complications was 24.2%, while in 2011 and 2012, following the checklist introduction, the incidence of complications was 16.7% and 11.7%, respectively (mean 14.2%).

CONCLUSIONS: Despite the limitations of the study, in particular the impossibility to carry out a randomized study, SSC seems to be an effective tool to reduce complications in spinal surgery. We propose to extend the use of checklist system also to the pre-operative and post-operative phases in order to further reduce the incidence of complications.

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PAPER #2

Concussive Injury to the Spinal Cord During Pediatric Spinal Surgery for Adolescent Idiopathic Scoliosis: A Rare Complication That Recovers Quickly

Robert Cho, Martin Morrison, Marty Herman, David Lazarus, and Selina Poon

Shriners for Children Medical Center

Disclosures: R. Cho: DePuy Synthes Spine (C), Ergobaby (C), Nuvasive (C), OrthoPediatrics (C), Prosidyan (C). **M. Morrison:** None. **M. Herman:** None. **D. Lazarus:** None. **S. Poon:** None.

INTRODUCTION: Posterior spinal fusion with instrumentation is the procedure of choice for most pediatric patients with scoliosis. Iatrogenic injury to the spinal cord is rare, but is usually associated with screw misposition or secondary to the corrective maneuver used and the resultant spinal cord stretch. Direct concussive injury to the spinal cord is rare and has not been reported in the literature previously.

AIMS/OBJECTIVES: To describe cases of patients who had sustained a direct concussive impact to the spinal cord during posterior spinal fusion with instrumentation which led to rapid loss of TcMEP signals.

METHODS: Five patients who underwent posterior spinal fusion with instrumentation for adolescent idiopathic scoliosis were treated at four institutions. Each patient had a direct concussive injury to the spinal cord secondary to an instrument used during surgery (gearshift pedicle probe, ball-tipped feeler probe, Frazier suction tip). Within 1–15 minutes, a decrease in TcMEP was noted in all 5 patients. Four patients experienced a subsequent decrease in SSEP as well. Surgery was aborted in all 5 cases after appropriate management of signal loss (blood pressure increase, warming spinal cord, removal of implants) and each patient was closed.

RESULTS: Initial postoperative neurologic deficit was noted on all 5 patients, ranging from weakness of an entire lower extremity with sensory changes, to loss of a particular muscle group with no sensory changes. Within 4–7 days, all patients had complete or near complete return of neurologic function. All patients were taken back to the operating room between 7–10 days for completion of the index procedure. No patients had TcMEP changes during the second procedure. Four of the five patients were within preoperative neurologic baseline at the completion of the procedure, and the last patient had complete return of sensory function by six weeks after the surgery.

CONCLUSIONS: Concussive injury to the spinal cord during pediatric spinal fusion with instrumentation for adolescent idiopathic scoliosis is a rare complication that results in immediate TcMEP changes with subsequent SSEP changes in most cases. These patients should be closed after appropriate spinal cord management for signal loss. The postoperative neurologic injury recovers completely or nearly completely within 4–7 days and it is safe to proceed with completion of the index procedure after 7–10 days.

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PAPER #3

Does a Surgeon's Performance and Patient Outcomes Improve with Dashboard Reporting?

Michelle Marks[1], Maty Petcharaporn[1], Mary Dalupang[1], Monica Lee[1], Ronald Lehman[2], Larry Lenke[2], Salil Upasani[3], Suken Shah[4], Tracey Bastrom[3], and **Peter Newton[3]**

[1]Setting Scoliosis Straight, [2]Columbia University, [3]Rady Children's Hospital, [4]Nemours AI DuPont Hosp for Children

Disclosures: M. Marks: Scoliosis Research Society (F), Setting Scoliosis Straight Foundation (G). **M. Petcharaporn:** Setting Scoliosis Straight (G). **M. Dalupang:** Setting Scoliosis Straight (G). **M. Lee:** Setting Scoliosis Straight (G). **R. Lehman:** DOD (A), Medtronic (C, I), Stryker (I). **L. Lenke:** AOSpine (A, F, I), Broadwater (F), EOS (B), Evans Family Donation (A), Fox Family Foundation (A), Fox Rothschild, LLC (F), Medtronic (C, I), Quality Medical Publishing (I), Scoliosis Research Society (A, F), Seattle Science Foundation (F), Setting Scoliosis Straight Foundation (A), Stryker Spine (F), The Spinal Research Foundation (F). **S. Upasani:** Broadwater (F); DePuy Synthes Spine (F), EOS Imaging (B), Globus Medical (C), Imagen (D), NuVasive (F), nView (B), Orthopediatrics (C, F, B, I), Wolters Kluwer Health—Lippincott Williams & Wilkins (I). **S. Shah:** DePuy Synthes Spine (A, B, C, F, I), Globus (I), Stryker K2M (A, F, I). **T. Bastrom:** None. **P. Newton:** DePuy Synthes Spine (B, C, I), EOS Imaging (B), Orthopediatrics (B), Stryker K2M (B, C, I).

INTRODUCTION: A dashboard reporting quality improvement (QI) initiative was evaluated following eight years of participation.

AIMS/OBJECTIVES: The aim of this analysis was to test the following hypothesis: Surgeon performance and patient outcomes will improve following surgeon participation in a quality improvement program.

METHODS: Design: Retrospective analysis of prospectively collected data. Methods: Data collected as a part of a prospective, multicenter, research study evaluating surgical outcomes of AIS was utilized to launch a QI initiative for surgeons. Annual dashboard reports were generated with consecutively enrolled patient data during a year. The dashboard report plots a surgeon's data against others with surgeon performance outcome variables including operating room time (OR Time), length of hospitalization (LOH), blood loss (BL), and primary major curve correction at 2 years post-op. Patient reported outcome measures (PROM) via SRS 22r questionnaire were evaluated for pre to postoperative changes. A mixed model analysis compared averages and Levene's test evaluated variance across years.

RESULTS: The data for nine surgeons who were provided annual dashboard reports from 2011 to 2018 were used in this analysis. The surgeons' average length of time in practice when the dashboard reporting was initiated was 15 years (range 4–40). A total of 1,381 patients were included. The average number of patients included per year per each surgeon was 19 (range 4–45). Across eight years of reporting, these improvements in performance were observed: 18% (53 minute) reduction in average OR time, 36% reduction in average LOH (2 day reduction in average stay) (p=0.007), 49% (433 ccs) reduction in average BL (p=0.002), 6% improvement in major coronal curve correction and improvements in preoperative to postoperative changes in the domains of the PROM ranging from 6%–33%. Wide variations in practices associated with BL and LOH were identified and BPGs for perioperative care were developed through a Delphi process. Implementation of a Best Practice Guideline (BPG) for BL led to a significant reduction of the variance (p=0.003).

CONCLUSIONS: Surgeon dashboards and implementation of BPGs demonstrated improvement of all nine surgeons and decreased variation over eight years. Take Home Message: Implementation of a dashboard reporting quality improvement program resulted in statistically significant improvements in patient outcomes and improved standardization of care.

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Full Text Abstracts: BEST PAPERS

PAPER #4

A Multidisciplinary Spine Surgical Indications Conference Leads to Alterations in Surgical Plans in a Significant Number of Cases

Joshua Benton, Rafael De La Garza Ramos, Yaroslav Gelfand, Erida Castro-Rivas, Mark Headlam, Lavinia Williams, Phillip Cezayirli, Murray Echt, Reza Yassari, and Vijay Yanamadala

Neurological Surgery, Montefiore Medical Center

Disclosures: J. Benton: None. **R. De La Garza Ramos:** None. **Y. Gelfand:** None. **E. Castro-Rivas:** None. **M. Headlam:** None. **L. Williams:** None. **P. Cezayirli:** None. **M. Echt:** None. **R. Yassari:** None. **V. Yanamadala:** None.

INTRODUCTION: Determining the optimal spine procedure for patients can often be difficult. Multidisciplinary decision making has previously demonstrated optimization of surgical planning. The input of multiple spine specialists may significantly change and improve this decision making process. We performed a single institution study to determine how a weekly spine surgery indication conference affects surgical planning.

AIMS/OBJECTIVES: To characterize the impact of a weekly multidisciplinary spine surgical indications conference on surgical planning for elective spine procedures.

METHODS: We reviewed consecutive cases at our institution's weekly spine surgery indications conference from September - November 2019 where three neurosurgical and three orthopedic spine surgeons discuss each upcoming surgery. The initial surgical decisions were documented prospectively. Every elective surgery at the institution was presented and each surgeon voiced their opinion before a group consensus decision was made on how to proceed. Patient demographics, comorbidities, surgeon specific information, the proposed surgery, invasiveness rating, and group consensus for each surgery were collected. Descriptive statistics were performed for the group's decision to accept or alter a proposed surgery. A binomial test was utilized to determine if the number of altered surgical cases significantly differed from zero. Univariate analysis was performed using chi-squared tests and Fisher's exact test for categorical variables and t-tests and Wilcoxon rank-sum test for continuous variables to compare differences between surgical cases approved without changes and those that the group altered.

RESULTS: A total of 100 consecutive cases were reviewed. The mean age was 58.2 and 27% of patients were male. Nineteen cases (19%) were altered based upon group consensus. Analysis with a binomial test indicated that the multidisciplinary group altered a statistically significant number of surgeries ($p < 0.001$). The group suggested alterations that increased the surgery's invasiveness in seven cases (36.8%) and elected to decrease or maintain the same level of invasiveness the other 12 cases (63.2%). No variables were associated with an increased incidence of procedure alteration.

