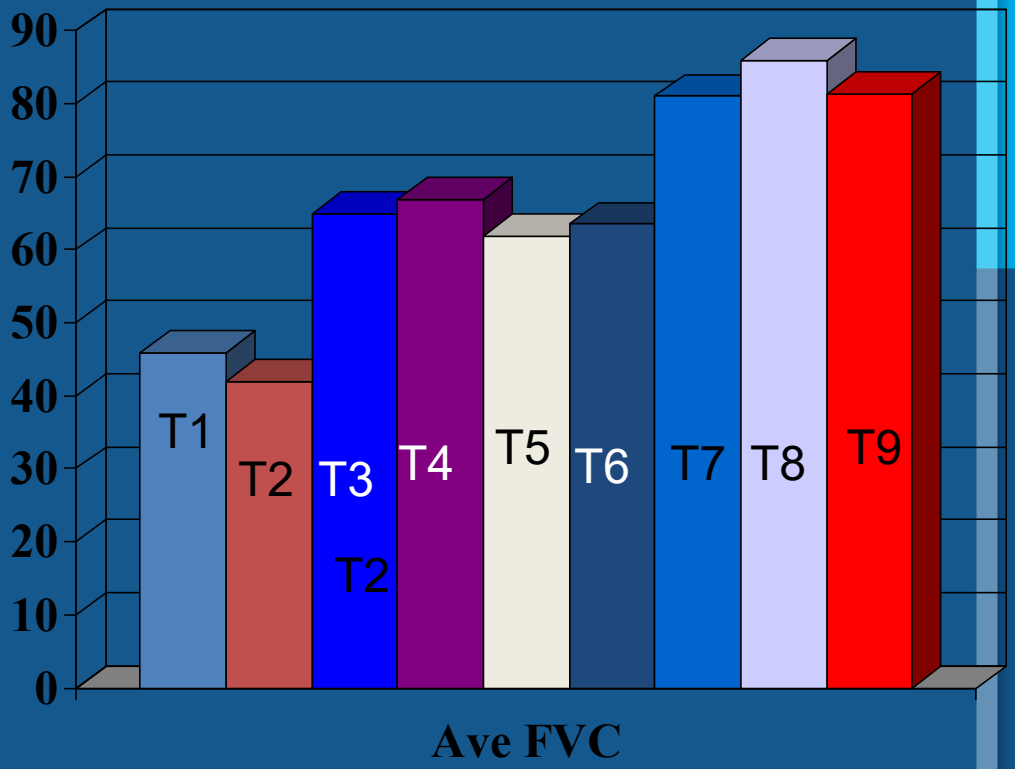
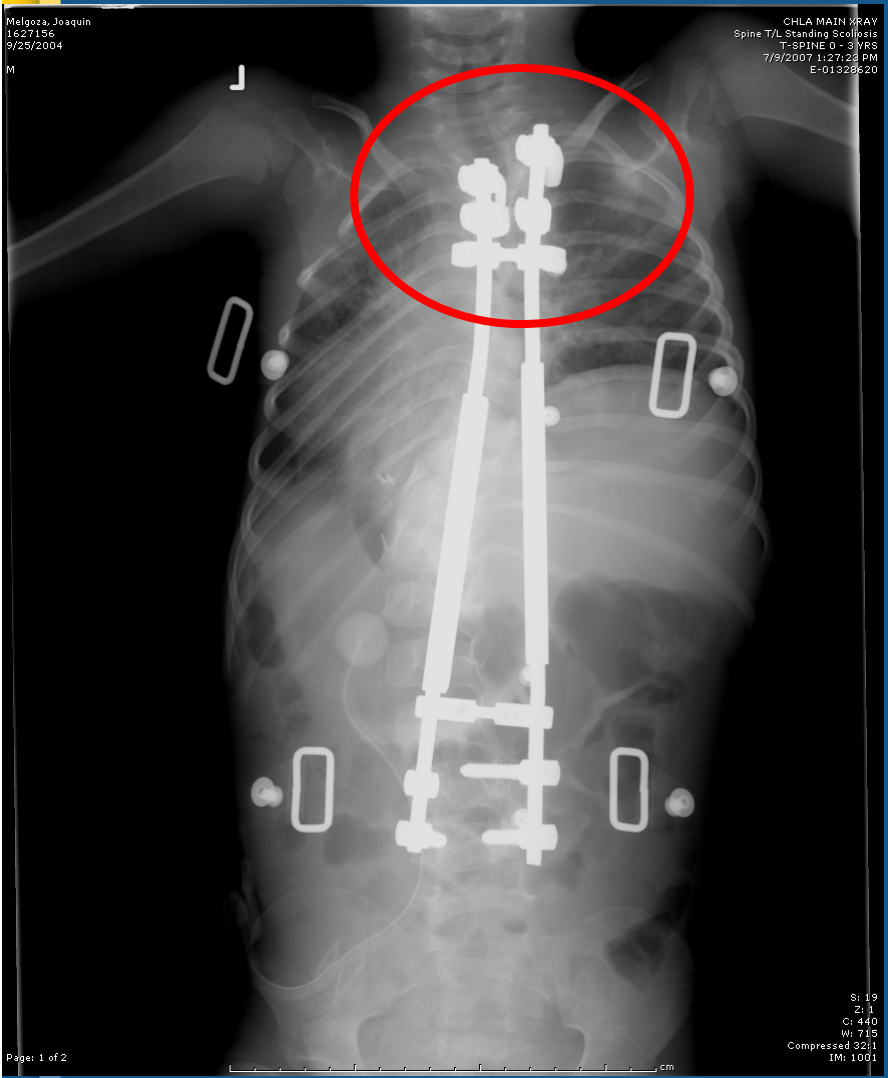


# Hybrid Growth Rods Using Spinal Hooks on Ribs

David Skaggs  
Karen Myung  
Muharrem Yazici  
Mohammad Diab  
Hilali Noordeen  
Michael Vitale  
Charles Johnston



