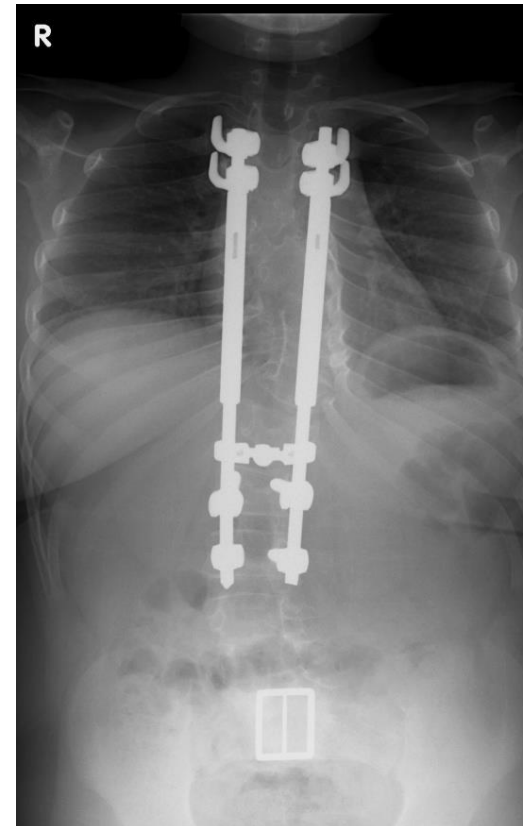
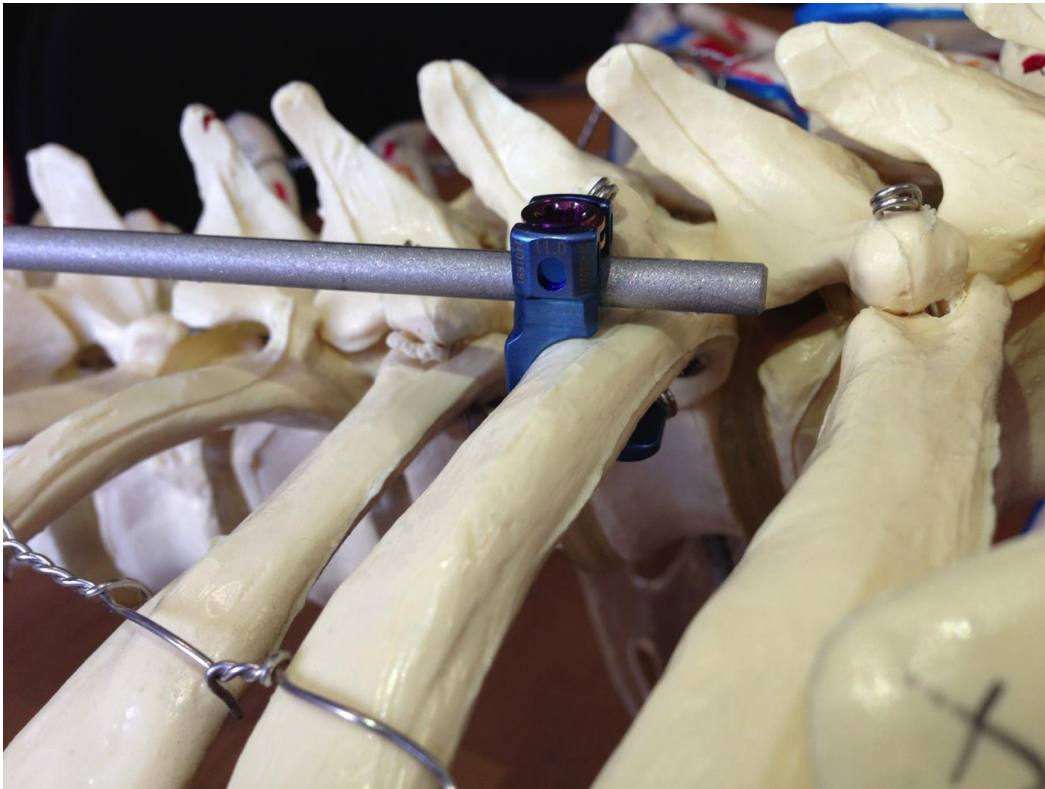


# Rib Anchors in Growing Rods

David L. Skaggs, MD  
Professor and Chief  
Children's Hospital Los Angeles  
University of Southern California  
Endowed Chair of Pediatric Spinal Disorders



What is  
Dr. Newton  
hiding?