CONCLUSIONS: Multispecialty indication conferences may improve the spine surgery planning process by offering surgeons feedback on their surgical decision and allowing them to optimize their surgical plan.

Full Text Abstracts: BEST PAPERS

PAPER #5

An Expedited Recovery Pathway to Greatly Reduce Length of Stay After Adult Spinal Deformity Surgery: The Hospital for Special Surgery Approach

Han Jo Kim, Michael Steinhaus, Jonathan Charles Elysee, Renaud Lafage, Ananth Puyala, Sachin Shah, Sharlynn Tuohy, Michael Urban, Chad Craig, Virginie Lafage, and Francis Lovecchio

Hospital for Special Surgery

Disclosures: H. Kim: ISSGF (A), K2M (C), Zimmer (I). **M. Steinhaus:** None. **J. Elysee:** None. **R. Lafage:** None. **A. Puyala:** None. **S. Shah:** None. **S. Tuohy:** None. **M. Urban:** None. **C. Craig:** None. **V. Lafage:** DePuy (F), Globus Medical (C), Nuvasive (I), Permanente Medical Group (F). **F. Lovecchio:** None.

INTRODUCTION: Clinical care pathways ensure that hospitals maximize the incentives of bundled payment models while maintaining high-quality patient care. However, spine surgery enhanced recovery pathways have not been shown to uniformly reduce LOS, a critical component of the cost equation

AIMS/OBJECTIVES: To determine the efficacy of a novel inpatient clinical care pathway on reducing length of stay after adult deformity surgery

METHODS: 40 patients who underwent ≥5 levels of fusion to the pelvis (single-stage, open posterior approach) were analyzed to determine the effect of a clinical care pathway targeted at reducing LOS. Patients were followed throughout their hospital stay and out for 90 days to evaluate our primary outcomes of length of stay and 90-day readmissions. The pathway involved participation by anesthesiology, hospital medicine, and physical therapy, and was designed to achieve goals previously associated with decreased LOS in a historical cohort (e.g. low EBL, short OR time, avoidance of ICU postoperatively, and early mobilization). In addition, patients began therapy sessions on POD0, were given postop IV acetaminophen, ketorolac, and dexamethasone, and worked with case management to facilitate home discharge. Patients were matched 1:1 to a historical cohort based on demographics, medical comorbidities, radiographic alignment parameters, and surgical factors, and outcomes were compared.

RESULTS: After matching, gender, BMI, ASA class, use of preop narcotics, day of surgery, sagittal alignment parameters, rate of revision surgery, three-column osteotomies, and interbody fusions were comparable between the cohorts ($p>0.05$). Length of stay was shorter in the expedited care (EC) cohort (4.5±1.3 vs. 7.3±4.4 days, $p=0.010$). The EC cohort also had less EBL (920±640 vs. 1437±555, $p=0.004$). 15% of EC patients ambulated POD0 and 85% ambulated POD1, compared with 55% of historical (H) cohort patients ambulating POD1 and 45% POD2 or more ($p=0.010$). No EC patient went to the ICU from the OR, compared with 30% of H patients ($p=0.022$). 90-day complications were comparable between the cohorts ($p>0.05$). No readmissions occurred in either cohort.

CONCLUSIONS: The described clinical care pathway can lead to dramatic reductions in LOS after long fusions to the pelvis, improving the value of ASD surgery. This study also provides further evidence that EBL, OR time, ICU stays, and early mobilization are strongly associated with LOS, and that care protocols designed to target those factors should reliably lead to reductions in LOS.

Full Text Abstracts: E-POSTERS

A large number of high-quality abstracts were submitted for presentation at the course. Due to time constraints, only five were selected for podium presentation as the Best Papers. Several authors were therefore invited to submit E-Posters for the Online Syllabus.

E-POSTER #1

The Patient Demographics, Radiographic Index and Surgical Invasiveness for Mechanical Failure (PRISM) Model Established for Adult Spinal Deformity Surgery

Mitsuru Yagi, Masaya Nakamura, Morio Matsumoto, and Kota Watanabe
Department of Orthopedic Surgery, Keio University School of Medicine
Disclosures: M. Yagi: None. **M. Nakamura:** None. **M. Matsumoto:** None. K. **Watanabe:** None.

INTRODUCTION: Mechanical failure (MF) following adult spinal deformity (ASD) surgery is a severe postoperative complication and often requires revision surgery. Predicting a patient's risk of MF is difficult, despite several potential risk factors that have been reported.

AIMS/OBJECTIVES: This study aimed to establish risk stratification model for predicting the risk of MF based on demographic and radiographic data from a retrospective case series.

METHODS: This is a multicenter retrospective review of the risk stratification for MF and included 321 surgically treated ASD patients (55 ± 19 yr, female: 91%). The analyzed variables were recorded for at least 2 yrs and included age, gender, BMI, BMD, smoking status, frailty, fusion level, revision surgery, PSO, LIF, previous surgery, spinal alignment, GAP score, Schwab-SRS type, and rod materials. Multivariate logistic regression analyses were performed to identify the independent risk factors for MF. Each risk factor was assigned a value based on its regression coefficient, and the values of all risk factors were summed to obtain the PRISM score (range 0-12). We used an 8:2 ratio to split the data into a training and a testing cohort to establish and validate the model. We evaluated the discriminative ability of the PRISM score based on the area under the receiver operating characteristic curve (AUROC). Linear regression analysis and the Cuzick test were performed to analyze whether there is a trend between the PRISM score and the incidence of MF.

RESULTS: MF developed in 41% (n=104) of the training subjects. The most common MF was PJK (n=55, 21%), and the second common was RF (n=33, 13%). Thirty-nine (38%) patients developed more than two MFs and 33 of the MF group patients (32%) required unplanned additional surgeries to treat the MFs. Multivariate analysis revealed that BMI, BMD, PT, and frailty were independent risk factors for MF (BMI: OR 1.7 [1.0-2.9], BMD: OR 3.8 [1.9-7.7], PT: OR 2.6 [1.8-3.9], frailty: OR 1.9 [1.1-3.2]). The MF rate increased with and correlated well with the risk grade as shown by ROC curve (r2 = .96, AUC of .81 [95% CI .76–.86]). The discriminative ability of the score in the testing cohort was also good (AUC of .86 ([95% CI .77–.95], r2 = .87).

CONCLUSIONS: The newly established risk-stratification scoring model can predict MF following ASD surgery using individual demographics and radiographic parameters as well as surgical description data that would normally be collected routinely when considering surgical treatment for a patient with ASD. This model can help surgeons identify patients with a high risk of MF and treat modifiable risk variables to mitigate the risk of MF following ASD surgery.

E-POSTER #2

Deformity Angular Ratio is Associated with Neuromonitoring Changes without a Vertebral Column Resection: Spinal Deformity is More Influential than Type of Surgery

Ali Siddiqui, Kenneth Illingworth, David Skaggs, Vernon Tolo, and Lindsay Andras

Children's Hospital Los Angeles

Disclosures: A. Siddiqui: None. **K. Illingworth:** None. **D. Skaggs:** CHLA Foundation (H), Grand Rounds (C), Green Sun Medical (D), Growing Spine Foundation/Growing Spine Study Group (H), Journal of Children's Orthopaedics (H), Medtronic (I), Nuvasive (A), Orthobullets (H, C, D), Orthopedics Today (H), Spine Deformity (H), Wolters Kluwer Health (I), ZimmerBiomet (I, C, F), Zipline Medical, Inc (D). **V. Tolo:** Journal of Bone and Joint Surgery —American (I), Wolters Kluwer Health—Lippincott Williams & Wilkins (I). **L. Andras:** Zimmer Biomet (C, F), Eli Lilly (D), Journal of Pediatric Orthopedics (H), Medtronic (C, F), Nuvasive (C, F), Orthobullets (I), Pediatric Orthopaedic Society of North America (F), Scoliosis Research Society (F).

INTRODUCTION: Lewis (2015) and Wang (2016) et al. reported that the deformity angular ratio (DAR=Cobb angle divided by levels of deformity), predicts intraoperative neuromonitoring (IONM) signal loss during 3 column osteotomies (3CO).

AIMS/OBJECTIVES: Our purpose was to investigate the effect of DAR on IONM changes during posterior spinal fusion (PSF) without vertebral column resection (VCR).

METHODS: Retrospective review of PSF patients without 3CO or VCR for severe spinal deformity between October 2008 and February 2018. Exclusion criteria were prior instrumentation and lack of baseline IONM. Total DAR was defined as the sum of coronal DAR and sagittal DAR. IONM signal loss was defined as decrease of greater than 50% in somatosensory evoked potentials or trans-cranial motor evoked potentials.