# FVC VS. PROXIMAL LEVEL OF FUSION



Karol et. al, JBJS 2008



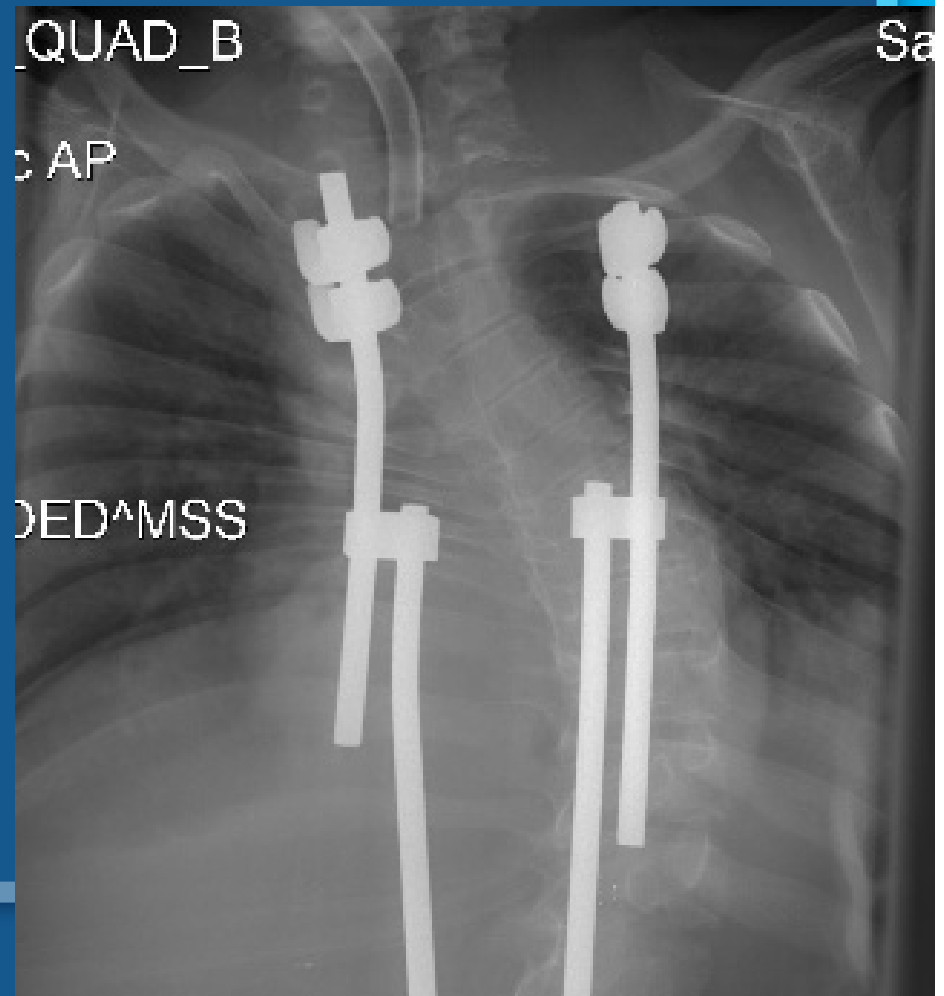
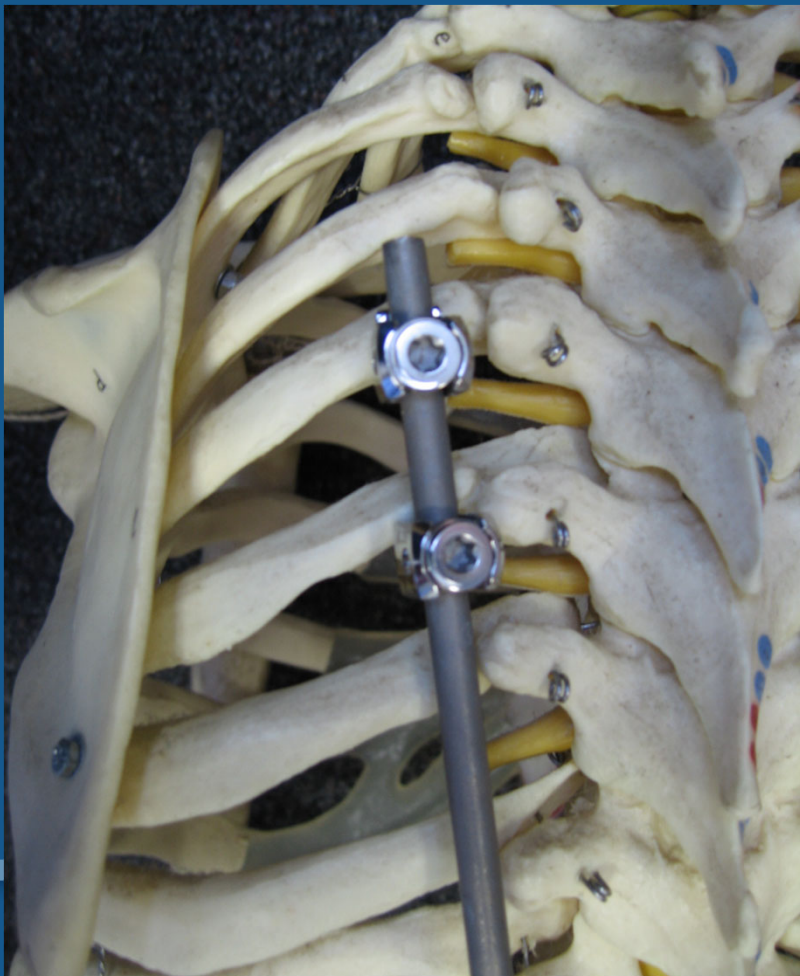
We Treat Kids Better



## Hooks on Ribs:

Do not expose or fuse upper spine

Spine Remain Virgin (no thorocotomy)

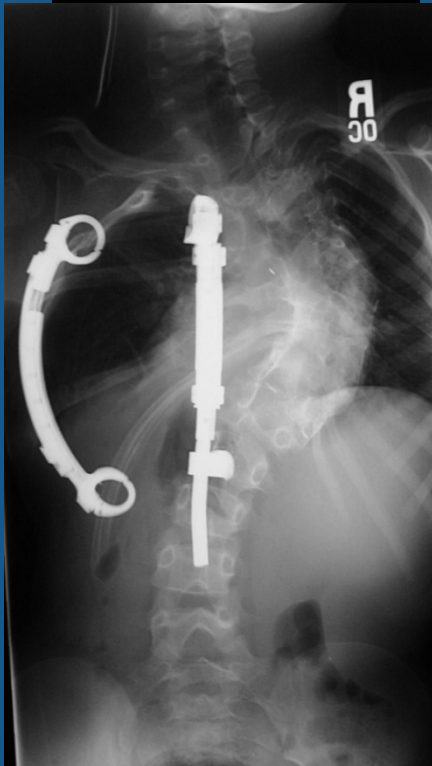


# Background: First Hybrid Publication

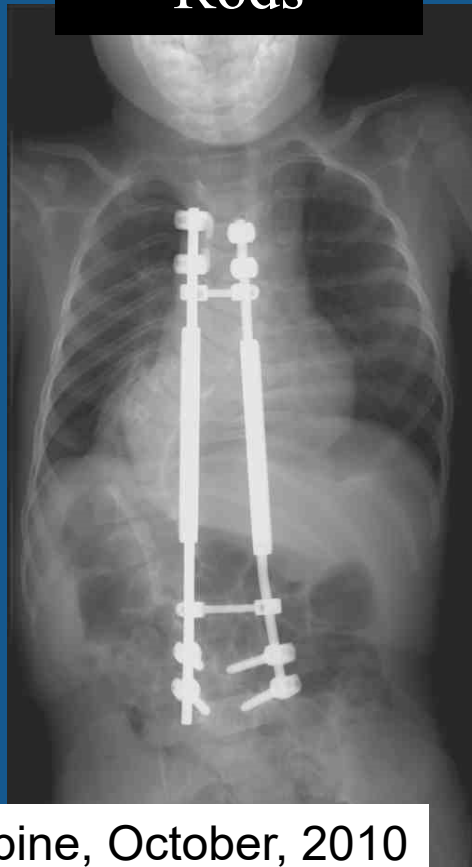
36 patients – mean age 4  
Mean f/u 51 mo (2-117)  
Mostly Congenital, NM

