Utilizing Two Surgeons Improves Operative Efficiency in Neuromuscular Scoliosis Corrective Surgeries

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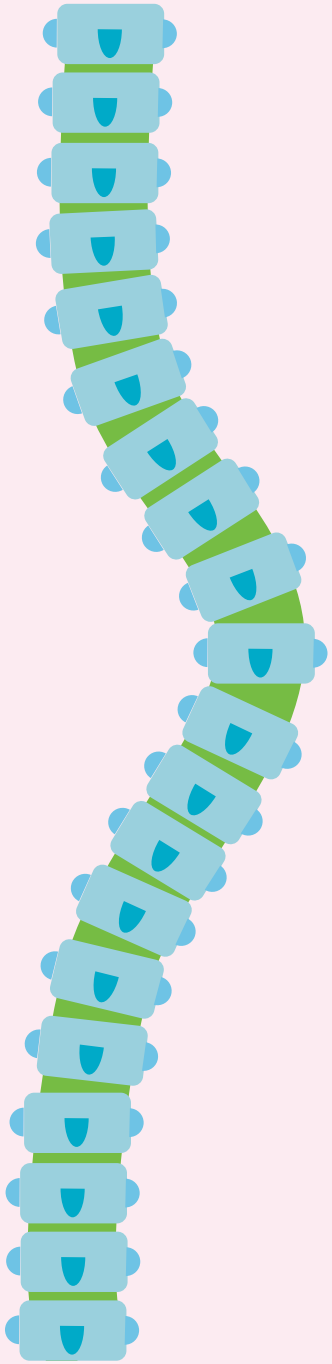
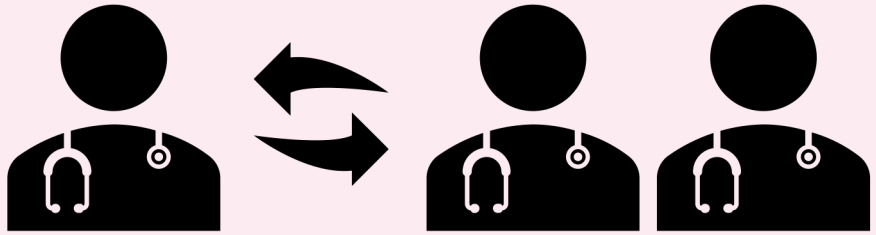


Disclosures

- Peter Sturm MD MBA: Consultant Depuy Synthes Spine and Nuvasive, Surgical Advisory Board Depuy Synthes Spine, Shareholder Green Sun Medical
- James McCarthy MD: LADD–Living Arrangements for the Developmentally Disabled–Wife: Board or committee member, Nuvasive: Research support royalties consultant, Orthopediatrics: Unpaid consultant, Pediatric Orthopaedic Society of North America: Board or committee member
- No disclosures for the following: Bryan Menapace MD MBA, Lindsay Schultz BS CCRP, Nichole Leitsinger BS, Viral Jain MD

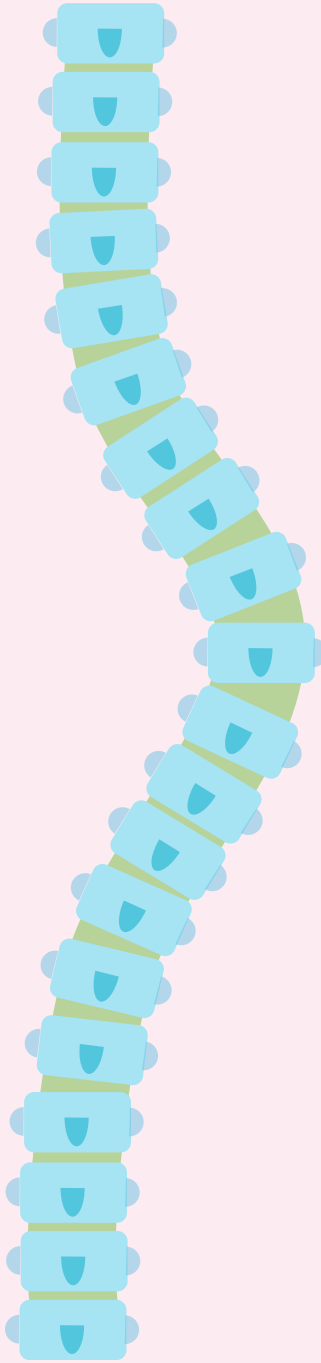
Study type

Retrospective, case control, single center, level IV



Aim

to identify differences in performing corrective surgeries in neuromuscular scoliosis with two experienced pediatric co–surgeons (CS) versus one single surgeon (SS)



