Improvement of Functional Outcome Using 6-minute walk in Patients with Congenital Scoliosis Treated by Growth Friendly Surgery: Five Years Follow-up Study

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Disclosure

• Noriaki Kawakami	NPO Japan Spinal Deformity Institute (JSDI) （a, e) Medtronic (b) DepyuSynthes (b) Kisco (b) EOS imaging (a)
• Hiroko Matsumoto	SRS (a) POSNA (a) Japan Spinal Deformity Institute (JSDI)（a, b) CSSG (b)
• Toshiki Saito	No relationship
• Ryoji Tauchi	No relationship
• Tetsuya Ohara	No relationship
• Gregory Redding	No relationship

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6 Minute-Walk Test (6MW)

- To assess function in several cardiopulmonary and neuromuscular conditions
- Influenced by muscle strength, balance, nutritional status, cardiac and lung function
- Standardized with norms for children ≥5 years of age
- Easy to do in the outpatient setting

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6-minute Walk Test in EOS

- **Pre-op 6MW test in congenital scoliosis with rib anomalies**
  - ICEOS 2017, San Diego (Kawakami, Matsumoto, Redding)
    - Reduced in all patients compared to norm (10-30%)
    - Absolute 6MW values correlated with age, FVC and major curve
- **6MW test has not been widely used for EOS.**
- **No report of changes during surgical treatment in EOS**

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Purpose

- **To investigate changes in 6-minute walk test before and after serial surgical treatment for congenital scoliosis**
  - Hypothesis: Growth friendly surgery improves functional outcome measured by 6-minute walk
- **To examine correlations between 6-minutes walk test and BMI and lung function forced vital capacity (FVC)**
  - Hypothesis: Longer walking distance in 6MW test is associated with higher BMI and FVC
- **To compare the results to changes reported in normal children**
  - Hypothesis: EOS patients have less changes in function compared to norm

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Study Methods

Design and Setting:

- A retrospective cohort study
- Consecutive patients 2004-2012 from a single center

Study Participants:

- Congenital scoliosis with rib anomalies (fused/defect, or severe deformed)
- Rib-based growth-friendly surgery
- Follow-up period: five years

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Methods

Endpoints:

- **6 minutes walk test at 1-year, 2-year and 5-year**
  - **Absolute distance (m)**
  - Standardized (height, age)

- **BMI %tile at 1-year, 2-year and 5-year**
  - Calculated by arm span
  - **%tile** by Japanese age specific norms

- **FVC %tile at 1-year, 2-year and 5-year**
  - Calculated by arm span

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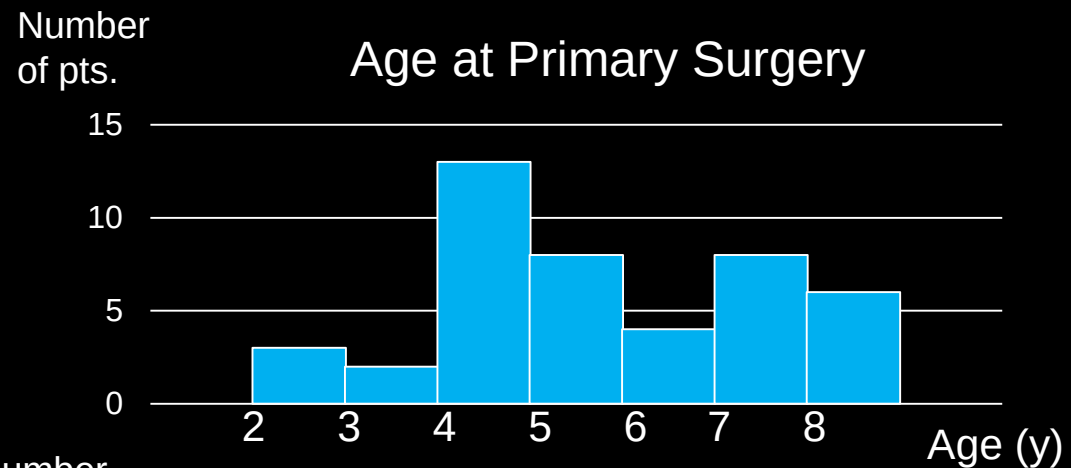
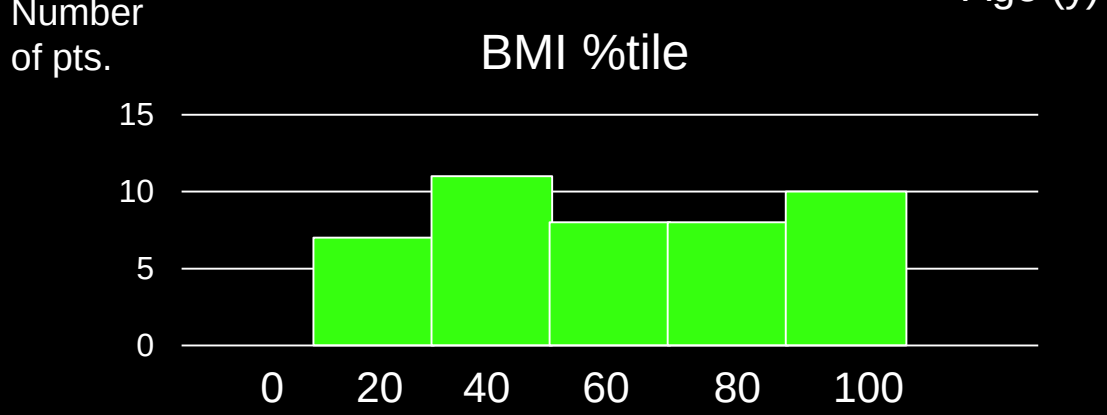
Study Participants