Fewest CCXs/yr  
Fewest CCXs/ cm growth

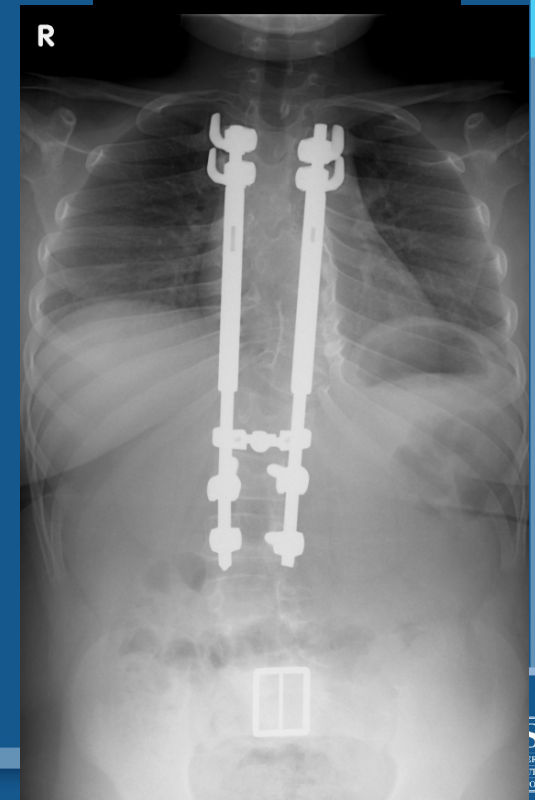
VEPTR



Growing  
Rods



Hybrid

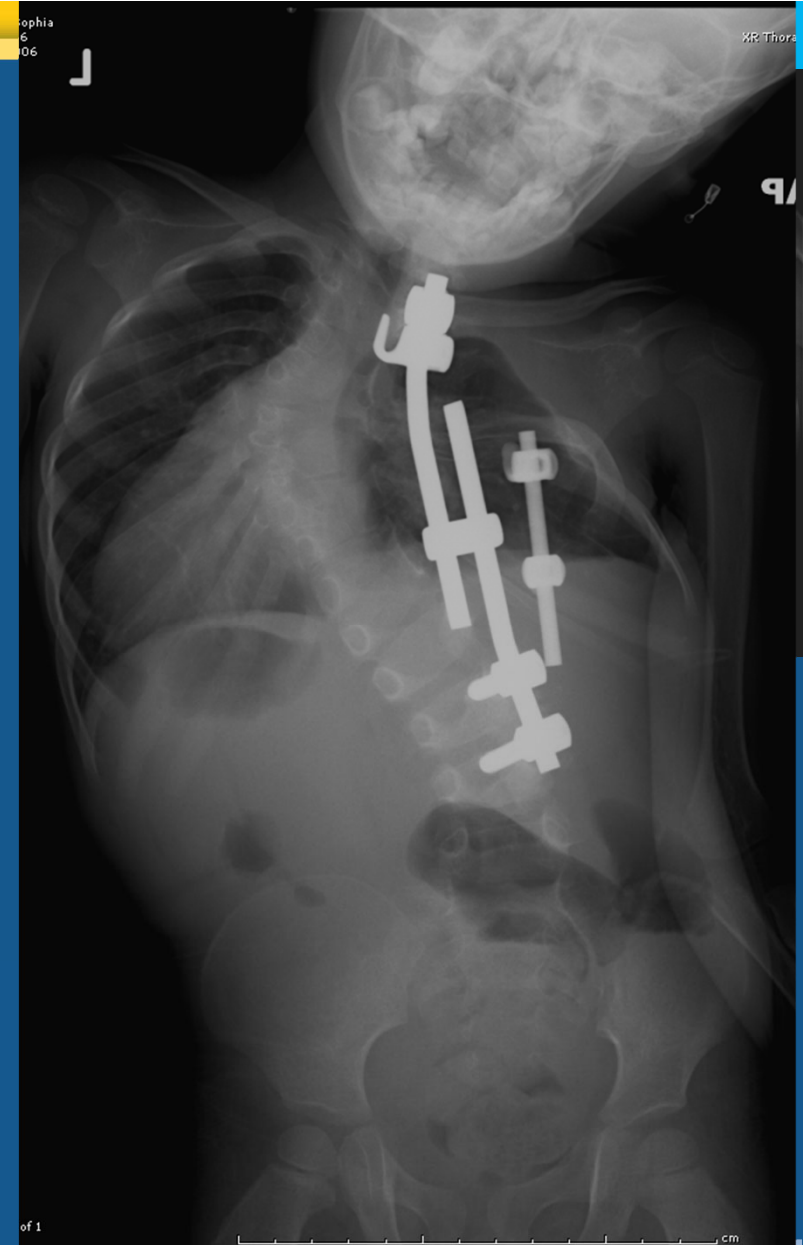


Wudbhav, Acevedo, Skaggs , Spine, October, 2010

We Treat Kids Better

# Methods

- Retrospective study
- 28 patients, 6 institutions
- Inclusion criteria:
  - Children <10 years
  - Hybrid growth rods
  - Minimum 2 year followup
    - Muharrem Yazici
    - Mohammad Diab
    - Hilali Noordeen
    - Michael Vitale
    - Charles Johnston

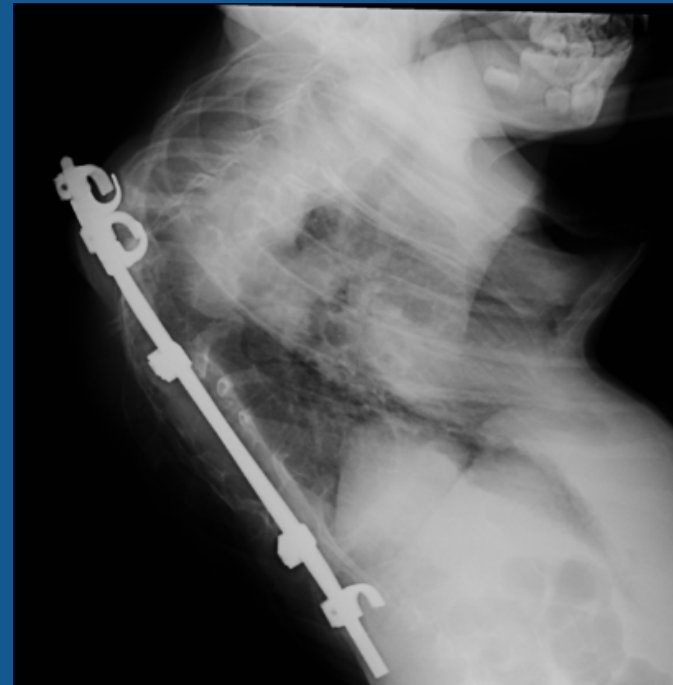
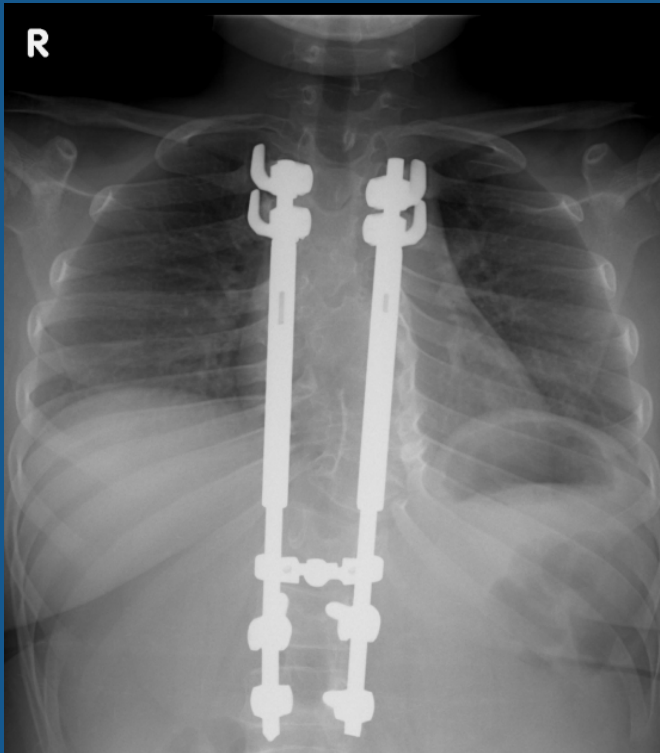


# Results

- Age at index surgery = 3.7 years
- Mean initial Cobb angle = 69°
- Mean f/u = 37 months (min 2 yrs)

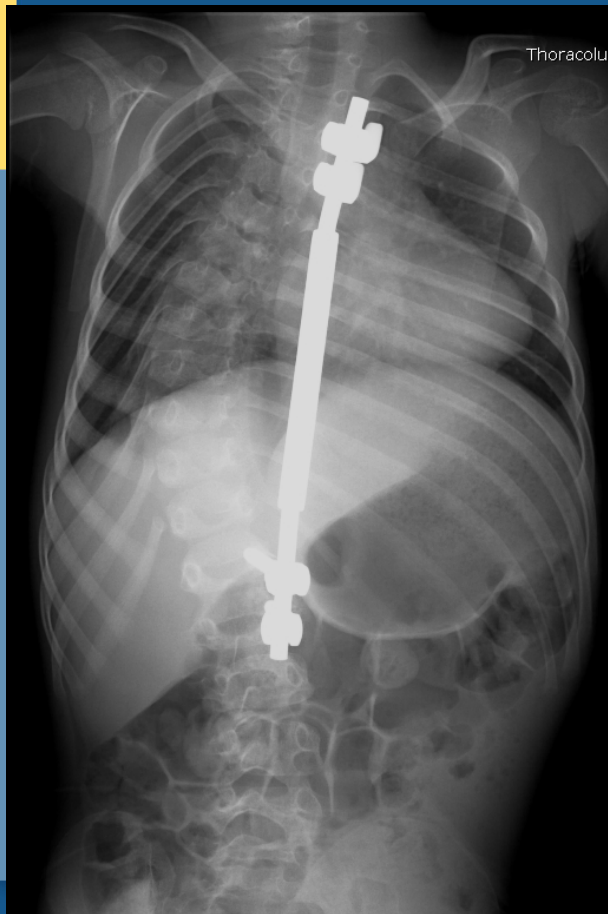
# Results

- 78 hooks on ribs, all proximal foundation
- ½ were up-going only; ½ were in a “claw”