RESULTS: 253 patients with mean age 13.7 years met inclusion criteria. 47/253 (18.6%) patients had IONM loss. Of these, 41/253 (16.2%) had return to baseline intraoperatively, and 6/253 (2.4%) did not return to baseline. Intraoperative wake-up test was performed in 7 cases, on which 3/7 (43%) had a neurological deficit. All neurological deficits resolved at mean 41.0 days postoperatively. IONM loss was associated with increased sagittal DAR (p = 0.03) and total DAR (p = 0.005), but not coronal DAR (p = 0.06). Increased risk of IONM loss was seen with sagittal DAR >7 (p=0.02) or total DAR >27 (p = 0.02). 24/92 (26%) patients with sagittal DAR>7 had intraoperative signal loss compared to 23/161 (14%) with sagittal DAR≤ 7 (OR, 2.1; 95% CI, 1.1-4.0). 7/16 (44%) of patients with total DAR >27 had signal loss compared to 40/237 (17%) patients with total DAR ≤27 (OR, 3.8; 95% CI, 1.3-10.9).

CONCLUSIONS: Similar to reports by Lewis and Wang et al. of patients undergoing VCR, both sagittal DAR (>7) and total DAR (>27) were found to be highly predictive of intraoperative neuromonitoring signal loss in patients undergoing PSF without VCR. Overall, patients with a high sagittal or total DAR are at increased risk of IONM signal loss during PSF even in the absence of a VCR.

E-POSTER #3

Do Routine Nutrition Consults for Neuromuscular Scoliosis Help the Patient or Just the Rankings?

Kavish Gupta, David Skaggs, Stephen Stephan, Kenneth Illingworth, and Lindsay Andras

Children's Hospital Los Angeles

Disclosures: K. Gupta: None. **D. Skaggs:** CHLA Foundation (H), Grand Rounds (C), Green Sun Medical (D), Growing Spine Foundation/Growing Spine Study Group (H), Journal of Children's Orthopaedics (H), Medtronic (I), Nuvasive (A), Orthobullets (H, C, D), Orthopedics Today (H), Spine Deformity (H), Wolters Kluwer Health (I), ZimmerBiomet (I, C, F), Zipline Medical, Inc (D). **S. Stephan:** None. **K. Illingworth:** None. **L. Andras:** Zimmer Biomet (C, F), Eli Lilly (D), Journal of Pediatric Orthopedics (H), Medtronic (C, F), Nuvasive (C, F), Orthobullets (I), Pediatric Orthopaedic Society of North America (H), Scoliosis Research Society (F).

INTRODUCTION: Optimization of patients' nutritional status has been recommended as part of the preoperative evaluation for neuromuscular scoliosis (NMS) patients undergoing posterior spinal fusion (PSF).

AIMS/OBJECTIVES: This study aims to investigate the efficacy of nutrition consults on preoperative weight gain and outcomes for NMS patients undergoing PSF.

METHODS: A retrospective chart review was conducted on NMS patients < 18 years old who underwent PSF from 2004–2018. Charts were reviewed for height and weight at 12, 6 and 3 months prior to surgery, methods of nutritional optimization and post-operative complications.

RESULTS: 243 patients met inclusion criteria. 46% (111/243) received a preoperative nutrition consult and 54% (132/243) did not. Mean age at time of surgery was 13.8 ± 2.4 (range: 9.0-17.9). Preoperative nutrition consults led to g-tube placement in 4.5% (5/111) of patients. Mean preoperative BMI of those who received a nutrition consult at 12, 6 and 3 months prior to surgery was 17.5, 19.0 and 18.6 respectively. Mean BMI of those who did not was 18.4, 19.2 and 19.7 at 12, 6 and 3 months preoperatively. There were no differences in 12-month (p=.66), 6-month (p=.79) or 3-month (p=.29) preoperative change in BMI. There were also no differences in 12-month (p=.10), 6-month (p=.20) or 3-month (p=.10) preoperative change in absolute weight. The incidence of infection (p=.52), implant-related complications (p=.12), wound complications (p=.35), reoperation (p=.44) and length of hospital stay (p=.08) between groups were similar.

CONCLUSIONS: Nutrition consults for NMS patients undergoing PSF did not significantly improve preoperative weight gain and no statistically significant differences in complication rates, reoperation rate or length of hospital stay were observed.

E-POSTER #4

Improving Blood Product Utilization at an Ambulatory Surgery Center: A Retrospective Cohort Study on 50 Patients with Lumbar Disc Replacement

Benjamin Dorenkamp[1], Madisen Janssen[2], and Michael Janssen[3]

[1]Orthopedic Surgery, Michigan State University, [2]Rocky Vista University College of Osteopathic Medicine, [3]Center for Spine & Orthopedics

Disclosures: B. Dorenkamp: None. **M. Janssen:** None. **M. Janssen:** Centinel (A), Cerapedics (A, C), Simplify (A, C).

INTRODUCTION: There is minimal literature discussing anterior lumbar spine surgery in ambulatory surgery centers (ASCs). The main concern with the anterior approach to the lumbar spine is the potential for injury to the great vessels. In our facility, there are two units of crossmatched blood and cell saver available during the procedure. We retrospectively reviewed 50 cases of lumbar total disc arthroplasty (TDA) in our ASC to determine utilization of blood products.

AIMS/OBJECTIVES: Determine utilization of blood products during anterior lumbar TDA in the ASC.

METHODS: 50 patients who underwent a lumbar TDA at an ASC were reviewed. Surgeries completed at the ASC were all transferred from the post anesthesia care unit to an attached convalescence care center which allows three days of observation. Patients who had either a 1 or 2 level lumbar TDA were included in the study. Data consisting of demographics, American Society of Anesthesiologist Status, length of stay, estimated blood loss, cell saver volume, transfusion, perioperative and post-operative complications were recorded. Preoperative, perioperative and postoperative medical records were reviewed.

RESULTS: The mean age was 40.86 ± 9.45. Of these, 48 (96%) had a 1-level lumbar TDA, one (2%) had a 2-level lumbar TDA, one (2%) had a lumbar TDA at L4/5 and an anterior lumbar interbody fusion at L5/S1. There were no mortalities. No patients had recorded perioperative complications. No patients received allogeneic blood transfusion. Four (8%) were re-transfused with cell saver. All 50 patients were discharged home in stable condition. We had 30-day follow-up data on 35 of 50 patients. Of the 35 patients, three (8.5%) were readmitted to the hospital. One patient was seen in the emergency department and discharged home after negative testing. No patient was readmitted for postoperative anemia.

CONCLUSIONS: The use of cell saver and crossmatched blood in the operating suite for lumbar TDA may be an over-utilization of resources. Of 50 patients, we had no need for transfusion of allogeneic packed red blood cells (PRBCs) and only four of the 50 patients had enough blood output for re-transfusion from cell saver. This opens the conversation for alternatives to crossmatched PRBCs being held in the operating room. Such alternatives may be the use of cell salvage, only type O blood for each patient or keeping type O blood on constant hold in ASCs.

E-POSTER #5

Does BMI Over 40 Have a Significant Risk in Spine Deformity Patients?

Yaroslav Gelfand, Rafael de La Garza, Vijay Yanamadala, and Reza Yassari
Neurological Surgery, Montefiore Medical Center
Disclosures: Y. Gelfand: None. **R. de La Garza:** None. **V. Yanamadala:** None. **R. Yassari:** None.

INTRODUCTION: Morbid obesity, and specifically body mass index (BMI) over 40 is known risk factor for post-operative complications. There is scarcity of literature, however, studying whether BMI>40 specifically is an independent risk factor for complication in surgical spine deformity patients.

AIMS/OBJECTIVES: To evaluate specific risks that are conferred by morbid obesity on patients undergoing spine deformity surgery.

METHODS: Patients undergoing surgery for adult deformity correction were identified in the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database from 2006 to 2016. Inclusion criteria were CPT codes for deformity surgery, a combination of ICD 9 and 10 codes for deformity (kyphosis, scoliosis, proximal junctional kyphosis, etc.) along with a combination of CPT codes for a 5 or more level fusion. Two groups were established as follows: those with BMI<40 and those with BMI≥40.

RESULTS: 2,869 patients fit the inclusion criteria. Average age was 56.4 and 63.6% were female. BMI over or equal to 40 was a predictor of overall complications (p=0.032) and ICU level complications (p=0.003) on univariate analysis. Interestingly the rate of wound infections, DVT, and pneumonias did not differ significantly between the groups, although these complications are often thought to be associated with high BMI. The rate of renal complications (p=0.036), cardiac arrest (p=0.008), and reintubations (p=0.004) was significantly higher in the BMI≥40 group. On multivariate analysis BMI over 40 remained a significant predictor of ICU level complications, even when controlled for dependent functional status, diabetes, and hypertension (statistically significant differences between the groups).

CONCLUSIONS: BMI greater than 40 is an independent predictor of ICU level complications in patients undergoing surgery for spinal deformity. Contradictory to common belief, however, it does not seem to infer greater risk of wound infections, DVTs, or pneumonias in this patient subgroup.

E-POSTER #6

Evaluation of Intraoperative tEMG Testing of Tap and Screw

Molly Mounsey, Kyrollos Barsoum, Robert Brenner, MD, Dennis Vasquez-Montes, and Charla Fischer, MD

Disclosures: M. Mounsey: None. **K. Barsoum:** None. **R. Brenner, MD:** None. **D. Vasquez-Montes:** None. **C. Fischer, MD:** Zimmer Biomet (C).