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Key Features of Neuromuscular Scoliosis (NMS)

- Defined by the Scoliosis Research Society[1] as:
  - "An **irregular spinal curvature** caused by disorders of the brain, spinal cord, and muscular system… often associated with **pelvic obliquity**… [and] frequently **kyphosis** is also concurrently present."
- **Etiologies** are numerous upper and lower motor neuron pathologies and primary myopathies[1]. Some of the most common diagnoses:

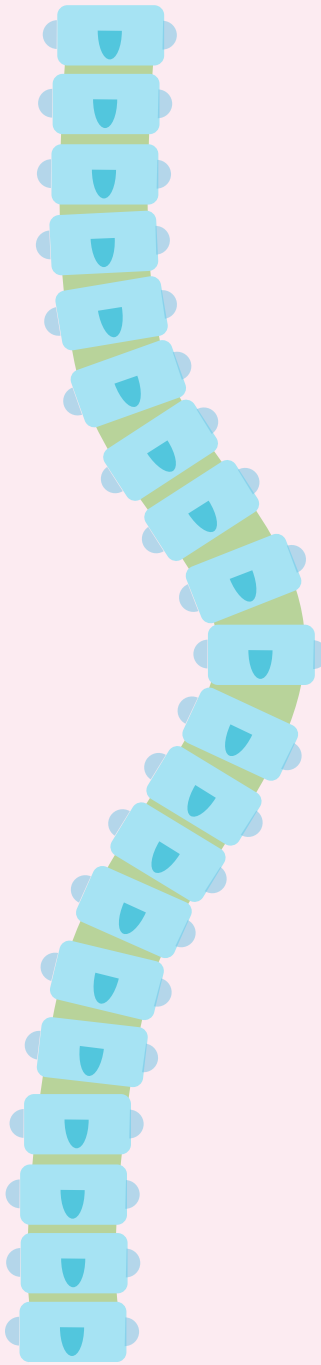
	Incidence	NMS (%)
Cerebral Palsy[2]	~1/500	25–80%
Myelomeningocele, Spina Bifida[2]	~1/1,700	60–100%
Muscular Dystrophy[2]	~1/7,00 males	90%
Spinal Muscular Atrophy[3]	~1/8,000	67%

Scoliosis management[4,5]

- **Bracing and orthoses** are useful early on for hygiene, wheelchair positioning, delaying cardiopulmonary compromise
- Early **surgical correction** is common, often when patient is in good health. Options include expandable constructions, spinal fusion.

Operative considerations, concerns[6,7,8,9,10]

- For all patients undergoing spinal deformity correction, NMS had greatest **blood loss**
- **High complication rates**, with the three most common being: pulmonary (22.7%), reoperation for implant, fusion (12.5%), infection (10.9%)
- 0.34% **mortality** rate for surgical treatment
- **Postoperatively** have increased length of stay and higher in-hospital mortality



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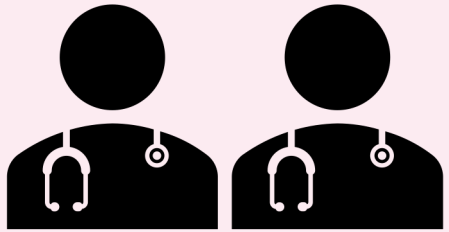
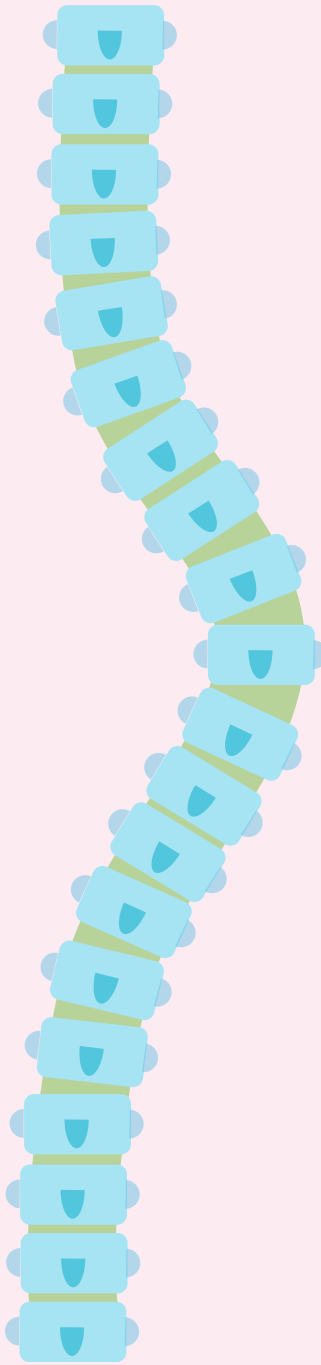
The Concept of Co–Surgeons