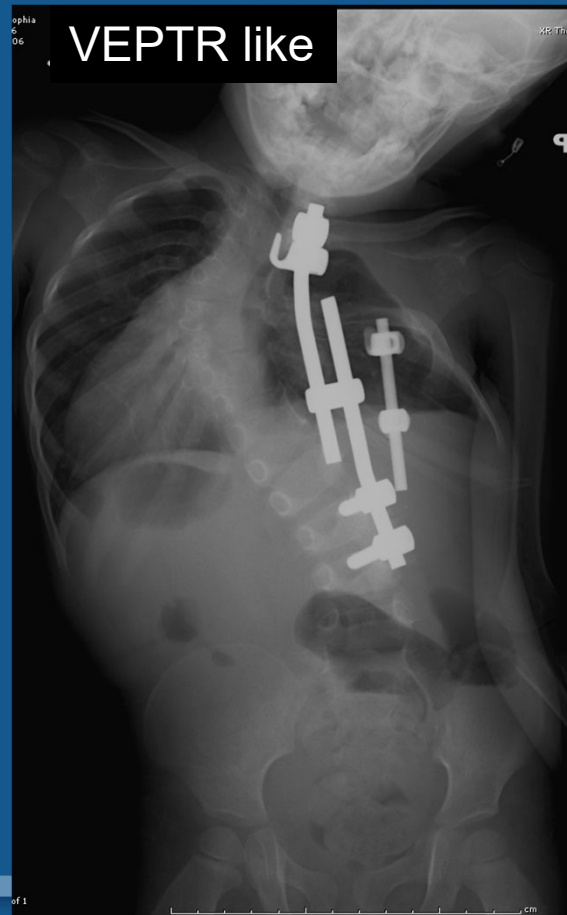


# Results: Most (69/78) hooks were applied to concave side only.

Unilateral Single Rods

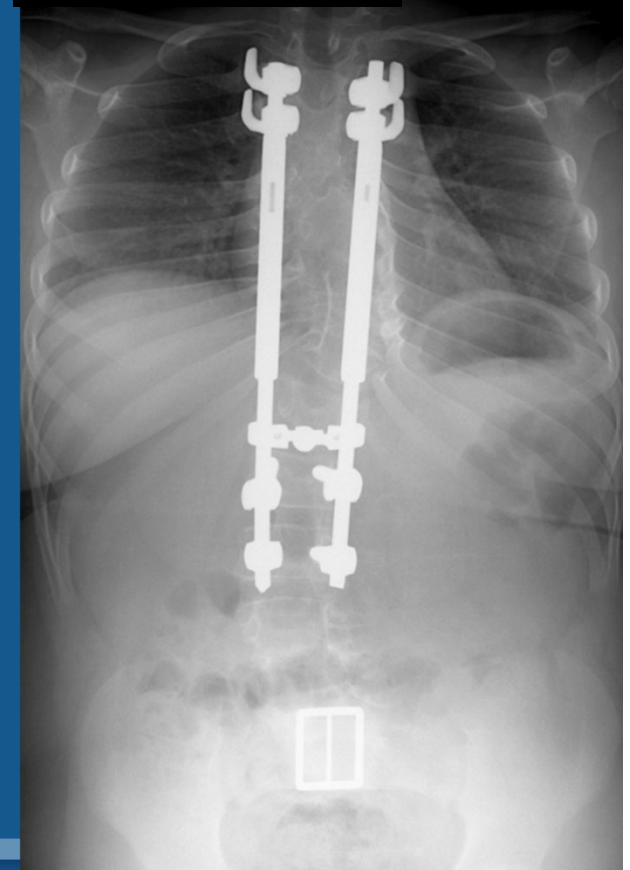


Unilateral Dual Rods



Bilateral Dual Rods

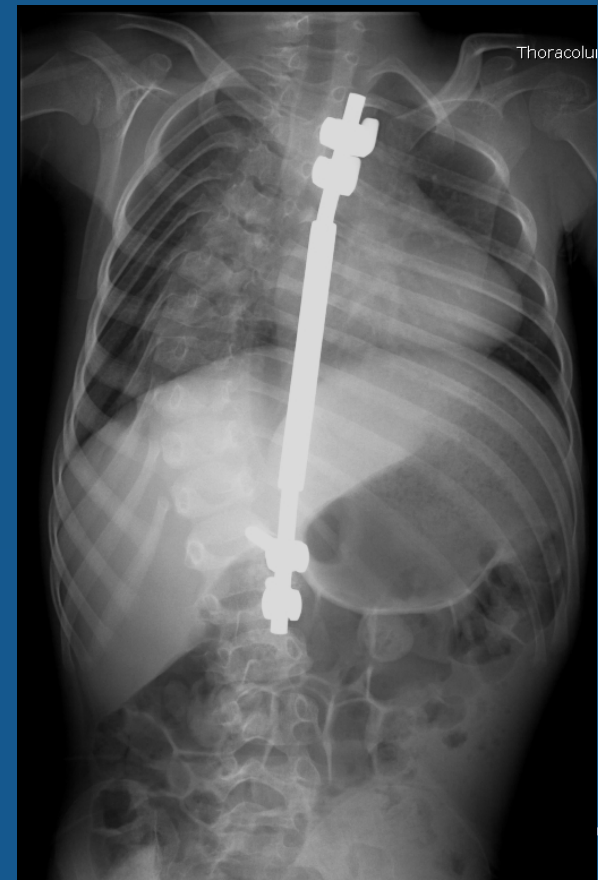
Growing rod like





# Results

- Mean increase in T1-S1 length = 49 mm
- Mean increase in SAL = 25 mm concave AND convex sides



# Implant Related Complications

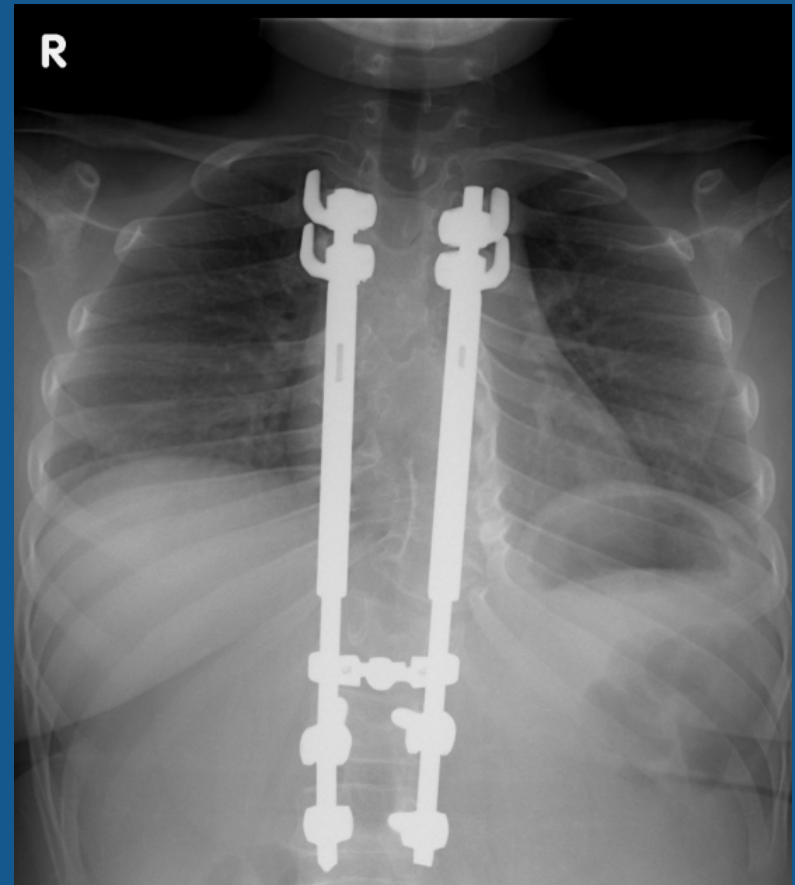
- 10 /28 pts (35%)
- Mean time to complication = 28 months
  - 7 losses of fixation
  - 2 wound issues
  - 1 rod breakage