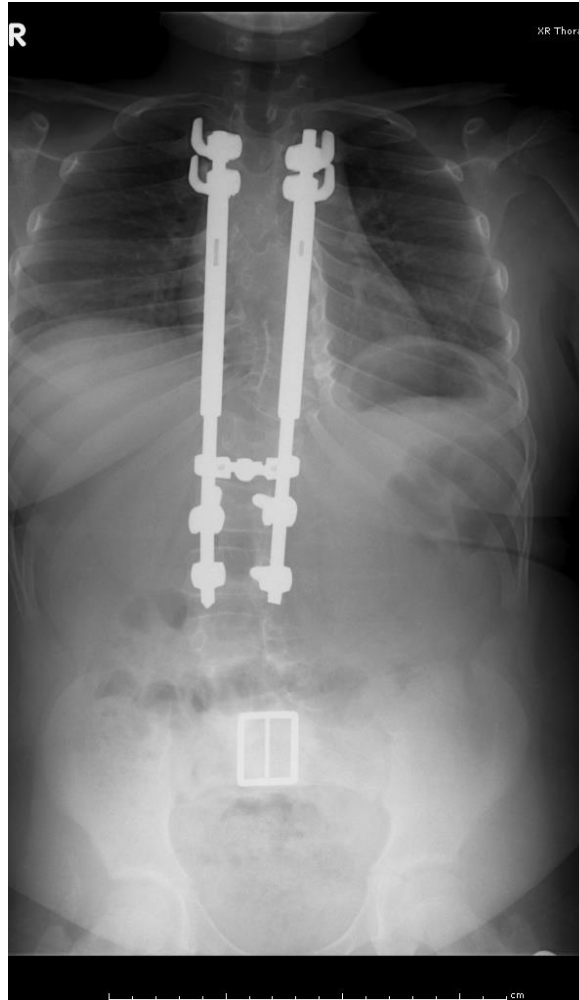


Stout rib hooks,  
not thin VEPTR



# Advantages of Rib Anchors

- Avoid proximal fusion
- Lower Profile
- Less rigid system
  - Less rod breakage
- Safer failure mode
- Better Moment Arm