- The concept is being explored in a number of surgical fields, including colorectal[11] and breast surgery[12]

- There have been some recent investigations into co–surgeons for various spine surgeries in both adults and children, with some notable rationale and findings[13,14,15,16]
  - Improved outcomes (e.g. better correction)
  - Improved operative measures including faster surgeries and less blood loss
  - Decreased complications both intraoperatively and postoperatively
  - Decreased 30– and 90–day readmission

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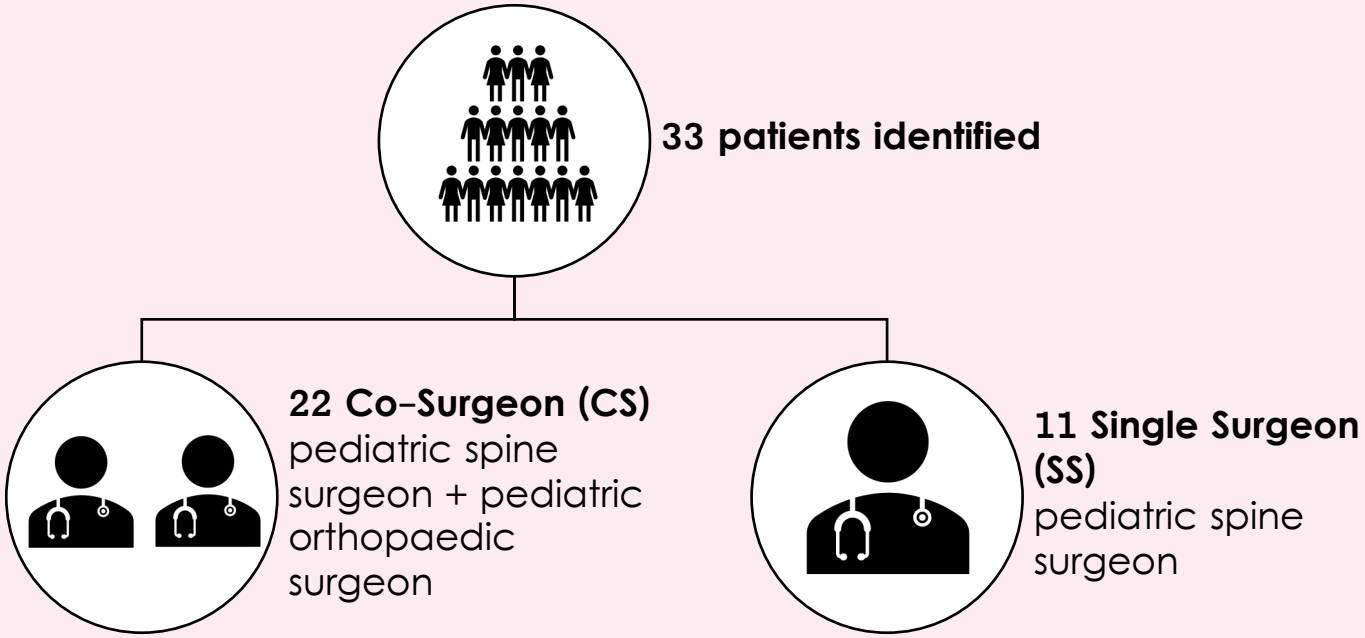
Methods

Patient Identification

- Database of NMS patients
  - Underwent posterior spinal fusion (PSF)
  - No prior spine operations
  - Surgery performed 2016–2019



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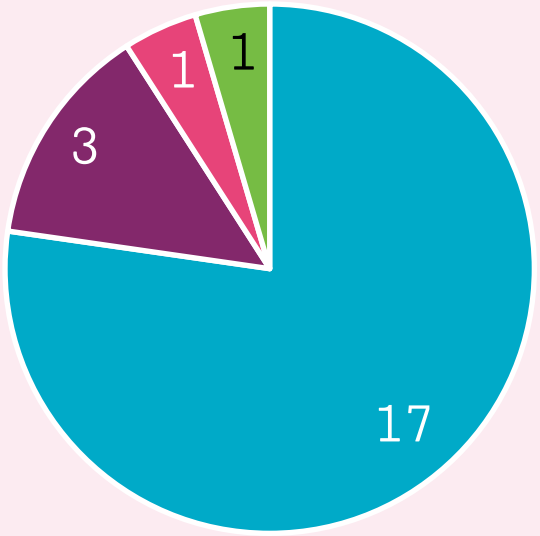
Measures and Analysis