**No neurologic complications**



# What Worked Best?

- No complications in dual-sided constructs
- No complications with  $\geq 3$  up-going hooks



# Comparison of Complications Of Distraction Based Implants

<b>VEPTR (Hassler, JPO 2007)</b>	<b>119%</b>
Dual Growing Rods (Spine 2005)	57%
Hybrid (this study)	35%

# T1-S1 Growth

## Normal Growth

0-5 yrs

2.0 cm/yr

5-10 yrs

1.2 cm/yr

## Dual Growing Rods, 2005,2008, 2009

5 + 6 yrs  
39 mo f/u

1.1 -1.8 cm/yr

## VEPTR, Congenital JBJS, 2003

3 + 3yrs  
50 mo f/u

0.83 cm/yr  
Thoracic only

## Hybrid Implants

85% congenital

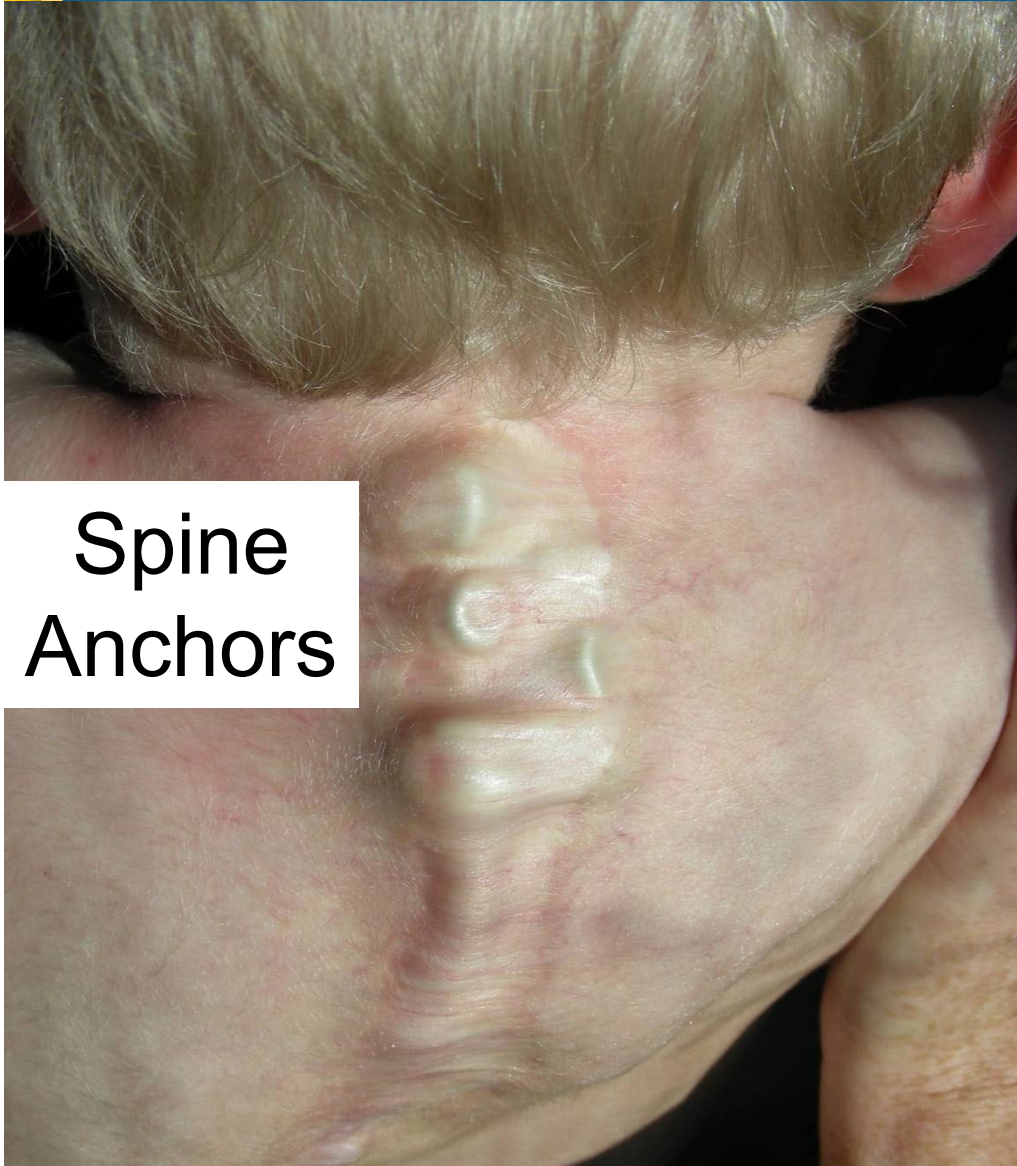
3 + 1 yrs  
37mo f/u

**Unilat -0.65 cm/yr**  
**Bilat-1.2 cm/yr**

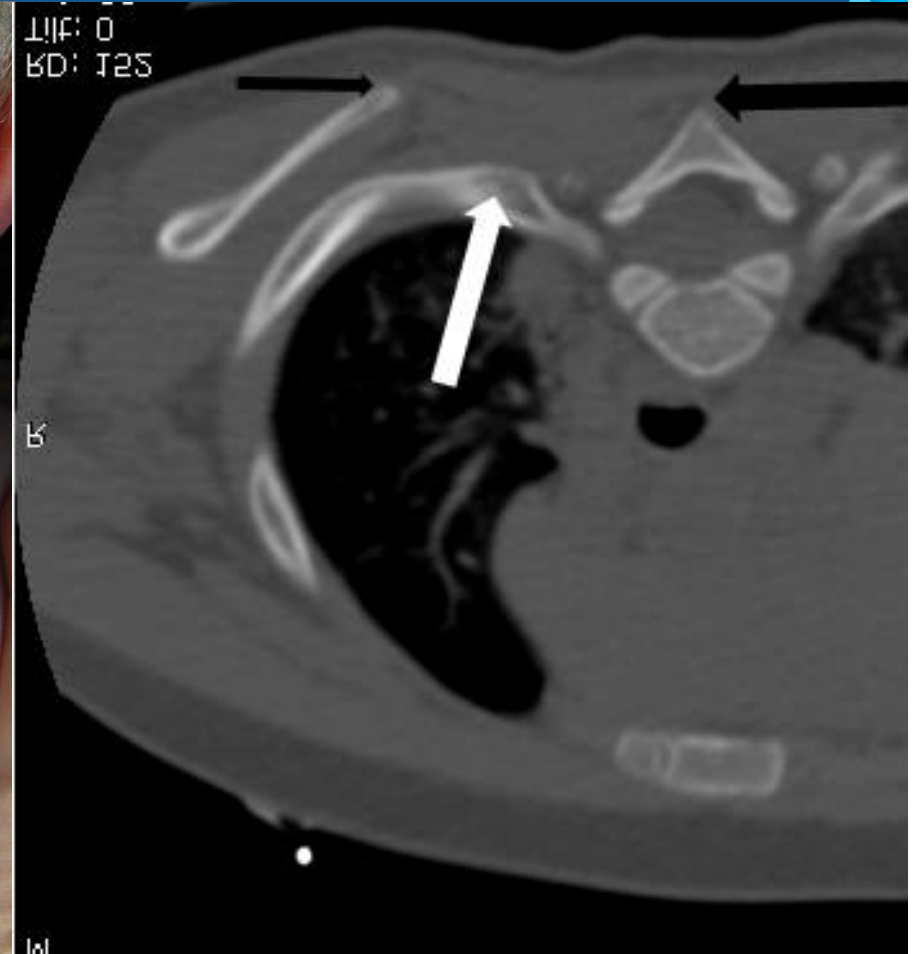
# Limitations

- Retrospective study
- Only 37 months mean f/u
- Only 28 patients
- No pulmonary outcome data