INTRODUCTION: Triggered electromyography (tEMG) is an established, adjunctive method for detecting pedicle wall breach. A breach in the pedicle wall reduces impedance relative to an intact pedicle resulting in an evoked electromyographic response. Generally, a positive response at screw thresholds less than 5-8mA warrants further evaluation of the pedicle screw tract. Comparison between screw and tap stimulation thresholds has not been well documented in the published literature. In this study, we compared tEMG thresholds between stimulation of both the tap and the pedicle screw at the same pedicle to assess the value of using the tap as the stimulated instrument for tEMG.

AIMS/OBJECTIVES: Aim: The aim of this study is to evaluate for differences between tEMG testing of the tap and the screw for the same pedicle. Objectives: 1. Perform intraoperative tEMG testing on patients undergoing spinal procedures using the tap as the stimulated instrument. 2. Repeat tEMG testing on the same pedicle using the screw as the stimulated instrument. 3. Compare thresholds eliciting a positive response in both conditions.

METHODS: A retrospective analysis was performed of a subset of patients who underwent procedures at NYU Langone Orthopedic Hospital from 12/2014 to 7/2019. Patients included were those who had tEMG performed during their procedure utilizing both tap and screw stimulation at the same nerve root level. Paired t-test was used for statistical analysis.

RESULTS: 10 patients were included with a total of 24 data points. Each data point included one stimulation value via tap and one via screw for the same nerve root level performed during the procedure. The set included patients who had undergone a variety of spinal surgeries between levels L3-S1. The average stimulation value was 29.09mA (SD=11.68) for the tap and 30.79mA (SD=7.96) for the screw ($p=0.242$). The mean value of tap minus screw recording was -1.693 (SE=1.41). Out of the 24 data points, 8 showed higher tap values compared to screw, with a higher value suggestive of a further distance from the stimulated instrument to the nerve root. Of the remainder, 6 showed higher screw values compared to tap, and 10 had equal values for both.

CONCLUSIONS: The tEMG values obtained via stimulation of the tap were lower on average than those obtained via stimulation of the screw, suggesting stimulating the tap may underestimate the distance from the pedicle screw to the nerve root. Taking this into account, tap tEMG values may then serve as a cautious predictor of pedicle breach and consideration for thresholds greater than 5-8mA used for screws should be made.

E-POSTER #7

A Multidisciplinary Spine Clinic Model Significantly Reduces Lead Times for Appropriate Specialist Visit and Intervention in an Underserved Population: A Case Control Pilot Study

Joshua Benton, Michael Longo, Brandon Weiss, Rafael De La Garza Ramos, Yaroslav Gelfand, Erida Castro-Rivas, Mark Headlam, Lavinia Williams, Reza Yassari, and Vijay Yanamadala

Neurological Surgery, Montefiore Medical Center

Disclosures: J. Benton: None. **M. Longo:** None. **B. Weiss:** None. **R. De La Garza Ramos:** None. **Y. Gelfand:** None. **E. Castro-Rivas:** None. **M. Headlam:** None. **L. Williams:** None. **R. Yassari:** None. **V. Yanamadala:** None.

INTRODUCTION: The potential benefits of provider centralization in a multidisciplinary clinic have not yet been explored in the context of degenerative spine pathology, despite the disease's exorbitant costs from lost productivity in the workplace. A multidisciplinary spine clinic (MSC) with providers from neurosurgery, orthopedics, pain medicine, and physiatry has the potential to coordinate care more efficiently for patients, resulting in shorter lead times to appropriate consultation and intervention, and consequently, quicker return to baseline function for patients. In this study, we present a comparison of these outcomes between a MSC and a traditional unidisciplinary neurosurgery clinic (UDC).

AIMS/OBJECTIVES: To evaluate the effect of a multidisciplinary spine clinic on patient lead times to appropriate specialist referrals and interventions for degenerative spinal pathologies.

METHODS: Data was consecutively abstracted from 150 patients seen for the first time in either an MSC or UDC over a four-month period in 2019. Descriptive statistics were used to characterize the population, and subsequently multivariable models were utilized to determine the effects of an MSC on time to appropriate specialist visit and intervention.

RESULTS: The cohort was comprised of 150 patients: 32.6% were initially seen in a UDC versus 67.4% in an MSC. The two groups were similar with regard to age, sex, race, diagnosis, vertebral level of pathology, and prescribed management strategy. However, patients seen in the MSC were more likely to require new imaging at their initial visit (24.5% versus 43.6%, $p=0.024$) and trended towards being less likely to have public insurance (73.5% versus 58.4%, $p=0.073$). Bivariate analysis revealed associations between shorter lead times to specialist visit (median 49 days versus 20 days, $p<0.001$) and intervention (median 63 days versus 43 days, $p=0.014$) in the MSC. These findings persisted in a controlled multiple linear regression model: time to specialist visit decreased by 45 days ($p<0.001$) and time to intervention decreased by 60 days ($p=0.007$) for patients with an initial visit in the MSC.

CONCLUSIONS: A MSC can effectively coordinate care for patients, leading to shorter time to specialist visit and intervention. This can have broader implications related to the cost of degenerative spinal pathologies in the population, as high-quality, streamlined care may allow patients to return to baseline function more quickly, thus mitigating productivity losses from disability.

Full Text Abstracts: E-POSTERS

E-POSTER #8

Impact of Neuromonitoring Alert Resolution on Neurologic Outcomes in Spine Surgery as a Function of Spine Region: A Review of 104,554 Procedures with Motor Evoked Potentials (MEPs)

Anthony Sestokas, Bryan Wilent, Eric Tesdahl, Jeffrey Jacobs, and Jeffrey Cohen

SpecialtyCare

Disclosures: A. Sestokas: SpecialtyCare (D, G). **B. Wilent:** SpecialtyCare (G). **E. Tesdahl:** SpecialtyCare (G). **J. Jacobs:** SpecialtyCare (C). **J. Cohen:** SpecialtyCare (G).

INTRODUCTION: The value of intraoperative neuromonitoring (IONM) depends both on its accuracy in diagnosing evolving neurologic compromise and the effectiveness of interventions implemented to reverse the compromise.

AIMS/OBJECTIVES: Compare the incidence and accuracy of IONM alerts during surgery in different spine regions when MEPs are included in a multimodality monitoring protocol. Assess the impact of the resolution of IONM alerts on neurologic outcomes.

METHODS: Retrospective review of a multi-institutional IONM database of adult extradural spine surgeries monitored between 2016 and 2019. Monitoring consisted of MEPs in all surgeries, complemented by somatosensory evoked potentials and electromyography in the majority of procedures. Incidence and resolution of IONM alerts were calculated separately for surgeries addressing the cervical (C), cervicothoracic (CT), thoracic (T), thoracolumbar (TL) and lumbosacral (LS) regions of the spine. Neuromonitoring diagnostic accuracy was estimated by calculating sensitivity, specificity, and likelihood ratios for new onset motor deficits identified by neurologic examination in the immediate postoperative period. The therapeutic impact of alert resolution was calculated using odds ratios (OR) for new onset motor deficits for cohorts of patients with full, partial, or non-resolution of IONM alerts.

RESULTS: The median rate of multimodality IONM alerts during surgeries across different regions of the spine was 13.7%(LS) [range= 9.7%(T)-17.2%(CT)]. The median rate of new onset motor deficits was 0.53%(TL) [range= 0.36%(LS)-1.02%(CT)]. Median IONM sensitivity was 82.1%(C) [range= 77.8%(CT)–87.7%(LS)]. Median specificity was 95.3%(T) [range=93.4%(CT)–95.6%(C)]. The median positive likelihood ratio was 18.3(T) [range=11.8 (CT)–19.9(LS)]. The median negative likelihood ratio was 0.19(C) [range=0.13(LS)–0.24(CT)]. Relative to patients with no IONM changes, patients with unresolved IONM alerts had significantly elevated odds for a new motor deficit [median OR=173.5(C), range=78.1(CT)-220.8(LS), all $p<0.0001$)]. These odds were lower for patients with partially resolved alerts [median OR=50.0(CT), range=39.7(T)–119.4(LS), all $p<0.0001$)] and were lowest for patients with fully resolved alerts [median OR=3.0(T), range=0.0(TL)-5.0(C)]. For thoracic, thoracolumbar and lumbosacral procedures, odds of a new deficit in patients with fully resolved alerts were statistically indistinguishable from odds in patients with no alerts. Importantly, relative to patients with non-resolution of alerts, odds of a new deficit in patients with full resolution of alerts were significantly decreased [median OR=0.016(T), range=0.000(TL)–0.054(CT), all $p<0.0006$)].

CONCLUSIONS: Multimodality monitoring with MEPs has high diagnostic accuracy for evolving neurologic compromise during spine surgery. Effective interventions implemented by the surgical team in response to IONM alerts are associated with improved neurologic outcomes following surgery in all spine regions.

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Full Text Abstracts: E-POSTERS

E-POSTER #9

Utilizing Two Surgeons Improves Operative Efficiency in Neuromuscular Scoliosis Corrective Surgeries

Bryan Menapace, Lindsay Schultz, Nichole Leitsinger, Viral Jain, Peter Sturm, and James McCarthy

Orthopaedics, Cincinnati Children's Hospital Medical Center

Disclosures: B. Menapace: None. **L. Schultz:** None. **N. Leitsinger:** None. **V. Jain:** None. **P. Sturm:** Depuy Consultant Surgical Advisory (C), NuVasive (C). **J. McCarthy:** DePuy (F), Nuvasive (C), Orthopedics (I), Wolters Klumer Health (I).