- **44 patients** (Male 14, **Female** 30)
- Age at primary surg.: **5.8±1.8 ys.**



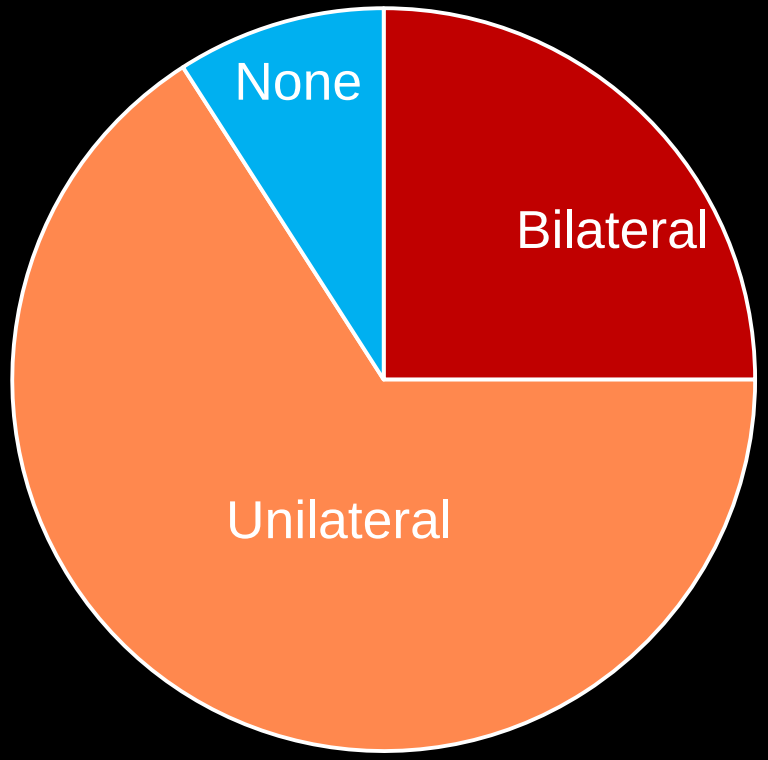
- Pre-op BMI: **53±30 %tile**



- Number of procedures: 9.8±1.4 within 5 years
- 14 of 44 (32%) underwent spine fusion, implant removal, or termination of expansion by the end of the study

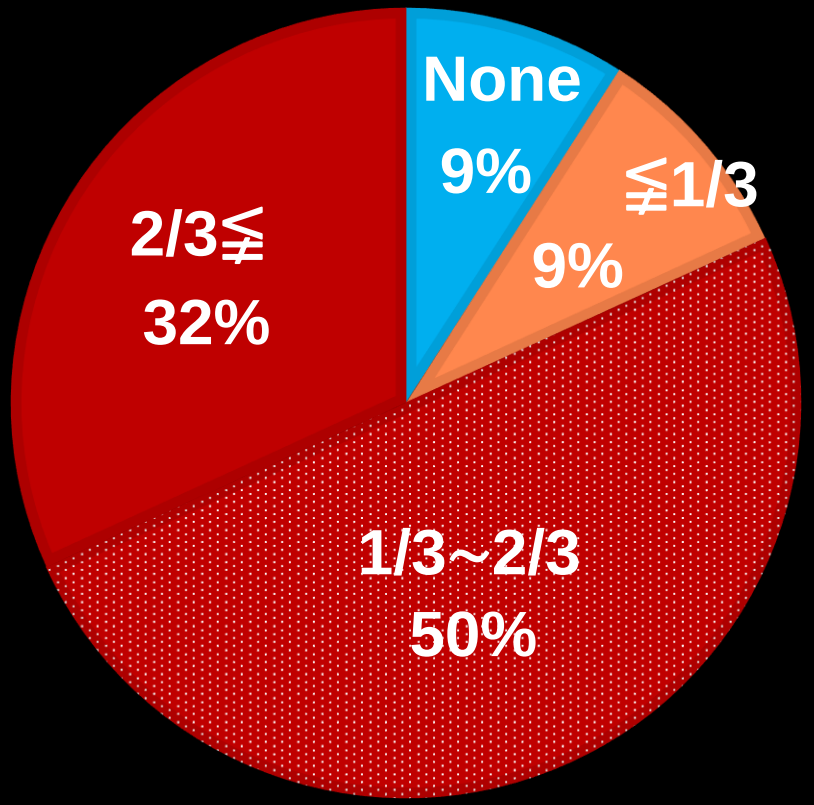
Involvement of Rib Anomalies in Thoracic Cage