# Hooks on Ribs: Lower Profile

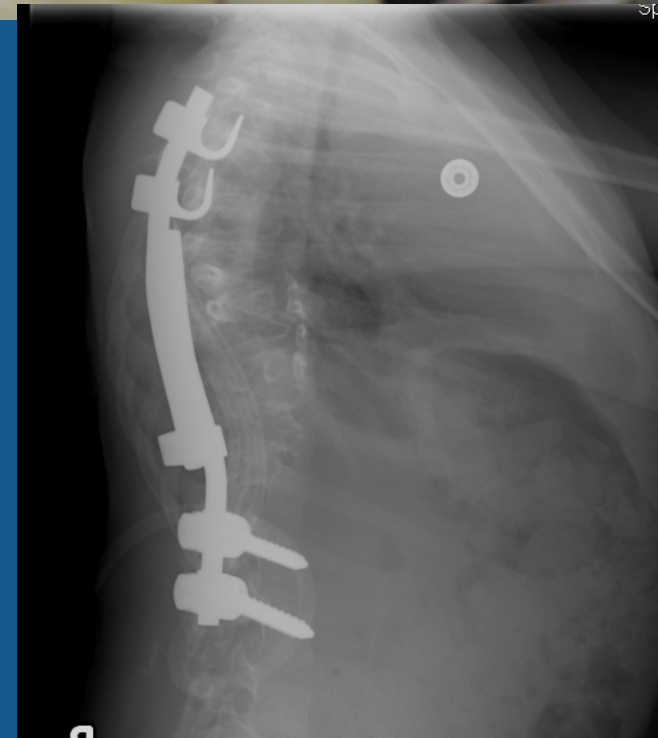


Spine  
Anchors



- FDA Off label
- No IRB approval
- \$ < VEPTR
- Allows precise hook placements - non-constrained

## – Sagittal contouring





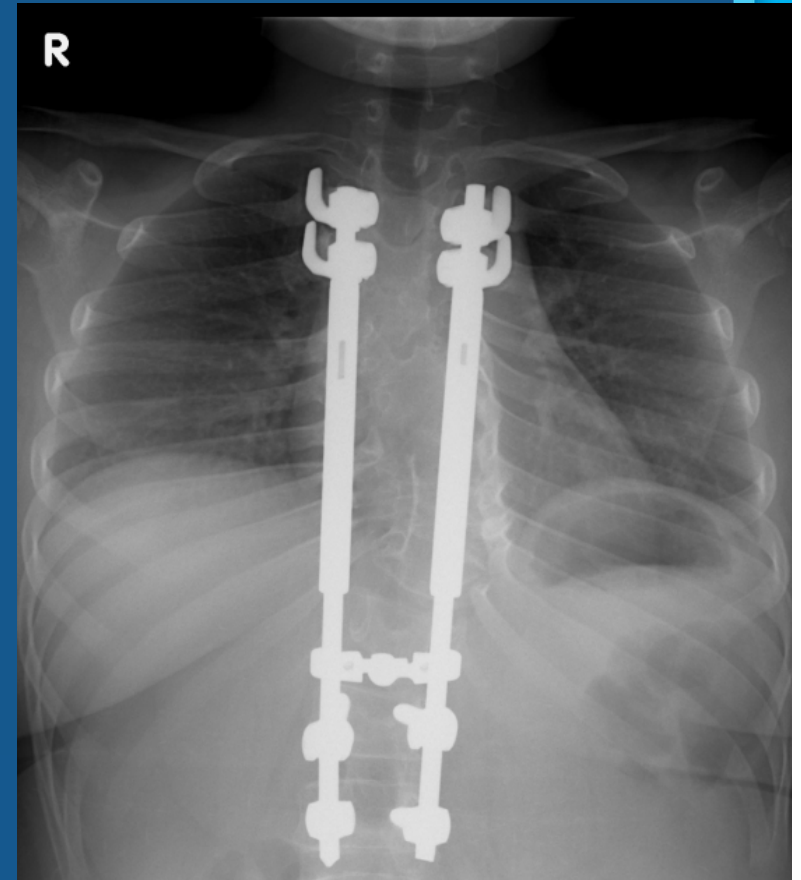
# Conclusions

- Complications in Hybrids is less common than other distraction based growth implants
  - Low profile
  - Multiple non-constrained load sharing anchors
  - Bend Sagittal profile to meet patients needs
  - Uses standard spine implants (no IRB approval needed)

**Avoids intentional fusion of upper thoracic spine**

# Current Preference

- Dual-sided constructs
- $\geq 3$  up-going hooks

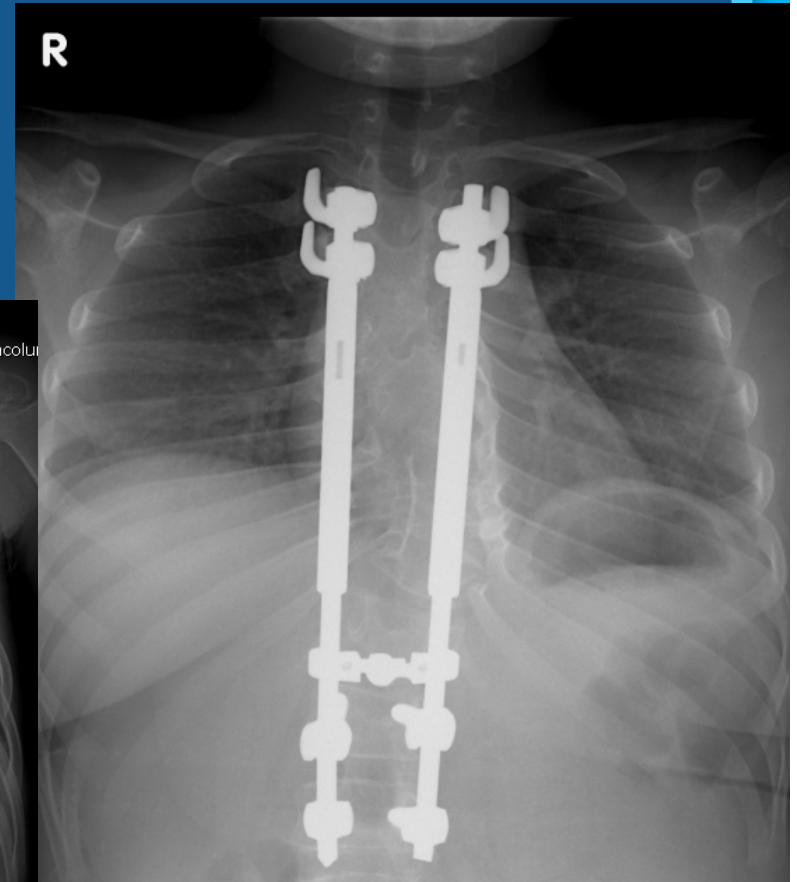
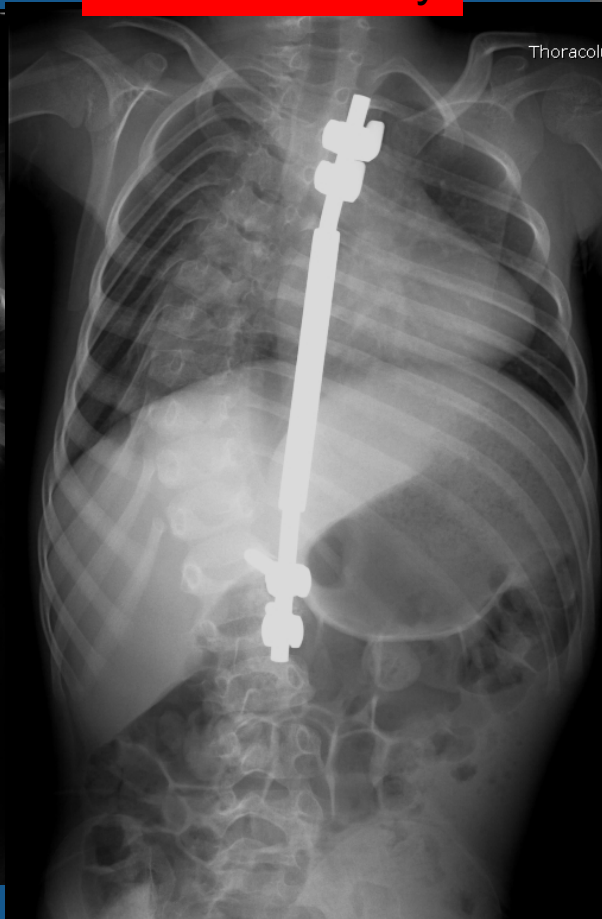


# Current Preference

- Dual-sided constructs
- $\geq 3$  up-going hooks

REALLY thin kids

NO Thorcotomy



Thank You



# Thank You



Growing Rod  
Surgery is Like ..