INTRODUCTION: Neuromuscular scoliosis (NMS) is an all-encompassing term for patients who develop scoliosis related to an underlying diagnosis that is often systemic. These patients tend to have complex medical histories and comorbidities that increase both intraoperative and postoperative risks.

AIMS/OBJECTIVES: In this retrospective study, the aim was to identify differences in performing corrective surgeries in NMS with two experienced pediatric co-surgeons (CS) versus one single surgeon (SS).

METHODS: A database of NMS patients who had undergone posterior spinal fusion (PSF) from 2016-2019 was investigated. 33 patients were identified, of which 22 were CS, while 11 were SS. The surgeons performing the co-surgeries composed of a pediatric spine surgeon coupled with a pediatric orthopaedic surgeon, while the solo surgeries were with the pediatric spine surgeon alone. Of the above patients, their diagnosis, sex, age, curve severity, levels fused, estimated blood loss, anesthesia and surgeon times, postoperative length of stay, and complications (both intraoperatively and postoperatively) were collected. The data underwent statistical analysis in Excel using one- or two-tailed T-test and a defined statistical significant at $p \leq 0.05$.

RESULTS: The majority of patients carried diagnoses of cerebral palsy or Rett syndrome (28/33). The groups showed no statistical difference in demographics (age, sex, and weight). The CS group had a relatively more severe curve (82.7 degrees vs 67.7 degrees, p=0.06) with greater number of levels fused (14.6 vs 14.3, p=0.26), rate of fusion to the pelvis (63.6% vs 45.5%, p=0.17), and blood loss (843cc vs 580cc, p=0.20). Operating room times were significantly faster for the CS group (anesthesia: 387 minutes vs 462 minutes, p=0.02; surgeon time: 282 minute vs 336 minutes, p=0.03). The CS group had a relatively shorter hospital stay (5.50 days vs 6.73 days, p=0.26) and complication rate (0% vs 9%, p=0.08). The one complication, seen in the SS group, was postoperative pneumonia requiring re-admission.

CONCLUSIONS: This study showed a number of trends in favor of CS PSFs in NMS. These include relatively shorter hospital stays and lower complication rates despite the patients having more severe curves preoperatively requiring more extensive fusions. Furthermore, performing the CS cases was significantly faster, with the operations completed on average 54 minutes faster with 75 less minutes of anesthesia time. For these patients, who are often medically tenuous, the ability to do larger PSFs in shorter timeframes could prove critically important in minimizing complications associated with prolonged operating room times.

Full Text Abstracts: E-POSTERS

E-POSTER #10

Opioid Consumption After Anterior Cervical Spine Surgery: What is the Appropriate Minimum Quantity?

Francis Lovecchio[1], Ajay Premkumar[1], Michael Steinhaus[1], Dianna Mejia[1], Joo Yoon[2], Alex Koo[1], Virginie Lafage[1], Han Jo Kim[1], Sravisht Iyer[1], Russel Huang[1], Kern Singh[2], and Todd Albert[1]

[1]Hospital for Special Surgery, [2]Midwest Orthopaedics at Rush

Disclosures: F. Lovecchio: None. **A. Premkumar:** None. **M. Steinhaus:** None**. D. Mejia:** None. **J. Yoon:** None. **A. Koo:** None. **V. Lafage:** DePuy (F), Globus Medical (C), Nuvasive (I), Permanente Medical Group (F). **H. Kim:** ISSGF (A), K2M (I), Zimmer (I). **S. Iyer:** None. **R. Huang:** None. **K. Singh:** Avaz Surgical (D), Jaypee Publishing (I), Lippincott (I), SLACK incorporated (I), Stryker (I), Thieme (I), Vital 5, LLC (D), Wolters Kluwer Health (I), Zimmer (C, I). **T. Albert:** ASIP (D), Augmedics (D), Biomerix (D), Biomet (I), Bonovo Orthopedics (D), CytoDyn Inc (D), DePuy (I), Gentis (D), Innovative Surgical Designs (D), Invuity (D), JP Medical Publishers (I), Morphogenesis (D), Nuvasive (C), Paradigm Spine (D), Physician Recommended Nutriceuticals (D), PMIG (D), Pulse Equity (D), Saunders/Mosby-Elsevier (I), Spinicity (D), Springer (I), Strathspey Crown (D), Surg IO LLC (D), Thieme (I), Vital 5 (D).

INTRODUCTION: As cervical spine procedures move into the outpatient setting, providers will be left without inpatient narcotic consumption data on which to base an outpatient prescription. There is a lack of quantitative data to inform opioid prescribing guidelines after ACDF or CDA.

AIMS/OBJECTIVES: The purpose of this study was to record daily opioid use and pain levels after one or two level ACDF or CDA through an automated text-messaging based data collection system.

METHODS: 57 adult patients undergoing one- or two-level primary ACDF or CDA were enrolled at two institutions. Patients with daily opioid dependence were excluded. Starting POD1, daily opioid use and pain scores were collected through a HIPAA-compliant, automated text-messaging system. To facilitate clinical applications, opioid use was converted from oral morphine equivalents (OME) into "pills" (oxycodone 5 mg equivalents). After 6 weeks or upon patient-reported cessation of opioid use, final survey questions were asked. Refill and prescription data were verified from the state registry. Risk factors for patients in top 25% of opioid use were analyzed.

RESULTS: 48 patients completed the daily queries (84.2%). Average age of the patient sample was 50.2±10.9 years, with a BMI of 27.4±4.2 kg/m2. 32 patients (66.7%) underwent ACDF and 10 CDA (33.3%); 64.6% one level and 35.4% two levels. 18.8% used opioids on a non-daily basis in the six months before surgery. Total post-discharge opioid use ranged from 0-160 "pills" (oxycodone 5mg equivalents), median of 6.7 pills (IQR 0-30). Use did not vary between the one- and two-level groups (10 IQR [1.3-31.3] vs. 4 pills IQR [0-18], respectively, p=0.085). 13 patients (27.1%) used no opioids after discharge. Out of those patients that took opioids, use dropped from median 2.6 pills POD1 to 1 pill POD5. 91.4% stopped opioids by POD12. Only 6 patients (14.2%) obtained a refill. Preoperative intermittent opioid use was associated with the top 25% of opioid consumption (9.1% vs. 50%, p=0.006). In all patients, pain scores declined from a median 6 on POD1 to 4 on POD7.

CONCLUSIONS: Most patients fall at the low end of the opioid-use spectrum, with a quarter taking no opioids post-discharge. A prescription equivalent to 10 oxycodone 5 mg pills (75 OME) would allow for pain relief while minimizing the number of leftover pills. Prescribing guidelines must reflect these numbers to avoid excess leftover pills in the home.

Full Text Abstracts: E-POSTERS

E-POSTER #11

Measurement of Visual Evoked Potentials (VEPs) During Spine Surgery to Predict Postoperative Visual Changes

Christian Smith[1], Melika Zarei[1], and Jonathan Carmouche[1,2]

[1]*Virginia Tech Carilion School of Medicine,* [2]*Carilion Clinic Orthopedics*

Disclosures: C. Smith: None. **M. Zarei:** None. **J. Carmouche:** None.

INTRODUCTION: Perioperative vision loss is a rare but devastating complication in spine surgery. Though rare, incidence may be increasing with the rise in annual spinal operations [1, 2]. No standard of care exists to directly monitor ophthalmic changes during surgery. Visual Evoked Potential (VEP) is a clinical neurological tool measuring electrical signals in the occipital cortex in response to a light stimulus. Intraoperative VEP amplitude has been correlated with post-operative visual function and has been effective in intraoperative neurosurgical monitoring [3]. It may be effective in spine surgery if proper guidelines are followed [3, 4].

AIMS/OBJECTIVES: This is a prospective cohort study to evaluate differences in intraoperative VEP changes and postoperative visual acuity in spine surgery.

METHODS: Patients scheduled for open lumbar, thoracic, or cervical spine surgery will be grouped by surgical position. At least one week before surgery, patients will undergo visual acuity, Humphrey's visual field, and Optical Coherence Tomography testing. VEPs will be monitored during surgery, and a standardized corrective action protocol initiated if an event (50% decrease in amplitude or 10% increase in latency) is detected. VEP return to baseline describes a technical event, while no return to baseline is considered a non-technical event. Six weeks postoperatively, patients will repeat ophthalmic testing. Number of events and visual testing results will be compared using logistic regression.

RESULTS: 32 patients have enrolled and 11 have completed the study (9 supine, 2 prone). We expect more VEP events in prone procedures versus supine, and for VEP non-technical events to be associated with an increased probability of visual change. To date, there have been no intraoperative VEP events. One patient in the prone group experienced a slight decrease in the retinal nerve fiber layer length, which correlated with worsening of vision. No clinical or intraoperative factors were significant against RNFL thickness or visual acuity change.

CONCLUSIONS: Injury to the visual pathway is often unnoticed until after the operation, when little can be done. No VEP events have been detected intraoperatively, however one patient experienced visual function changes. This prone patient had the longest procedure time but no medical history that would increase risk. It is possible VEP is unable to capture these events in the setting of spine surgery. More data is needed to confirm this conclusion. If this is the case, the focus must be on reduction of intraoperative risk factors to prevent injury to the visual pathway.