Laterality



2/3 of patients :
unilateral involvement

Area



80% of patients :
>1/3 of the unilateral thoracic cage

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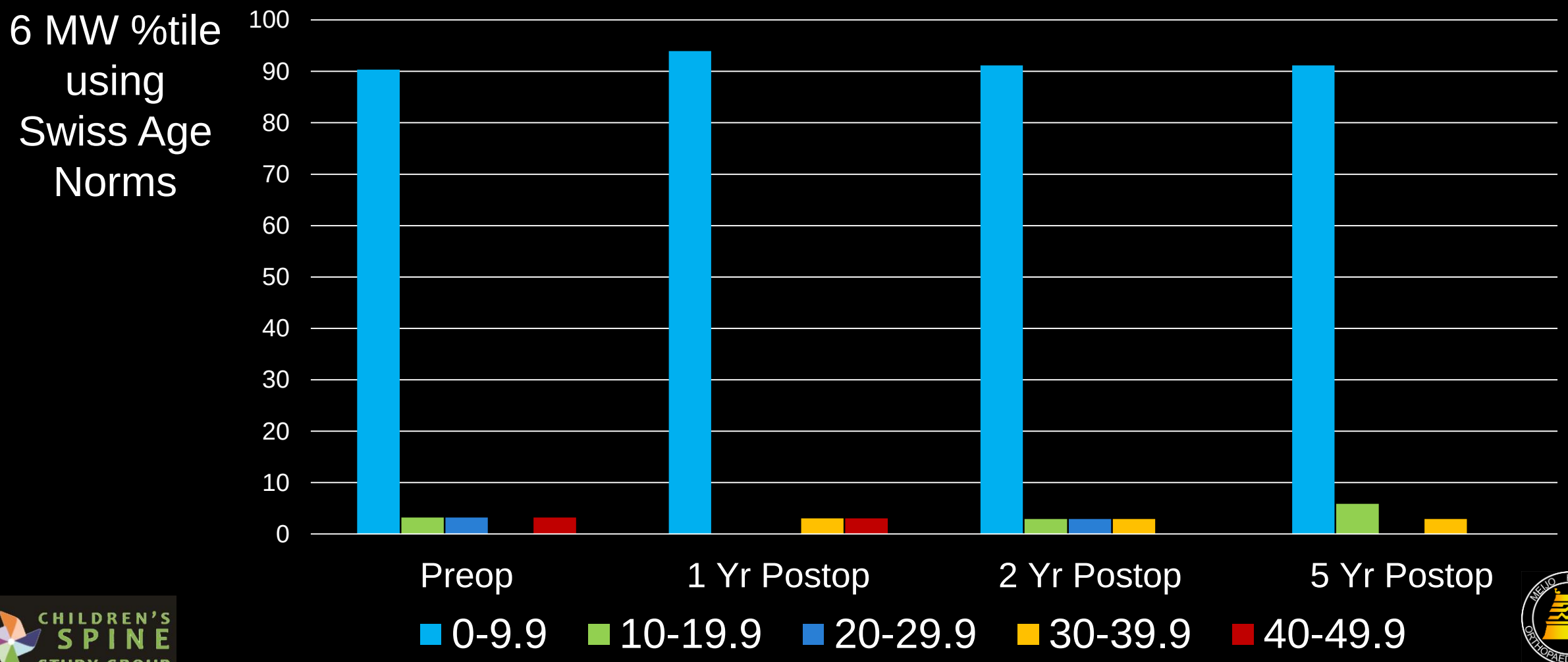
Changes of Walking Distance: Standardized 6MW was compromised at preop but did not worsen postoperatively



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Results:

	Preop.	Immediate Postop.	1-year Postop.	2-year Postop.	5-year Postop.
Major curve (°)	72 ± 28	53 ± 23	56 ± 22	56 ± 22	52 ± 23
BMI (%tile)	53 ± 30	---	51 ± 29	43 ± 31	34 ± 27
FVC % Predicted (%)	58 ± 17	---	57 ± 15	57 ± 15	54 ± 16
6-minute Walk (m)	344 ± 86	---	374 ± 74	390 ± 78	434 ± 80

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Results:

- Over the 5-year period of study, 6-minute walk increased by 86±97m (17.2m/year)
  - Normal children increase distance of 16-25m per year

- The change in FVC did not correlate with the change in 6-minute walk as a % of incremental change over 5 years (p=0.30)

- No correlation between BMI and 6-minutes walk

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Conclusions

- **Over 5 ys. of surgical Tx. for congenital scoliosis:**
  - ✓Major coronal curve was reduced
  - ✓BMI decreased
  - ✓Lung function did not change as FVC % of predicted
  - ✓6-minute walk distance increased in absolute terms at a rate seen in normal children over time
- **Improvement in 6 minute walk occurs despite persistently reduced lung function, suggesting improvements in balance, strength, and stride length may be more important determinants of performance by rib-based growth-friendly surgery.**

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Thank you for your attention.

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Standardized 6MW was compromised at preop but did not worsen postoperatively