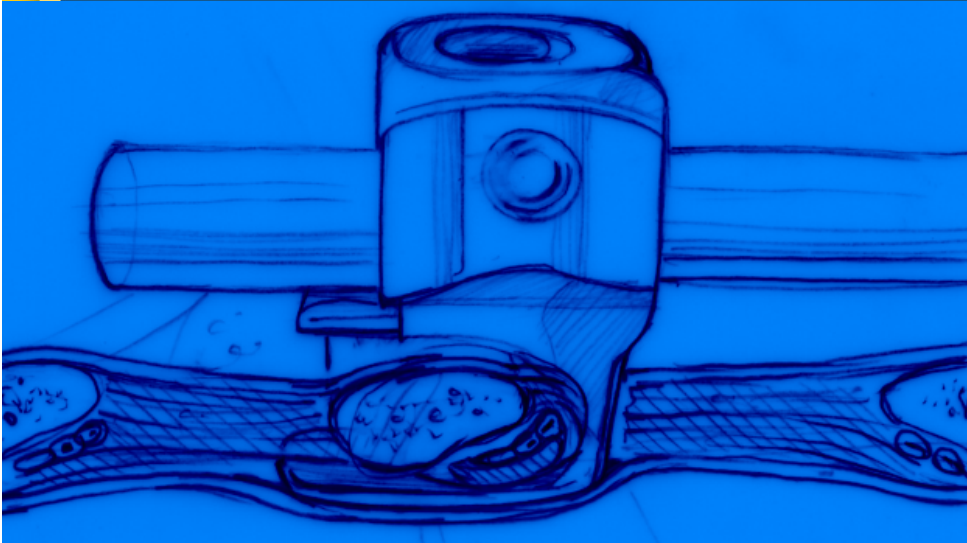


# References

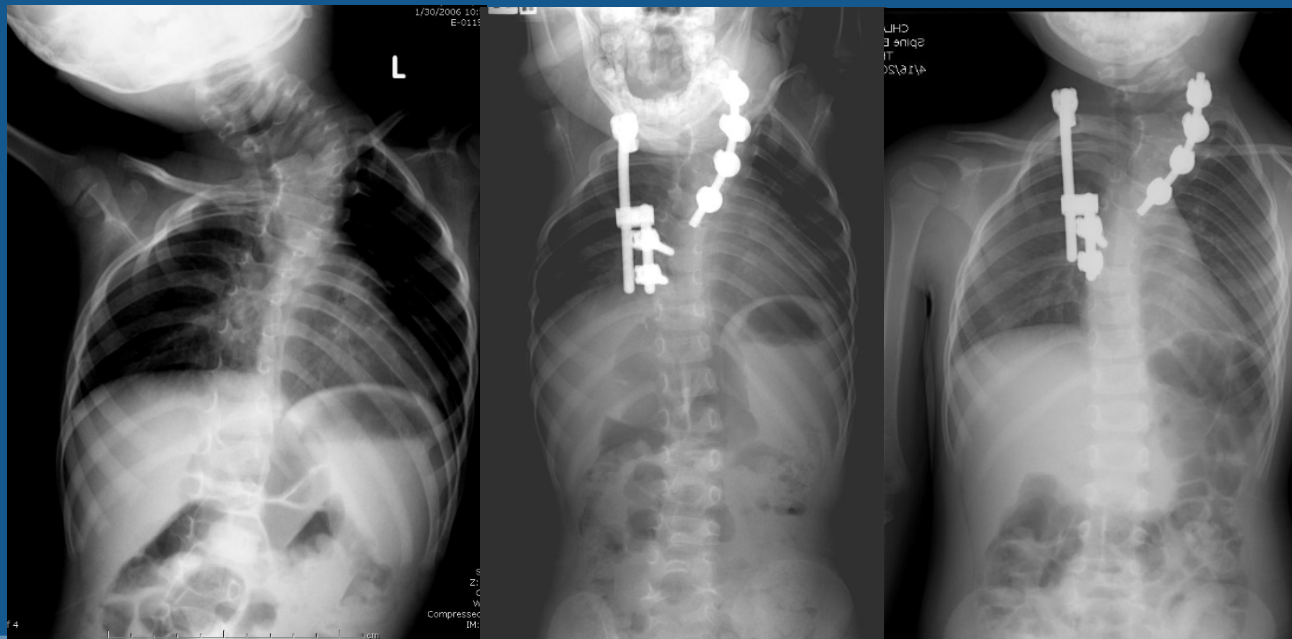
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# Purpose

- To report the early results of this technique.







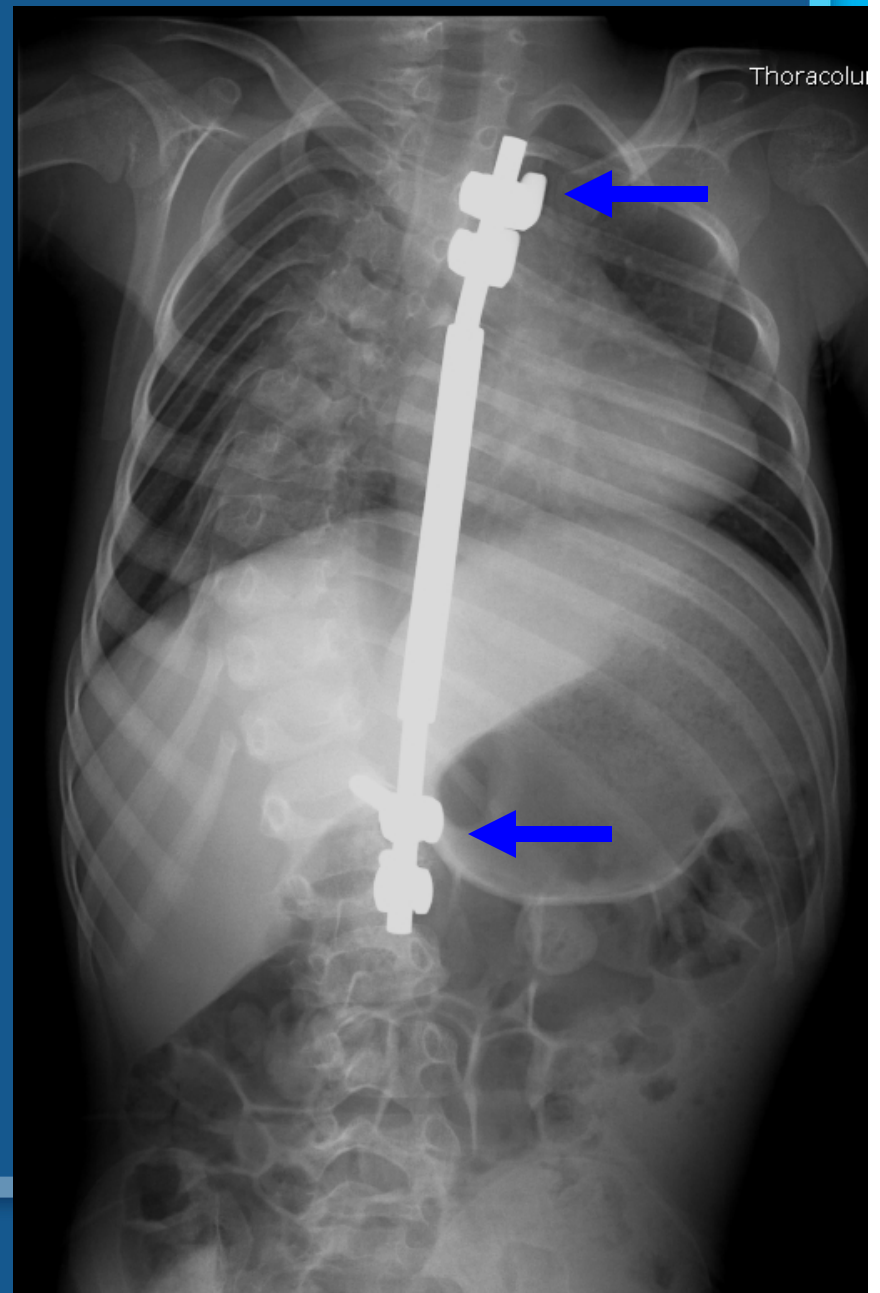
# Use of Spine Hooks on Ribs NOT FDA Approved