E-POSTER #12

The Use of Predictive Modelling in Spine Surgery

Christopher Kleck and Evalina Burger

Department of Orthopedics, University of Colorado Anschutz Medical Campus

Disclosures: C. Kleck: Colorado Orthopaedic Society (H), Medacta (C), Medicrea (B, C), Medtronic (C), Orthofix (B), Pfizer, Inc (B), SI Bone (B), Vertiflex (B). **E. Burger:** Adallo Spine (C), Anschutz Foundation Grant (A), Mainstay Medical (B), Medicrea (C), Pfizer, Inc (B), Premia Spine LTD (B), Spinal Kinetics (B), Spine Wave (C), Vertiflex (B).

INTRODUCTION: Adult spinal deformity surgery often has high complication rates that include malalignment, adjacent segment disease, and hardware failures. Surgeons started planning their cases to help achieve sagittal alignment and reduce the complications. However, it is unknown how the patient will react after the surgery above and below the construct. A predictive model is now utilized to simulate how the patient's thoracic kyphosis (TK) and pelvic tilt (PT) will compensate. Over 600 patients with 6-month follow-up were utilized in training and testing the predictive model (PM). The model uses projected lumbar lordosis and levels fused to provide the most likely postoperative TK and PT values.

AIMS/OBJECTIVES: To understand the mean error between the postop and planned thoracic kyphosis and pelvic tilt.

METHODS: Two cohorts were analyzed for the mean error (ME) between the plan and postoperative results: (1) 38 patients without the PM and (2) 28 patients with the PM. The PM was also applied to cohort 1. All patients were fused from T10 through L1 to S1 or pelvis and had a minimum 6-month follow-up.

RESULTS: The mean error when comparing the plan and postoperative TK and PT was less when utilizing the predictive models. There was a significant difference in the mean error between cohort 1 and 2 for TK and PT and between cohort 1 and cohort 1 with the PM for TK. While there was not a significant difference between cohort 1 and cohort 1 with the PM for PT, the PM had less mean error. Mean Error of TK (deg) Mean Error of PT (deg) Cohort 1 13.2*† 6.5* Cohort 2 6.6* 4.1* Cohort 1 with PM 6† 5.4 *Statistical difference ($p < 0.05$) between cohort 1 and 2 †Statistical difference ($p<0.05$) between cohort 1 and cohort 1 with PM

CONCLUSIONS: The predictive model has the capacity to calculate the possible outcome of the surgery based on machine learning algorithms in comparison to surgery planned without a predictive model. The accurate prediction of compensatory mechanisms after spinal realignment procedures, can play a significant role in the prevention of junctional failures. This methodology has the potential to reliably predict not only the correction, but also the unforeseen compensation of multiple parameters in the spine, allowing surgeons to adjust the planned corrections to be patient specific.

E-POSTER #13

Do Children's Hospitals Present Opportunities for Appropriate Opioid Disposal?

Joseph Petfield, Arun Hariharan, and Margaret Baldwin
Department of Orthopaedic Surgery, Nemours Alfred I. duPont Hospital for Children
Disclosures: J. Petfield: None. **A. Hariharan:** None. **M. Baldwin:** None.

INTRODUCTION: The opioid epidemic has reached crisis proportions in the United States. Approximately 13% of US high school seniors report having used prescription opioids recreationally. Moreover, eighty percent of those high-schoolers who reported non-medical use of prescription opioids obtained these medications from a previously legitimate prescription. Orthopaedic surgeons rank among the top prescribers of opioids in the US. Following posterior spinal fusion, at least 83% of patients are prescribed some form of opioid medication as an outpatient. Appropriate disposal of excess opioid medications is therefore essential.

AIMS/OBJECTIVES: This investigation sought to identify whether public narcotic disposal opportunities exist at or near major pediatric hospitals.

METHODS: A database of major pediatric hospitals was established consisting of all US medical centers that currently serve as pediatric orthopaedic surgery fellowship training locations or are designated by the American College of Surgeons (ACS) as level I or level II pediatric trauma centers. The presence and number of Controlled Substance Public Disposal (CSPD) locations existing on-site or within ten miles of each hospital was determined by using the search utility of the US Drug Enforcement Administration Diversion Control Division Website. The number of pediatric opioid overdose deaths occurring in each respective hospital's county and state from 1999-2017 was ascertained using the CDC WONDER database.

RESULTS: An on-site public narcotic disposal location is offered by 45.8 % (N=67/146) of major children's' hospitals. Similarly, 46.1% (N= 18/39) of POSNA fellowship institutions offer on-site CSPD. Hosting a POSNA fellowship did not make a hospital more likely to offer on-site CSPD (p=0.89). 52.8% (N=37/70) of ACS level I trauma centers offer CSPD. 98.6% (N=144/146) of hospitals have a CSPD location within 10 miles. Average distance to the nearest CSPD location was 2.23 miles (SD 3.1 miles). The likelihood of a hospital offering on-site CSPD was statistically unrelated to the rate of pediatric opioid overdose deaths in each hospital's county or state.

CONCLUSIONS: Less than 50% of major pediatric medical centers in the United States publicly offer on-site opioid disposal. The number of pediatric narcotic overdose deaths in the surrounding county or state is not related to a hospital offering narcotics disposal. Offering patients opioid disposal at their point of care appears to be a prime opportunity to prevent drug diversion.

E-POSTER #14

Awake Spinal Fusion: Outcome Analysis of Spinal Anesthesia for Minimally Invasive Transforaminal Lumbar Interbody Fusion

Richard Sekerak[1], Alok Sharan, MD[2], Matthew Morris, MD[3], Evan Mostafa[1], Adam Nessim[1], and Anjali Vira, MD[4]

[1]Albert Einstein College of Medicine, [2]WESTMED Spine Center, [3]Northwell Health, [4]St. John's Riverside Hospital

Disclosures: R. Sekerak: None. **A. Sharan, MD:** Depuy (C), Paradigm Spine (C). **M. Morris, MD:** None. **E. Mostafa:** None. **A. Nessim:** None. **A. Vira, MD:** None.

INTRODUCTION: Spinal anesthesia (SA) has been shown in several studies to be a viable alternative to general anesthesia (GA) in laminectomies and discectomies. In particular, lower postoperative pain has been consistently demonstrated with SA. However, very few spine surgeons have extended the use of SA to lumbar fusion surgery, and few studies have documented its use in the literature. The authors posit that SA may lead to lower postoperative pain than GA, and thus have implemented use of a novel thoracolumbar interfascial plane (TLIP) block for additional long-lasting analgesia.

AIMS/OBJECTIVES: The purpose of this study was to evaluate the effectiveness of SA and SA+TLIP block in patient outcomes following fusion surgery.

METHODS: The authors retrospectively reviewed the charts of all 111 patients who underwent 1- or 2-level minimally invasive transforaminal lumbar interbody fusion (TLIF) surgery by a single surgeon, at a single institution, from 2015-2018. TLIP block consisted of injection of a long-acting local anesthetic agent in liposomal suspension into the fascial plane between the multifidus and longissimus muscles. Patients were placed into 1 of 3 groups based on anesthetic modality: 1) GA; 2) SA; 3) SA+TLIP block. The authors recorded patient demographic information, BMI, diagnosis, comorbidities, levels operated on, post-anesthesia care unit (PACU) time, pain scores, adverse events, opioid doses administered, and length of stay.

RESULTS: A total of 29 patients received SA, 46 received GA, and 36 received SA+TLIP block. All groups were similar in terms of age, gender, BMI, number of levels operated upon, preoperative diagnosis, and ASA physical score. Both the SA and SA+TLIP groups experienced significantly lower max postoperative pain scores (3.31±1.65 out of 10 and 1.69±0.95/10, respectively) than the GA group (5.96±0.84/10, $p<0.05$). Additionally, the SA and SA+TLIP groups required fewer opioid doses in the PACU (2.38±1.76 and 1.28±0.69 doses) than the GA group (5.39±1.24 doses, $p<0.05$). Time spent in the PACU was significantly less for SA and SA+TLIP groups (82.0±8.69 and 74.1±8.09 min) than the GA group (102.9±8.45 min, $p<0.001$). Further, the SA+TLIP group spent fewer days in the hospital (0.74±0.44 days) compared with the GA group (1.30±0.32 days, $p<0.01$). The SA+TLIP group had lower initial, final, and max pain scores; required less opioid doses; spent less time in the PACU; and had a shorter length of stay than the SA group, although these results did not reach statistical significance. No significant difference in adverse events was observed.

CONCLUSIONS: To our knowledge, the use of the preoperative TLIP block is a novel concept in spine surgery. In this study, we demonstrate that the use of SA and SA+TLIP block in TLIF surgery can lead to less time spent in the PACU, lower pain scores, fewer opioid doses, and can reduce average length of stay compared to GA. Addition of the TLIP block may lead to even lower pain scores and less opioid usage over SA alone, though our sample size was not large enough to achieve significance. Thus, SA and SA+TLIP block appear to be beneficial alternatives to GA for TLIF surgery.

E-POSTER #15

Comparative Outcome Analysis of Spinal Anesthesia versus General Anesthesia in Lumbar Fusion Surgery

Richard Sekerak[1], Alok Sharan, MD[2], Matthew Morris, MD[3], Evan Mostafa[1], Adam Nessim[1], and Anjali Vira, MD[4]

[1]Albert Einstein College of Medicine, [2]WESTMED Spine Center, [3]Northwell Health, [4]St. John's Riverside Hospital

Disclosures: R. Sekerak: None. **A. Sharan, MD:** Depuy (C), Paradigm Spine (C). **M. Morris, MD:** None. **E. Mostafa:** None. **A. Nessim:** None. **A. Vira, MD:** None.