- Measurements
  - Demographics
    - Sex, age, weight,
    - Diagnosis, curve severity
  - Operative
    - Levels fused, estimated blood loss, anesthesia and surgeon times, intraoperative complications
  - Postoperative
    - Postoperative length of stay, postoperative complications
- Analysis
  - One– or two–tailed T–test
  - Statistical significance $p \leq 0.05$

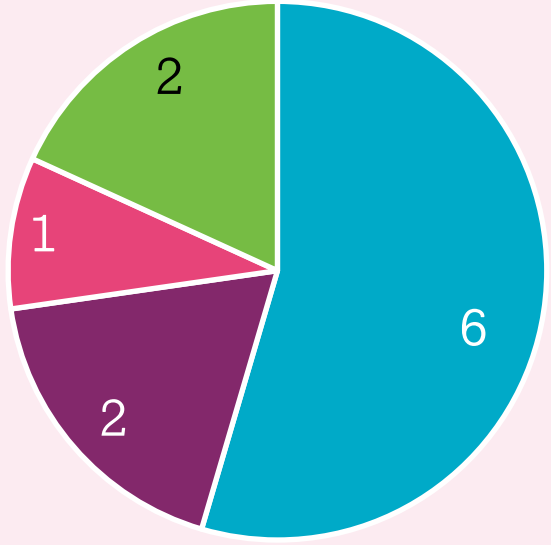
Results – Demographics

	CS	SS	p
Age (years)	13.5	12.5	0.27
Sex (% male)	50.0	27.3	0.22
Weight (kg)	37.5	41.6	0.43
Curve severity (°)	82.7	67.7	**0.028**

Co–Surgeon



Single Surgeon



- Cerebral Palsy
- Rett Syndrome
- Spinal Muscular Atrophy
- Other (Cri-du-chat syndrome)

- Cerebral Palsy
- Rett Syndrome
- Spinal Muscular Atrophy
- Other (Myelomeningocele, Congenital CMV)

p = 0.11

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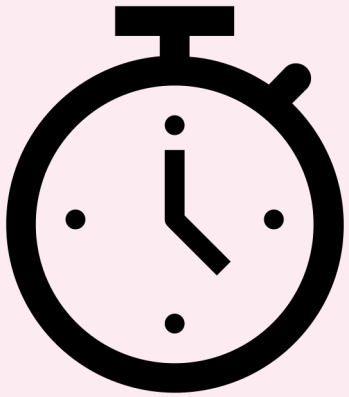
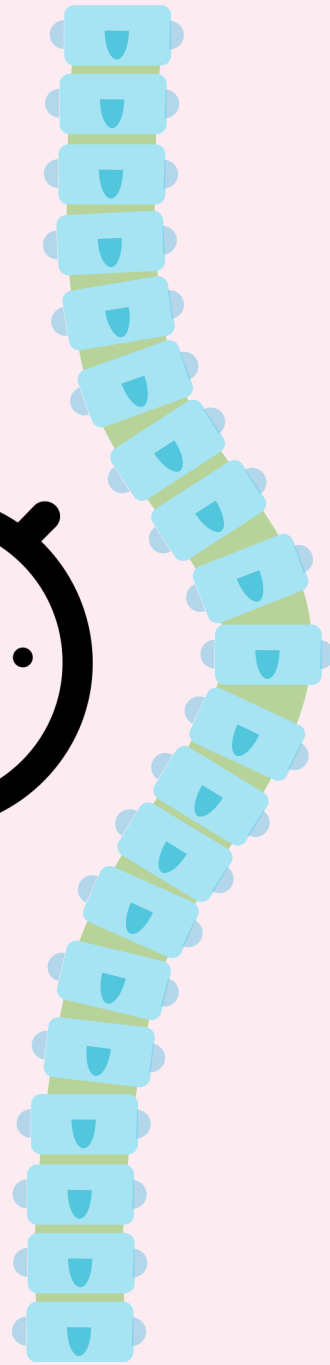
Results – Intraoperative