Use of Spine Hooks on Ribs  
NOT FDA Approved



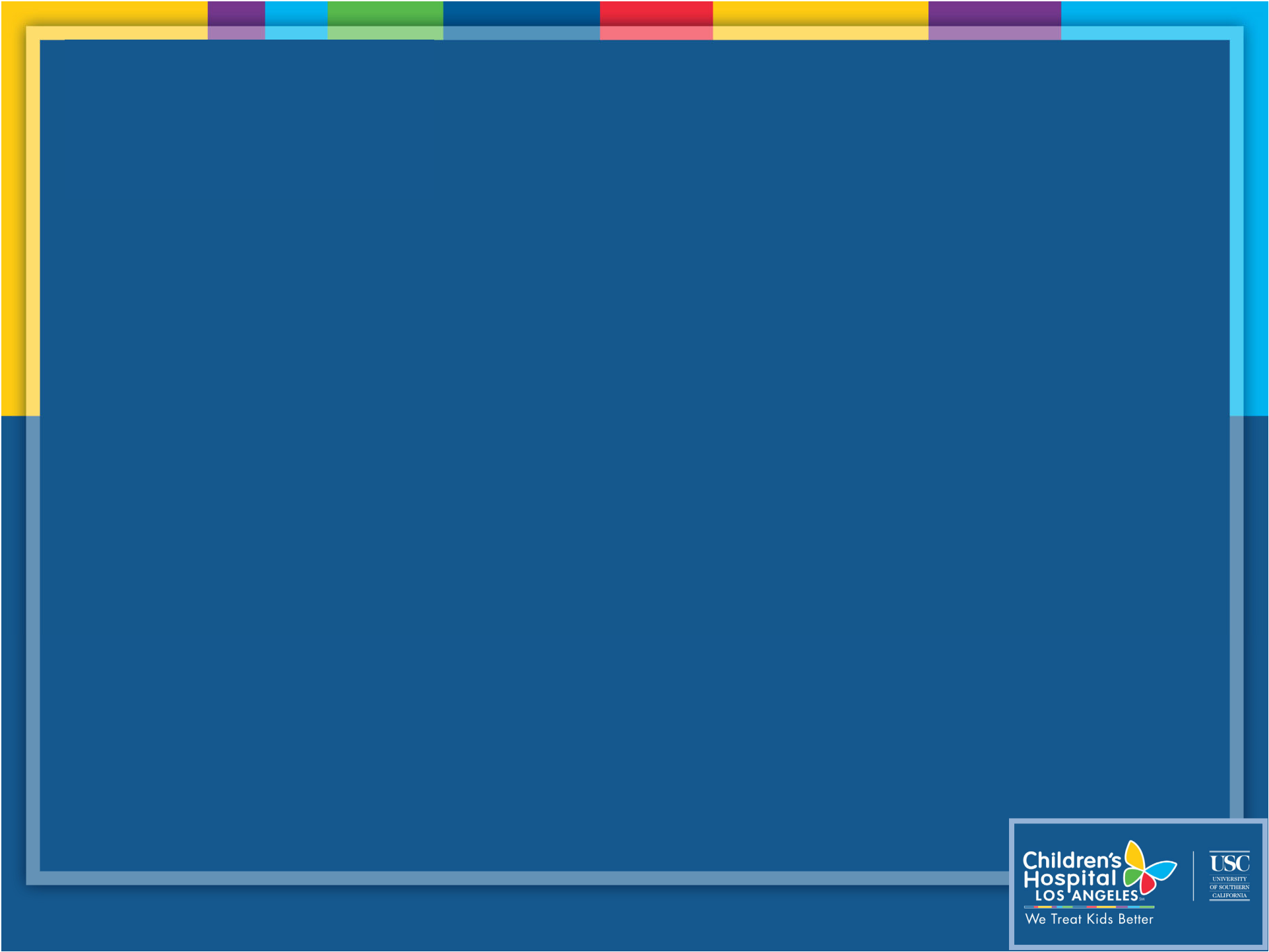
International leader in Pediatric

# Portable Traction



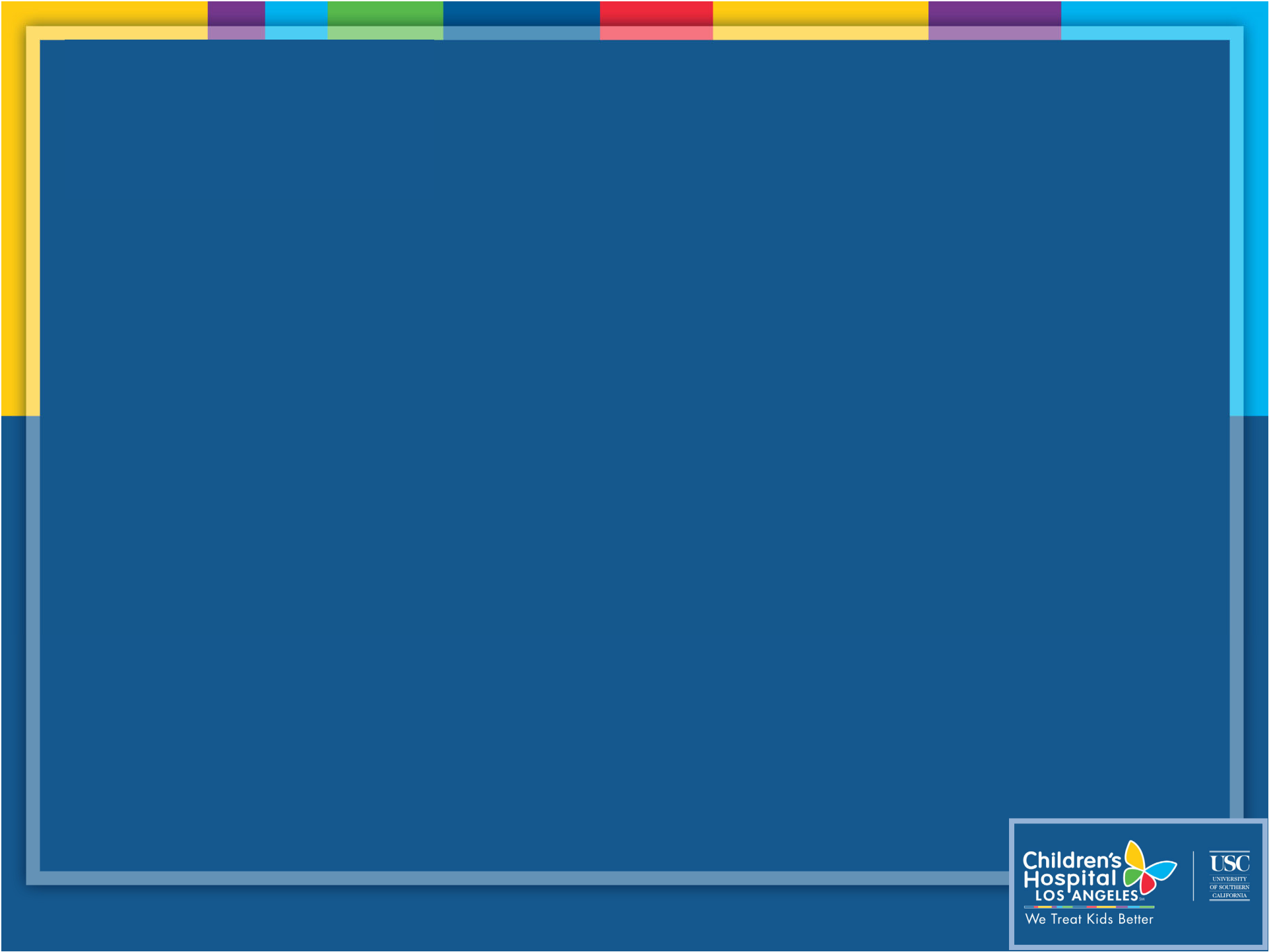
# Complications

- Risk factors:
  - Younger age at index surgery ( $p=0.12$ )
  - Larger initial Cobb angle ( $p=0.12$ )



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