

# Increased Rates of Anchor Failure Can Be Predicted by an Early Onset Scoliosis Severity Score

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# Early Onset Scoliosis

- Deformity diagnosed < 6 yrs
- Wide spectrum of severity
  - Infantile “idiopathic”
  - Congenital
  - Syndromic
  - Associated medical co-morbidities

→ Complications frequent  
(up to 100% surgical)





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# Hypothesis

- Implant complications (anchor failure) rates higher in fragile patients with more severe deformity and more medical co-morbidities

Needed: severity scoring index to assist with prognostic issues and outcome determination





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# Methods

- EOS severity score developed at TSRH
- Retrospectively applied to initial experience with growth-sparing surgery

## Diagnoses

- Syndromic (20)
- Muscular dystrophy (7)
- Congenital (5)
- Idiopathic (3)
- Thoracogenic (2)



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# Methods

- 37 patients with EOS treated since 2003 with growth sparing surgery
  - 1 with less than 12 mo f/u
- 20 boys 17 girls
- Age at initial surgery 5 yrs (1.3 – 9.3 yrs)
- 5 have completed lengthenings
  - All have had definitive fusion
  - 32 still undergoing lengthenings
- Average f/u 3.8 years



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## Components (4)

### 1. *Fragility index score* (0-5 points)

0 = BMI > 20

1 = BMI < 20, no other co-morbidities

2 = BMI < 20, ambulatory w/ co-morbidities

3 = BMI < 20, non-ambulatory

additional 1 point each for:

- osteopenia
- connective tissue/bone dysplasia  
(NF, Marfan, E-D, OI)



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# EOS Severity Score

## 2. *Age* (0-2 points)

- 0 = age > 7
- 1 = age 4-7
- 2 = age < 4

## 3. *Respiratory* (0-3 points)

- 0 = normal
- 1 = night assistance (CPAP/BiPAP) without oxygen
- 2 = tracheostomy, supplemental oxygen, or night-only ventilator assistance
- 3 = full time ventilatory support





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## 4. Radiographic Score

- Points awarded (up to 3) for severity of 4 separate anatomic deformities

points	AP Cobb	Sag Cobb	Congenital segments	Ribs (fused or absent)
0	<50	10-50	None	None
1	50-70	<10, 50-70	<3 levels	<3
2	71-90	71-90	3-6 levels	3-6
3	>90	>90	>6 levels	>6

Max score = 12



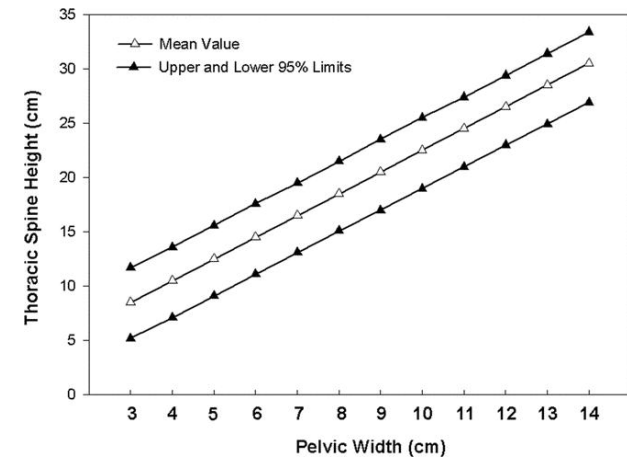
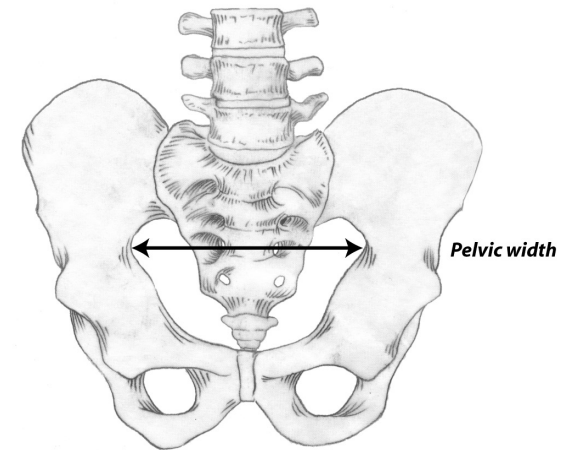


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## 4. Radiographic Score

- Length T1-12 (anatomic size)
- Flexibility
- Max score = 4

points	T1-T12 height	Flexibility
0	>50 <sup>th</sup> %	>33%
1	5-50	15-33%
2	<5 <sup>th</sup> %	<15%



*Emans Spine 2005*



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# Radiographic Conversion

- 1 = 1-3 xray points
- 2 = 4-6 “
- 3 = 7-10 “
- 4 = 11-16 “



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Example 1 : 7 yo male, non-ambulatory, connective tissue syndrome, no respiratory support, myelopathic, VSD repair, osteopenia

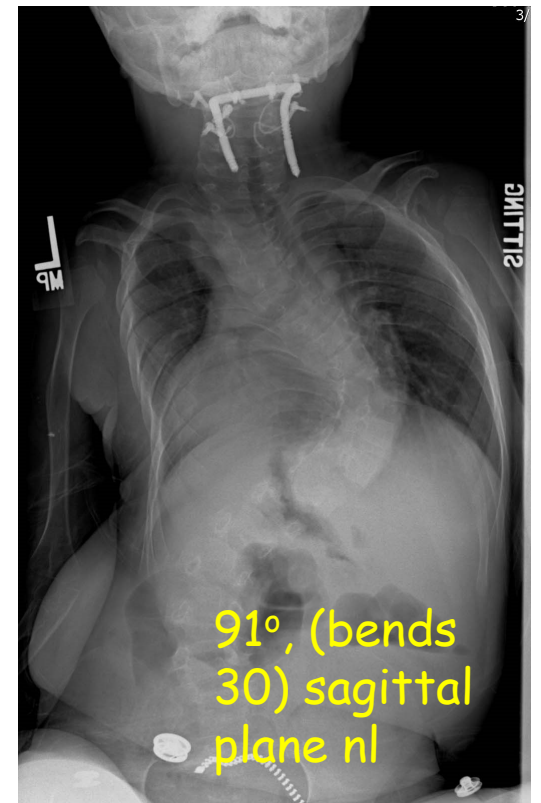
- 7 yo = 0
- Respiratory = 0
- Fragility = 5
- Radiograph = 2

