

22% of patients had one organ defect, 19% had two defects, 17% had three, and 14% had four. An average of 2.2 total anomalies occurred per patient (range= 0-8). Intraspinal anomalies were observed in 43% of patients; syrinx occurred most frequently. Urogenital anomalies were observed in 39% of patients; solitary kidney was most prevalent. Cardiac anomalies were observed in 54% of patients; ventricular septal defect was most common. In 12% of patients, a trio of spinal, urogenital, and cardiac defects was observed. Organ systems found to have significant associations ( $p < .05$ ) in anomaly development are outlined in Table 1.

**Conclusion:** Cardiac anomalies were the most common defect in this study (54%), occurring at a rate more than two times higher than previously reported. The high rate of intraspinal, urogenital and cardiac defects makes MRI, renal ultrasound and echocardiography a critical part of evaluation for all congenital scoliosis patients.

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**Paper #7**

**Repeated Anesthetics and Radiographic Imaging during Traditional Growing Rod Management**



*Christopher Migdal, Eric Klineberg, Joel Lerman, Max Haffner, Blythe Durbin-Johnson, Rolando Roberto*

**Summary:** We provide a risk-benefit analysis of each traditional growing rod instrumentation (TGR) procedure that can aid in shared decision-making of initiating, continuing, and completing treatment with TGR.

**Hypothesis:** Each TGR lengthening procedure will be associated with significant T1-T12 height gain, minimal coronal curve reduction, and significant radiation and anesthetic exposure.

**Design:** Retrospective Review.

**Introduction:** TGR has become a popular method of treatment for early-onset scoliosis (EOS). It requires a return to the OR and manual distraction every 6 months. This procedure is associated with significant risks that include instrumentation failure, infection, additional radiation dose, and additional time under anesthesia. The purpose of this study is to develop a model to determine the risks and benefits of each lengthening procedure.

**Methods:** A retrospective review of a single center’s experience treating 29 patients with severe EOS with TGR. All patients treated at our institution who either completed their treatment course with TGR or were treated for a minimum of two years with TGR were selected for this study.

**Results:** 10 of our 29 patients completed treatment with TGR and had definitive fusion. These 10 patients’ primary coronal curve reduced on average from 66 degrees to 37 degrees on final films. For the entire duration of their care, they had an average of 31 radiographs, 2 fluoroscopic exams, and 1 CT. They were under general anesthesia for an average of 1,312 minutes for routine scheduled procedures, and if there were implant or wound complications, they were under anesthesia for an additional 155 or 279 minutes, respectively. 60% of the patients had an implant complication and 30% had a wound complication. Our linear

mixed effects model estimated that each lengthening procedure roughly decreased the patients’ primary coronal curve by 0.7 degrees and increased their T1-T12 height by 0.4 cm. However, each procedure was associated with a 20% instrumentation complication rate, 3% wound complication rate, 4 radiographic studies, and 104 minutes under general anesthesia.

**Conclusion:** While TGR is an effective treatment for EOS, there are additional risks associated with the repeated anesthetics and radiographic imaging. Our model can help weigh the potential risks and benefits in the shared decision-making of initiating, continuing, and completing treatment with TGR. *Author disclosures:* Christopher Migdal: none. Eric Klineberg: DePuy Synthes; Stryker Spine; K2M; AO Spine. Joel Lerman: none. Max Haffner: none. Blythe Durbin-Johnson: none. Rolando Roberto: none.

**Paper #8**

**Cumulative Anesthesia Exposure in Patients Treated for Early Onset Scoliosis**



*Fady Baky, A. Noelle Larson, Scott Echternacht, Todd Milbrandt*

**Summary:** Anesthesia time was collected for 72 consecutive patients with early onset scoliosis (EOS). Patients averaged 26.8 hours of anesthesia, of which 64% came from orthopedic procedures. 42% of patients received greater than 3 hours of cumulative anesthesia prior to age 3, exceeding the FDA’s recommendation. Non-idiopathic diagnosis and treatment other than bracing were statistically significant risk factors for greater cumulative anesthesia exposure.

**Hypothesis:** In 2016, the United States Food and Drug Administration released a warning that “general anesthesia and sedation drugs during surgeries or procedures in children younger than 3 years may affect the development of children’s brains.” We hypothesized that patients treated for EOS receive many hours of anesthesia exposure in childhood. We sought to determine which factors were associated with greater cumulative anesthesia time in EOS patients.

**Design:** Retrospective Review.

**Introduction:** EOS is a potentially life-threatening condition that requires early intervention to prevent severe deformity and pulmonary compromise. Observational studies have demonstrated that children receiving multiple procedures requiring general anesthesia are at a higher risk for adverse neurocognitive outcomes. We sought to characterize cumulative anesthesia time in EOS patients and to determine risk factors for increased exposure.

**Methods:** Records of EOS patients treated at a tertiary referral center from 2000-2014 were reviewed. Patients with minimum 2 year follow-up and < 10 years at diagnosis were included. Anesthesia was recorded in three categories: 1) orthopaedic surgeries, 2) non-orthopaedic surgeries 3) imaging/associated procedures. Diagnoses included congenital, idiopathic, neuromuscular, syndromic scoliosis and tumor/other. Treatment included observation, bracing, Mehta casting, growing spine procedures, or fusion.

**Results:** Mean cumulative anesthesia time was 26.8 hours. Patients with neuromuscular (mean 35.5 hrs,  $p$ -value = 0.0003) or congenital scoliosis (31.3 hrs,  $p$ -value = 0.049) received more anesthesia than those with idiopathic scoliosis (12.6 hrs). 16 patients underwent Mehta casting with a mean of 4.1 casts/patient and 10.8 cumulative hours of anesthesia. In multivariate analysis, reduced anesthesia time was associated with

Risk-Benefit Analysis per Procedure

|                        | Hardware Complication/<br>Unplanned Surgery | Wound Complication/<br>Unplanned Surgery | Spine Radiograph/<br>Chest Radiograph/<br>Fluoroscopy (#) | TAT/ST/AT/%ST<br>(min/min/min/%) | Cobb Correction<br>(deg) | TI-T12 gain<br>(cm) |
|------------------------|---|--|---|----------------------------------|--------------------------|---------------------|
| Initial (n=29)         | 3%/7%                                       | 7%/7%                                    | 4.5/4.0/0.2   | 305/232/73/76                    | 15                       | 1.6                 |
| Lengthening<br>(n=198) | 20%/4%                                      | 3%/3%                                    | 3.3/0.2/0.3   | 104/62/42/60                     | 0.7                      | 0.4                 |
| Final (n=10)           | 0%/0%                                       | 20%/20%                                  | 2.3/3.7/0.4   | 454/346/108/76                   | 3                        | 0.5                 |

Rates listed are per procedure. TAT=Total Anesthesia time, ST=Surgical Time, AT=Anesthesia time (TAT-ST), %ST=Percentage of TAT dedicated to ST, deg=degrees, #=number