INTRODUCTION: Typically, general anesthesia (GA) has been used to perform the majority of spinal surgeries including fusion surgeries, lumbar laminectomies, discectomies, and microdiscectomies. However, there is limited literature documenting the use of Spinal Anesthesia (SA) in lumbar fusion surgery, particularly in terms of cost-effectiveness and outcome analysis compared to GA. Here we present a retrospective study comparing SA and GA in lumbar fusion surgery, assessing perioperative outcomes and cost.

AIMS/OBJECTIVES: The objective of this study was to compare the cost and outcomes of SA and GA in minimally invasive transforaminal lumbar interbody fusion (TLIF) to demonstrate their relative cost-effectiveness.

METHODS: The authors retrospectively reviewed the charts of all patients who underwent 1- or 2-level minimally invasive transforaminal lumbar interbody fusion (TLIF) surgery by a single surgeon, at a single institution, from 2015-2017. Data collected included demographics, operative and recovery times, nausea/vomiting, postoperative pain, and opioid requirement. Costs were included in analysis if they were: 1) non-fixed; 2) incurred in the operating room (OR); and 3) directly related to patient care. All cost data represents net costs, and was obtained from the hospital revenue cycle team. Patients were grouped for statistical analysis based on anesthetic modality.

RESULTS: A total of 29 patients received SA and 46 received GA. Both groups were similar in terms of age, gender, BMI, number of levels operated upon, preoperative diagnosis, and medical comorbidities. The SA group spent less time in the OR (163.86±10.41 vs. 195.63±11.27 min, $p<0.05$), PACU (82.00±8.69 vs. 102.98±8.46 min, $p<0.05$), and under anesthesia (175.03±10.45 vs. 204.98±10.15 min, $p<0.05$) than the GA group. Post-surgery OR time was significantly less with SA than with GA (6.00±1.09 vs. 17.26±3.05 min, $p<0.05$); however, pre-surgery OR time was similar between groups (50.17±3.08 vs. 56.17±5.34 min, $p=0.061$). The SA group also experienced less postoperative pain (3.31±1.65 out of 10 vs. 5.96±0.84/10, $p<0.05$) and required less opioid analgesics (2.38±1.76 vs. 5.39±1.24 doses, $p<0.05$). Both groups experienced similar nausea or vomiting rates and adverse events postoperatively. Net operative cost was found to be $812.31 (6.04%) less with SA than with GA, although this difference was not significant ($p=0.225$).

CONCLUSIONS: To our knowledge, SA is almost never used in lumbar fusion, and a cost-effectiveness comparison with GA has not been recorded. In this retrospective study, we demonstrate that the use of SA in lumbar fusion surgery leads to significantly shorter operative and recovery times, less postoperative pain and opioid usage, and slight cost savings over GA. Thus, we conclude that this anesthetic modality represents a safe and cost-effective alternative to GA in lumbar fusion.

E-POSTER #16

Cost Utility Analysis of Postoperative Discharge Pathways Following Posterior Spinal Fusion for Scoliosis in Non-Ambulatory Cerebral Palsy Patients

Kenneth Shaw[1], Vahe Heboyan[2], Nicholas Fletcher[3], and Joshua Murphy[3]

[1]Orthopaedic Surgery, Dwight D. Eisenhower Army Medical Center, [2]Department of Interdisciplinary Health Sciences, Augusta University, [3]Pediatric Orthopaedic Surgery, Children's Healthcare of Atlanta

Disclosures: K. Shaw: None. **V. Heboyan:** None. **N. Fletcher:** Medtronic (C, F), Nuvasive (F), OrthoPediatrics (F). **J. Murphy:** Depuy (C), OrthoPediatrics (A, C)

INTRODUCTION: Accelerated postoperative discharge (AD) pathways have demonstrated numerous benefits for patients with adolescent idiopathic scoliosis undergoing posterior spinal fusion. Although early evidence supports the application of AD pathways over more traditional discharge (TD) approaches for patients with neuromuscular scoliosis, the impact of these pathways on the benefits and costs of treatment has not been investigated.

AIMS/OBJECTIVES: To perform a cost-utility analysis of postoperative discharge pathways following posterior spinal fusion for scoliosis in patients with non-ambulatory cerebral palsy

METHODS: A decision-analysis model was constructed using a hypothetical 15-year-old male with non-ambulatory cerebral palsy (CP) with a 65-degree thoracolumbar scoliosis with associated pelvic obliquity undergoing operative treatment with posterior spinal fusion from T2-pelvis with pedicle screw fixation. The literature was reviewed to estimate costs, probabilities, health utilities, and quality-adjusted life years (QALYs) for identified complication profiles for TD and AD pathways (Table 1). Health utility and QALYs were constructed using age-matched values for US population average, applying a corrective value for diagnosis of CP. A sensitivity analysis was performed using mixed first-order and second-order Monte Carlo simulations. Incremental cost utility ratio (ICUR) and incremental net monetary benefit (NMB) were calculated.

RESULTS: Operative treatment, combining both AD and TD, resulted in a NMB of $629,783 with a cost-utility ratio of $4426.70/life years. Comparing these two pathways, the AD pathway resulted in a net cost of $57,353 compared to a net cost of $65,001 for the TD pathway, Table 2. Additionally, AD resulted in a 29% greater NMB with a cost utility ratio of $3,734.58/life year compared with the TD cost utility ratio of $5,292.81/life year. Both figures fell below the societal willingness-to-pay threshold of $50,000/life year.

CONCLUSIONS: This cost-utility analysis demonstrated that the implementation of a AD pathway following posterior spinal fusion for non-ambulatory cerebral palsy provides a 29% greater NMB with a favored cost utility ratio when compared with a TD pathway.

E-POSTER #17

Looking Closer at Length of Stay: A Structured Analysis of Post Op Progress Notes for Patients Undergoing Minimally Invasive Lumbar Fusion

Ishaan Sachdeva[1] **a**nd Jonathan Carmouche[1,2]

[1]*Virginia Tech Carilion School of Medicine,* [2]*Carilion Clinic Orthopedics*

Disclosures: I. Sachdeva: None. **J. Carmouche:** None.

INTRODUCTION: Length of stay (LOS) for patients undergoing minimally invasive (MIS) spine fusion is often longer than expected. Previous research has identified factors that predict longer length of stay including preexisting disease and postoperative complications.

AIMS/OBJECTIVES: Here, we analyze postoperative progress notes created by the Orthopedic Spine Service at our institution to determine which postoperative issues have smaller, or larger effects on LOS.

METHODS: This is a retrospective chart review of forty patients who underwent MIS lateral or transforaminal approach lumbar interbody fusion at an academic tertiary care referral center. Two cohorts were created, patients who had a length of stay of two nights or fewer (shorter LOS: n=15), and patients who had a length of stay of three nights or greater (longer LOS: n=25). We reviewed each patient's daily postoperative progress notes written by the Orthopedic Spine Service. We tallied and compared various post op issues for each cohort, (shorter LOS, longer LOS) to determine which issues were more prevalent in the longer LOS cohort.

RESULTS: 36% of patients in the longer LOS cohort and 0% of patients in the shorter LOS cohort had hypotension or acute blood loss anemia post op. (p=0.01*) Delays caused by admission to skilled nursing, lower back/lower extremity pain, numbness, or weakness, reduced mobility post op, ileus, urinary retention, and nausea/vomiting were not significantly different between the longer and shorter LOS cohorts. Post op issues found only in the longer LOS cohort included: leukocytosis (12%), pneumonia (8%), delirium (8%), dizziness (12%), facial flushing (4%), acute kidney injury (4%), small bowel obstruction (4%), and hypokalemia (4%).

CONCLUSIONS: Lower back and lower extremity pain/numbness/weakness, reduced mobility, ileus, urinary retention, and nausea/vomiting are common post op, however, these issues were found to be equally prevalent in patients with both shorter and longer LOS. These issues may have smaller effects on prolonging total length of stay. Post op hypotension/anemia, and unique issues such as pneumonia, leukocytosis, AKI, dizziness, delirium, SBO, and electrolyte abnormalities may have larger effects on total LOS. Close and frequent monitoring of patient status is important to implement early consultations and interventions to correct these issues.

E-POSTER #18

Transitioning Minimally Invasive Lumbar Fusion to the Ambulatory Setting: An Assessment of Contributors to Length of Stay in Older Patients

Ishaan Sachdeva[1] and Jonathan Carmouche[1,2]

[1]*Virginia Tech Carilion School of Medicine,* [2]*Carilion Clinic Orthopedics*

Disclosures: I. Sachdeva: None. **J. Carmouche:** None.

INTRODUCTION: Minimally invasive (MIS) spinal fusions have not consistently provided the desired length of stay and cost benefits. Prior evidence of the safety and efficacy of MIS fusions in the ambulatory setting exists but is sparse and limited to younger patients.

AIMS/OBJECTIVES: The purpose of this study is to determine contributors to length of stay that preferentially affect older patients.