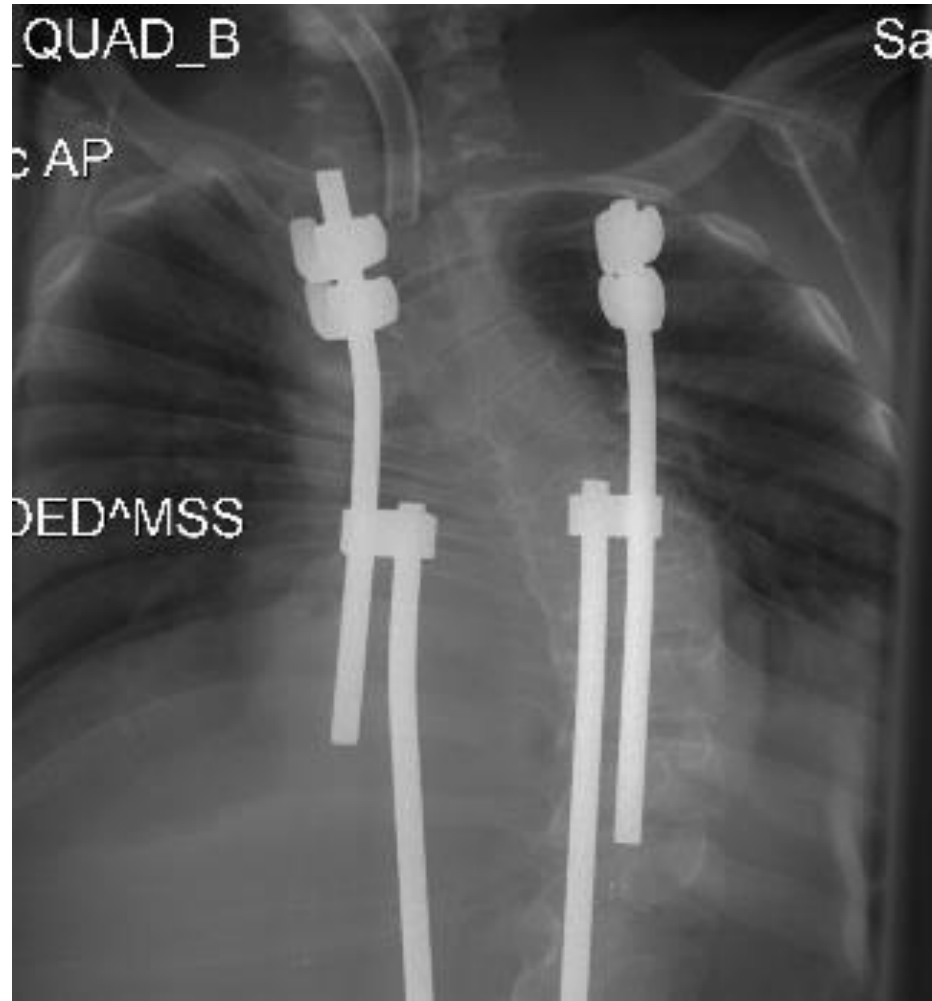


# No Difference Rib and Spine

- Pullout Strength
- PJK
- Failure Rate

# Hooks on Ribs: No intentional fusion Do not expose or fuse upper spine

No thorocotomy!