**Total 7**

BMI < 20, non-amb, osteopenic, connective tissue, myelopathy

AP > 90 = 3  
sagittal = 0  
flexible = 0  
T1-12 < 5<sup>th</sup>% = 2  
noncong. = 0

**Index points 2**





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# Severity Index - Results

- Range 2-11 (mean 6)
- 23 pts with spine based surgery (growing rods)
  - Average score 5.4
- 14 with rib based surgery (VEPTR)
  - Average score 7.9 (p<0.003)
- 1 excluded (f/u < 1 yr) from complication analysis



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# Results - Severity Index

- Overall anchor failures/procedures = 0.6
- Overall rib anchor failures/procedure = 0.5
- Overall spine anchor failures/procedure = 0.25
  - rib/spine failure rate difference not statistically significant

- Mean score for pts with  $> 0.5$  anchor failures/procedure = 7.6
- Mean score for pts with  $< 0.5$  anchor failures/procedure = 5.5 (p<0.03)



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# Results

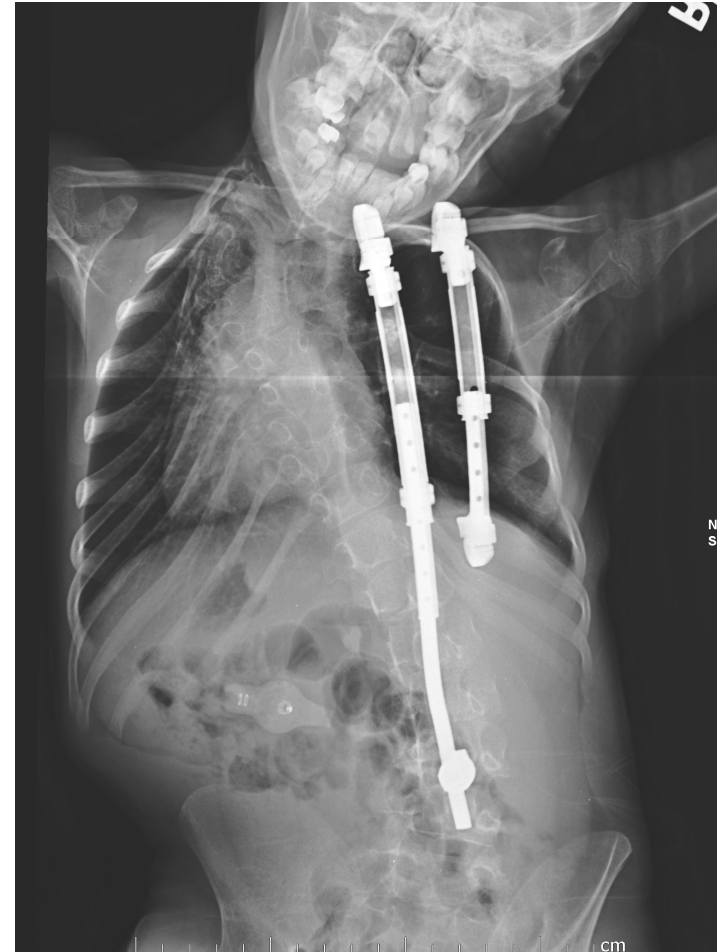
- Other complications not related to severity score
  - 7 infections requiring surgical debridement
  - 4 intraoperative neuromonitoring changes
  - 2 late motor deficits
    - 1 brachial plexus injury after VEPTR lengthening
    - 1 paraplegia from thoracic pedicle screw migration
  - 3 implant erosion through skin
  - 1 domino set plug failure requiring rod replacement



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# Discussion

- Many EOS patients have significant comorbidities
- Growth-sparing rx requires repeat surgery over time, inviting complications
- Wide spectrum of severity characteristic of EOS patients

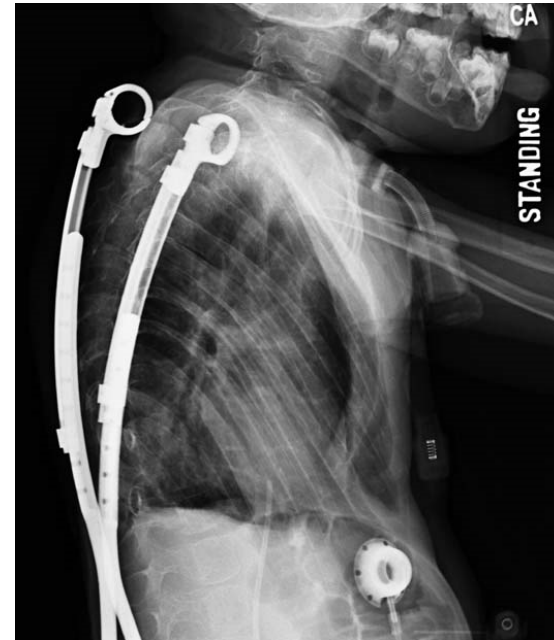




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# Discussion

- Severity index 8 or greater is prognostic for anchor failures
- Anchor failure should be anticipated and technique strategies planned in advance







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# Thank You



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