	CS	SS	p
Levels fused (#)	14.6	14.3	0.26
Fusion to pelvis (%)	63.6	45.5	0.17
Blood loss (mL)	843	580	0.20
Anesthesia time (min)	387	462	**0.015**
Surgical time (min)	282	336	**0.025**
Intraoperative complications (#)	0	0	1





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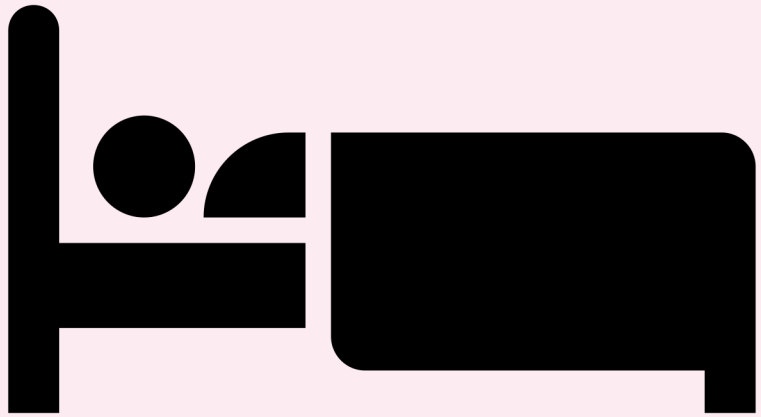
Results – Postoperative

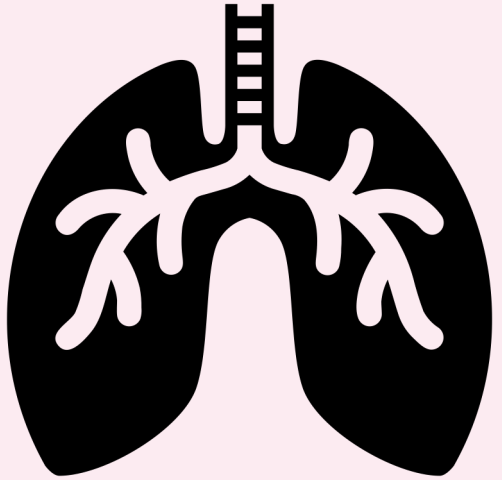
Postoperative length of stay (LOS)

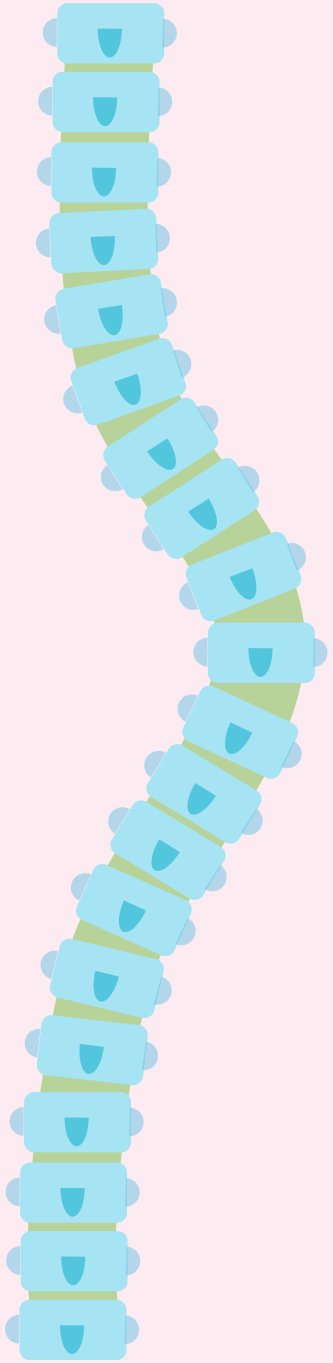
- Co-surgeon: 5.5
- Single Surgeon: 6.7
- P-value: 0.26