# Adjacent to TP

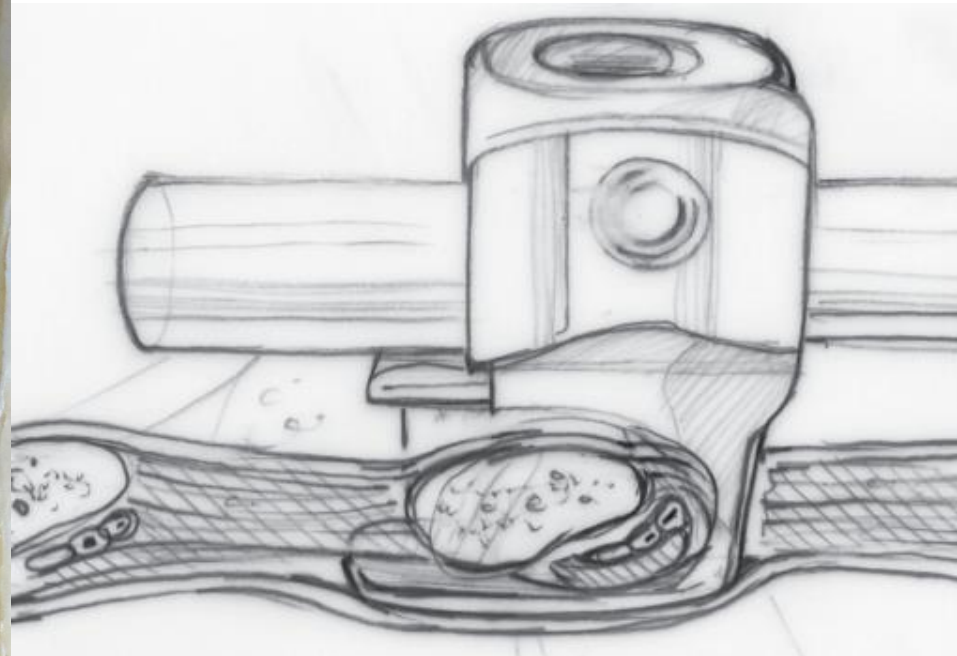


Extra-Periosteal

Want ribs to hypertrophy

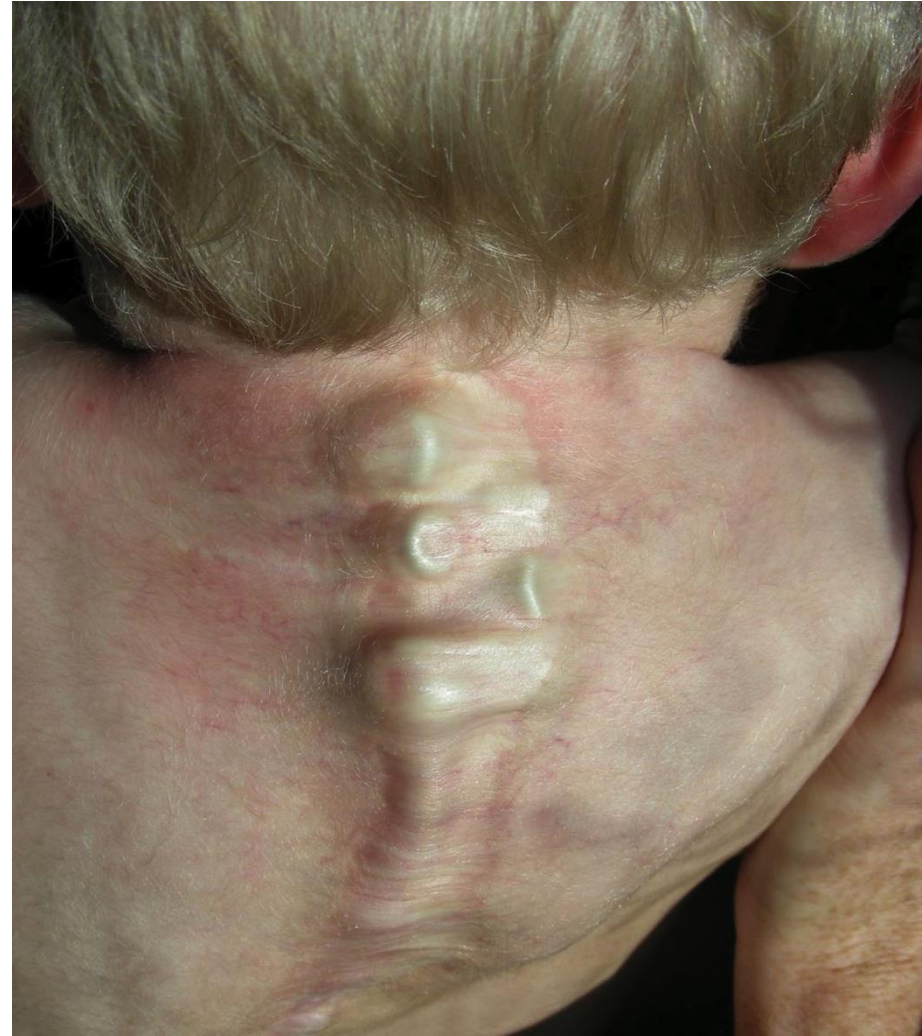
NOT in chest

No chest tube



# Nutritionally Depleted Population

- Soft tissue Coverage Challenging
- 47% pts pre-op failure to thrive (<5 percentile)