METHODS: In this retrospective study, all patients who underwent MIS lateral (LLIF) and transforaminal (TLIF) lumbar interbody fusion between January 2017 and March 2018 at an academic tertiary care referral center were selected. Eighty-one patients were included. The patients were sorted into cohorts. The older age cohort included patients age 60 and greater, and the younger age cohort included patients age less than 60. Demographic variables including gender, length of stay, admission diagnosis, American Society of Anesthesiologist (ASA-PS) score, perioperative factors including surgical procedure, number of levels fused, blood loss, and crystalloids administered, and postoperative factors including postoperative mobility and discharge destination were evaluated and compared between the older age and younger age cohorts using t-tests.

RESULTS: Length of stay, percentage of patients with spondylolisthesis, choice of LLIF instead of TLIF, and percentage of patients discharged to a nursing home or short-term rehabilitation was significantly greater in the older age cohort. ($p \leq 0.01$*) Older patients also received a greater volume of perioperative IV fluids. ($p=0.05$*) ASA-PS scores, number of levels fused, postoperative mobility assessment scores, and blood loss were not significantly different between the older age and younger age cohorts.

CONCLUSIONS: Older patients had longer length of stay. Discharge to a nursing home and the presence of spondylolisthesis may be factors that explain longer length of stay in older patients. ASA scores and number of levels fused were similar between older and younger cohorts, and future trials of ambulatory MIS lumbar fusion may be able to include older patients with higher ASA scores and greater number of levels fused. Older patients did receive a greater volume of perioperative IV fluids. It is appropriate to select older patients who are not anemic at baseline for ambulatory MIS lumbar fusion to avoid challenges with fluid resuscitation.

E-POSTER #19

Real Event Analysis and Learning (REAL): Assessing Operating Room Surgical Team Performance

Peter Waters, M. Timothy Hresko, and Daniel Hedequist
Boston Children's Hospital, Harvard Medical School
Disclosures: P. Waters: None. **M. Hresko:** None. **D. Hedequist:** None.

INTRODUCTION: We believe that surgical team performance and safety in surgery can be enhanced by engagement of the entire surgical team in simulation and event analysis. To advance the process further, we have proposed that video capture and event analysis of complex interaction during real spine surgery could be achieved.

AIMS/OBJECTIVES: To measure individual and spine team nursing, anesthesia, and surgical operating room performance by a live and audiovisual recorded capture and analysis system (REAL) at a tertiary care pediatric teaching hospital.

METHODS: To create REAL, a four step process was achieved including (1) approval from hospital executive leadership, IRB, legal, and departmental leadership (nursing, anesthesia, orthopaedics), (2) technical equipment optimized for recording and analysis, (3) step-wise socialization and (4) implementation comprising 40 operative cases and >100 hours of observation and scoring by one in OR and four video validated scorers blinded to one another for orthopaedic surgery cases. Once it was clear this was feasible and reliable, spine surgery was analyzed. 5 days of spinal deformity was assessed from "wheels in to wheels out" of the operating room. All elements of the cases including sign in; induction of anesthesia; peripheral access, foley, and neuromonitoring lead placement; positioning; time out; surgical exposure; instrumentation including pedicle screw placement and O-arm verification; neuromonitoring; deformity correction including imaging and neuromonitoring; closure; sign out; and extubation and transport to PACU. Mixed method analysis included (1) validated team performance scoring tools for surgeons (NOTSS), anesthesiologists (ANTS) and scrub nurses (SPLINTS) for situational awareness, task management, teamwork, leadership, and communication skills; (2) compliance scoring for WHO sign in, time out, sign out recording and critical parts of each surgery; and (3) qualitative thematic analysis scoring for each operative team debriefing. "In OR" and "Video" scorings were compared for accuracy.

RESULTS: NOTSS, ANTS, and SPLINTS mean scores were statistically significant including median first and third quartile scores. The anesthesia team scored lower in aggregate and with fewer top quartile scores. Subcategory scores for leadership, teamwork and decision making, situational awareness and task management were measured. Compliance scoring was addressed for every element of sign in, time out and sign out. Time out compliance for site marking and consent matching was recorded with every surgery (100%) while sign out scores for resolving equipment and operative problems was recorded infrequently. Compliance scores did correlate with NOTSS, ANTS, and SPLINTS aggregate scores. Remote audiovisual scoring was found to be as reliable than live in OR scoring. Thematic analysis indicated our anesthesia and nursing communication want more and better communication from us as surgeon leaders; and they accepted both in OR and AV analysis in order to improve care.

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CONCLUSIONS: OR team and individual team performance can be assessed with validated scoring tools and compliance scores to enhance performance. An over-arching goal of this project is to further enhance our culture of psychological safety to lessen our safety risks. A burning platform is to NEVER again have a wrong site, wrong patient, wrong procedure (WSPEs). We think REAL in conjunction with iterative simulation training is getting us closer to this vision.

If noted, the financial relationships are disclosed as follows:
A. University Grants/Research Support B. Industry Grant Support C. Consultant Fee D. Stock or Shareholder E. Honorarium F. Speakers' Bureau G. Employee H. Fiduciary Position I. Other Financial Support

E-POSTER #20

Patient Satisfaction and a QSVI Program: the TSRH Journey in AIS

Lori Karol
Texas Back Institute
Disclosures: L. Karol: None.

AIMS/OBJECTIVES: To integrate family reported satisfaction tool with quality and value metrics in a large adolescent idiopathic scoliosis surgical program.

METHODS: Chart and database review was performed for all consented AIS cases from 2015 to 2018. Radiographic measures were gathered from a prospective database. Length of stay was calculated annually. Patient families were surveyed regarding their inpatient experience. Responses from families who returned the HCAPS survey were analyzed and correlated with the quality data.

RESULTS: 537 patients with AIS underwent posterior spinal fusion by seven surgeons at a single institution from January 2015 through December 2018. The average age was 14.5 overall. The average preoperative Cobb angle was 62.8 degrees, ranging from a minimum of 43 to a maximum 118 degrees. The average annual Cobb angle remained stable over the four years, ranging from 62.6 to 63.3 degrees. Length of stay decreased over the four years, from 3.39 days in 2015 to 2.94 days in 2018. Over the four years, there was one surgical site infection reported within 90 days of initial surgery, for an acute infection rate of 0.19 per cent. 141 families returned the completed HCAPS survey. Parents were asked to rate the hospital on a scale from zero, representing the worst experience, to ten, representing the best. The overall rating remained stable ranging from 9.76 in 2015 to 9.90 in 2016. Likewise, when asked if the parents would recommend the hospital to relatives or close friends, the average response was 3.99, with 4.0 the highest score possible signifying “definitely would recommend”. Finally, the “would recommend” score from 2018, during which the length of stay was the shortest, was 4.0.

CONCLUSIONS: A notable decrease in length of stay occurred from 2015 to 2018, although preoperative curve magnitude remained stable, indicating that the surgeries were not “easier” over that time period. Quality was maintained, as evidenced by a very low acute infection rate. Parent satisfaction remained extremely high, indicating the decreased length of hospitalization was acceptable by the patient families. A low return rate on the HCAPS survey tool has led to adoption of a shorter realtime survey to gain more complete parent feedback.

Full Text Abstracts: E-POSTERS

E-POSTER #21

Helping Spine Surgeons Detect Pre-Surgical Psychological Distress in Complex Spine Patients: An Observational Pilot Study

Matt Sikora, Venu Nemani, Rochelle Winnett, Andrew Friedman, Joel Peterman, Kellen Nold, and Rajiv Sethi

Virginia Mason

Disclosures: M. Sikora: None. **V. Nemani:** None. **R. Winnett:** None. **A. Friedman:** None. **J. Peterman:** None. **K. Nold:** None. **R. Sethi:** None.

INTRODUCTION: Spine surgeons do a poor job assessing and treating psychological disorders and distress, which are highly prevalent in the spinal surgical patient population. If these factors are left unaddressed, patients are at risk for a suboptimal surgical outcome. There have not been previous studies assessing psychological and psychosocial conditions in complex spine patients.

AIMS/OBJECTIVES: Spine surgeons are inaccurate at assessing psychological disorders and psychosocial barriers in complex spine patients and predicting outcomes based on those assessments.

METHODS: Our institution developed a standardized pre-surgical psychological evaluation, with a color grading system (Figure 1), ranging from Green to Red, incorporating psychological and cognitive factors, as well as potential psychosocial and architectural barriers. 129 consecutive complex spine surgery candidates receiving a pre-surgical psychological evaluation were analyzed between January 1st 2014 and December 31st 2018. Univariate analysis was used to evaluate color grades between demographics, mental health disorders and outcomes.

RESULTS: 83% of complex spine patients had at least one psychological disorder or psychosocial barrier. The pre-surgical psychological color criteria was validated in showing higher rates of major depression, anxiety disorder, and bipolar disorder in moderate to severe color grades ($p<.001$) in addition to higher PHQ-9 and GAD-7 scores ($p<.001$). Patients having a more severe color grade had a trend towards lower rates of a discharge home and taking higher MEDs at their six-month follow up ($p=.07$ and $p=.08$; respectively).

CONCLUSIONS: Only 17% of ASD patients have realistic postoperative expectations, a good support plan, and no history of mental illness. A comprehensive pre-surgical psychological evaluation may be beneficial to risk stratify and counsel patients being evaluated for surgical reconstruction of adult spinal deformity.