Postoperative complications

- Co-surgeon: 0
- Single Surgeon: 1 (pneumonia)
- p-value: 0.080







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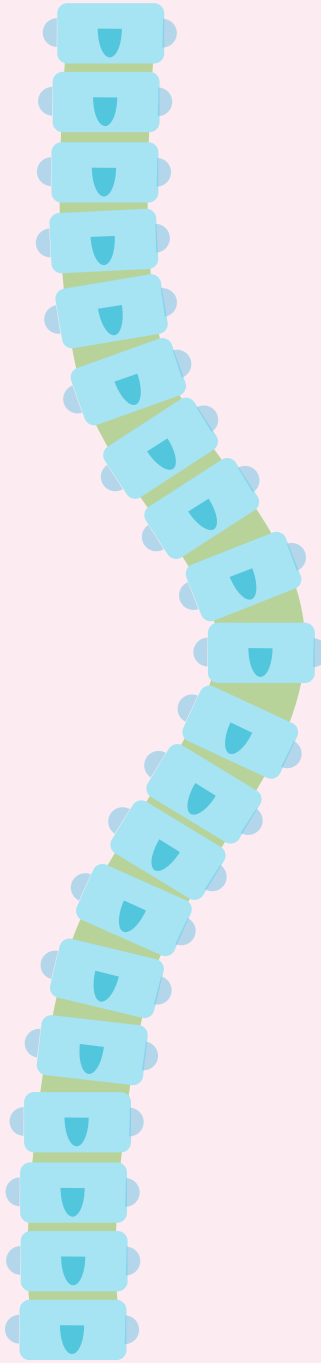
Conclusion, Discussion (1/3)

Demographics were similar but not identical

- Age, weight, gender were similar between the two groups
- The CS group had, on average, patients with statistically more severe curves. Patients in the CS group were more likely to have cerebral palsy.
  - Possible selection bias
  - This would be minimized in a prospective, randomized series

Two surgeons were faster than one

- Statistically significantly faster anesthesia and operative times were seen in the CS group
  - The surgeries, on average, were nearly an hour faster
  - Patients were out of the operating room (OR) nearly 1.5hr sooner
  - This was despite the father that patients had more severe curves, similar levels fused, and relatively higher rates of fusions to pelvis
- Less time in the operating room translates to lower costs[17] and gets patients out of anesthesia, off the table, and to recovery sooner



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Conclusion, Discussion (2/3)

Blood loss was dissimilar, though not statistically different

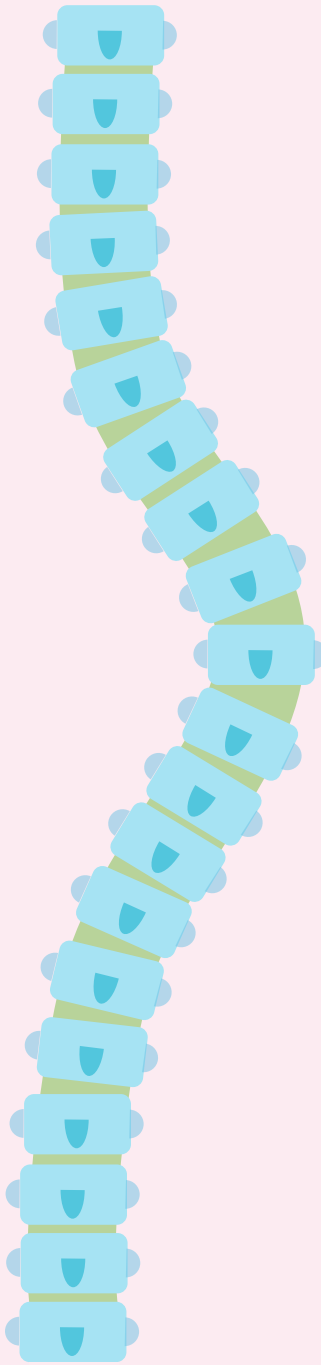
- Blood loss was relatively higher in the CS group
  - Proposed to be due to this group having more severe curves and higher rate of fusion to the pelvis

Postoperative length of stay was similar

- Patients in each group remained in the hospital for a similar amount of time, as would be expected

Intraoperative and postoperative complications were similar

- There was only one complication in this study, postoperative pneumonia in the SS group
- A much larger cohort would be needed to determine statistical significance in complications
  - Complications occur 6.3% of the time in NMS PSF[6]
  - This study was underpowered to determine differences in complication rates



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Conclusion, Discussion (3/3)

Interpretation, Recommendations, and Next Steps

- Overall, this study sheds light on some potential benefits of utilizing co-surgeons for pediatric surgery, particularly more difficult cases.
  - These benefits include: shorter operative and anesthesia times, no change in complication rates
- We would encourage readers to consider utilizing co-surgeons for severe curves in complex patients (e.g. NMS).
  - Particularly, this consideration may be of greater consideration if the primary surgeon is not a pediatric spine surgeon and the second surgeon could offer this expertise
- Potential continuations of this study could include larger cohorts to determine differences in complication rates, or a study that is randomized, prospective to minimize particularly selection bias

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