patient died as a result of postop. acute cardiac failure. Three patients with myelomeningocele & kyphosis were excluded from this study. In total, 68 patients were followed-up for five years postoperatively. 68 patients were divided into two groups, CS and Non-CS in terms of etiology. All patients with CS except for two had associated rib anomalies either unilaterally or bilaterally. Non-CS group included neuromuscular in 12 patients, syndromic in 11, and idiopathic in 3. DRC were investigated in each group at intraop., postop. within 1 year, and within 5 years.

Results: CS group included 42 patients (male 13, female 29, age at primary surgery 5.8 years). Non-CS group included 26 patients (male 13, female 13, age at primary surgery 6.8 years). Non-CS group preoperatively exhibited greater scoliosis ($p=0.0108$) and longer thoracic height ($p=0.0109$) while greater space was available for the lung (SAL) ($p=0.0162$) than in the CS group. No significant differences were seen in the total number of operative procedures, scoliosis magnitude, SAL, and in the rate of growth of thoracic height per year at postop. five years between the two groups. DRC occurred at a significantly lower rate ($p=0.0176$) during surgery but at a higher rate (0.0002) postoperatively in the Non-CS group than the CS group. The most common DRC was proximal junctional kyphosis due to drift or fracture of the upper instrumented rib in both CS group (5/42) and Non-CS group (15/26). Unplanned surgery was performed due to significantly higher incidence of DRC in the Non-CS group than the CS group ($p= 0.0087$).

Conclusion: Despite high rates of DRCs in EOS surgeries, CS with rib anomalies is a more appropriate target etiology than Non-CS for RBDs as CS with rib anomalies had resulted in lower rates of unplanned surgeries.

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Paper #14

Neural Axis Abnormalities in Early Onset Scoliosis Patients Can Be Detected With Limited MRI Sequences

Rajan Murgai, Benita Tamrazi, Ken Illingworth, David Skaggs, Lindsay Andras

Summary: A limited spine screening MRI protocol with sagittal T1 + T2 for EOS patients can allow for a nearly 70% reduction in the length of MRI and significant reduction in anesthesia time without losing the ability to detect neural axis abnormalities.

Hypothesis: Neural axis abnormalities in EOS patients can be detected on limited sequence MRI's for EOS patients.

Introduction: Routine spine MRI screening is recommended for the detection of neural axis abnormalities in early onset scoliosis (EOS) patients. However, routine MRI's are expensive, lengthy, and in this patient population often require general anesthesia. The purpose of this study was to determine if neural axis abnormalities in EOS patients can be reliably detected with limited MRI sequences (sagittal T1, sagittal T2, axial T2).

Methods: A retrospective review of consecutive EOS patients in 2017 who received a screening cervical, thoracic, and lumbar non-contrast MRI was conducted. MRI images were reviewed for pertinent neural axis abnormalities: cerebellar tonsillar ectopia, normal termination of the conus medullaris, cord signal abnormalities/syrinx, and fatty filum. Three sequences (sagittal T1, sagittal T2, axial T2) of these previously reviewed MRIs were read at a separate time by an attending pediatric neuroradiologist. The imaging findings from these 3 sequences were then compared to the prior radiology report based on all of the standard MRI sequences.

Results: 50 patients met criteria. 10/50 (20%) of patients had pertinent neural axis abnormalities detected on sagittal T1 + sagittal T2. No additional pertinent neural axis abnormalities were detected on review of the axial T2 sequence. When compared to the prior radiology report based on all sequences, all pertinent neural axis abnormalities were detected on sagittal T1 + sagittal T2 images. Full MRI's lasted 66±20 minutes and patients required 90±22 minutes of anesthesia. Sagittal T1 + sagittal T2 sequences lasted 21±7 minutes ($p<.0001$).

Conclusion: Limited screening MRI's with sagittal T1 and T2 sequences for EOS patients had 100% sensitivity for the detection of neural axis abnormalities and would allow for a nearly 70% reduction in the length of MRI and significant reduction in anesthesia time.

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Paper #15

The Safety and Efficacy of Intrathecal Morphine in Early Onset Scoliosis Surgery - A 25 Year Single Center Experience

Connie Poe-Kochert, Christina Hardesty, Jochen Son-Hing, Paul Tripi, Jason Ina, George Thompson

Summary: Pre-incision intrathecal morphine (IM) was effective in early postoperative pain management in 97 early onset scoliosis (EOS) patients with growing rod surgery. Complications were minimal.

Hypothesis: The use of IM would be effective in decreasing early postoperative pain in EOS surgical patients.

Introduction: IM is a popular adjunct for pain management in pediatric spinal deformity surgery. It has not been studied in EOS surgical patients.

Methods: Our prospective database (1993-2018) was reviewed to identify EOS patients undergoing growing rod surgery who received (IM) or did not receive IM (non-IM). We assessed age, gender, diagnoses, surgical time, length of stay, pediatric intensive care unit (PICU) admission, and complications (respiratory depression, pruritus, nausea/ vomiting). We also assessed start time for narcotics following surgery and pain scores.

Results: There were 97 patients (171 procedures) who met inclusion criteria: 26 IM patients (43 procedures) and 71 non-IM patients (128 procedures). We only included data from initial insertion and final fusions. Our dose was 15 μg/kg up to a maximum of 1.0 mg. IM was not used for lengthening procedures, short procedures (< 3 hours), respiratory drive/ pulmonary reserve concerns, paraplegia, unsuccessful access to intrathecal space, and anesthesiologist decision. Both groups followed a strict perioperative care path. There were 2 patients with IM that had mild respiratory depression following initial insertion but did not require PICU admission. An IM patient at final fusion had respiratory depression and required PICU admission. There was no difference between pruritus and nausea / vomiting at final fusion. The first dose of narcotics occurred at approximately 12 hrs post-operatively in IM group vs 1.1 hrs in the non-IM group for both procedures ($p=0.0001$). Pain scores were significantly lower in the IM groups during recovery and the first postoperative night.

Conclusion: Pre-incision IM is a safe and effective method of pain management in the first 18-24 hrs postoperatively for EOS patients undergoing growing rod insertion and final fusion. Complications were minimal.

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