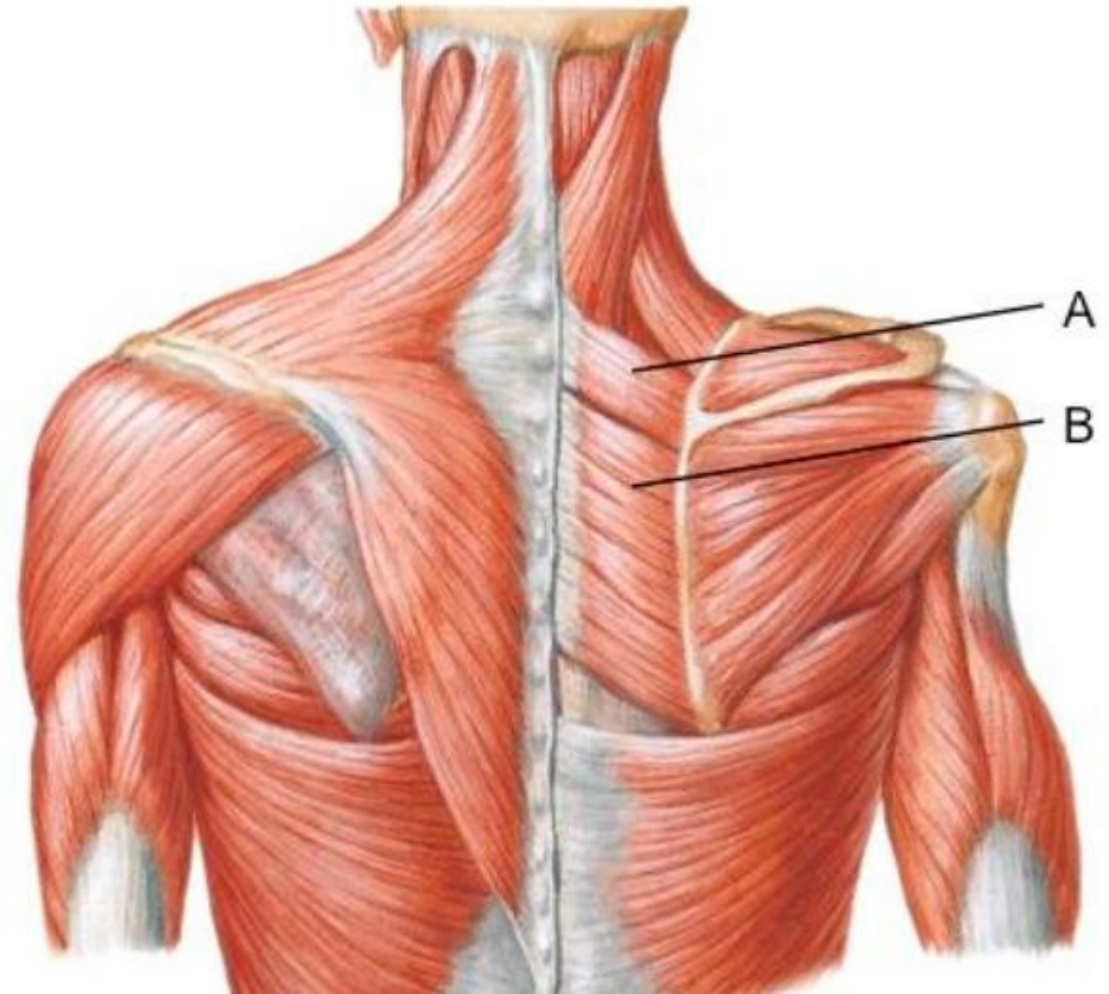
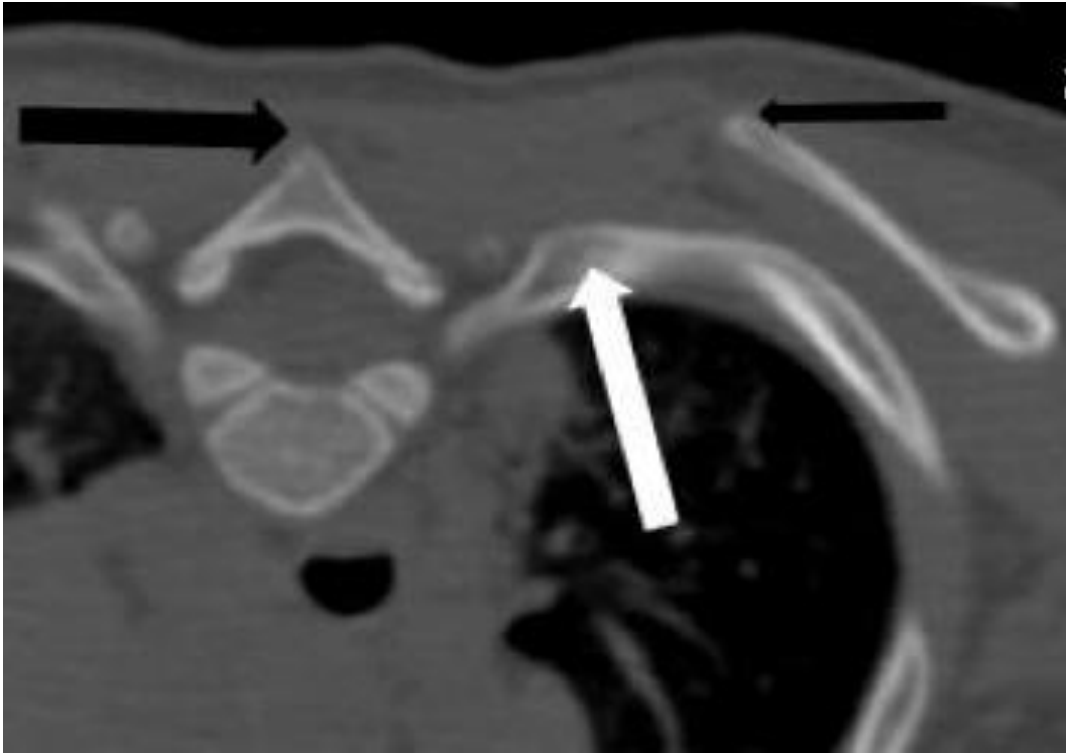
Myung, 2009

# Midline Incision – Plan for final fusion

## final fusion

## Minimal Muscle Dissection

**Low Profile**



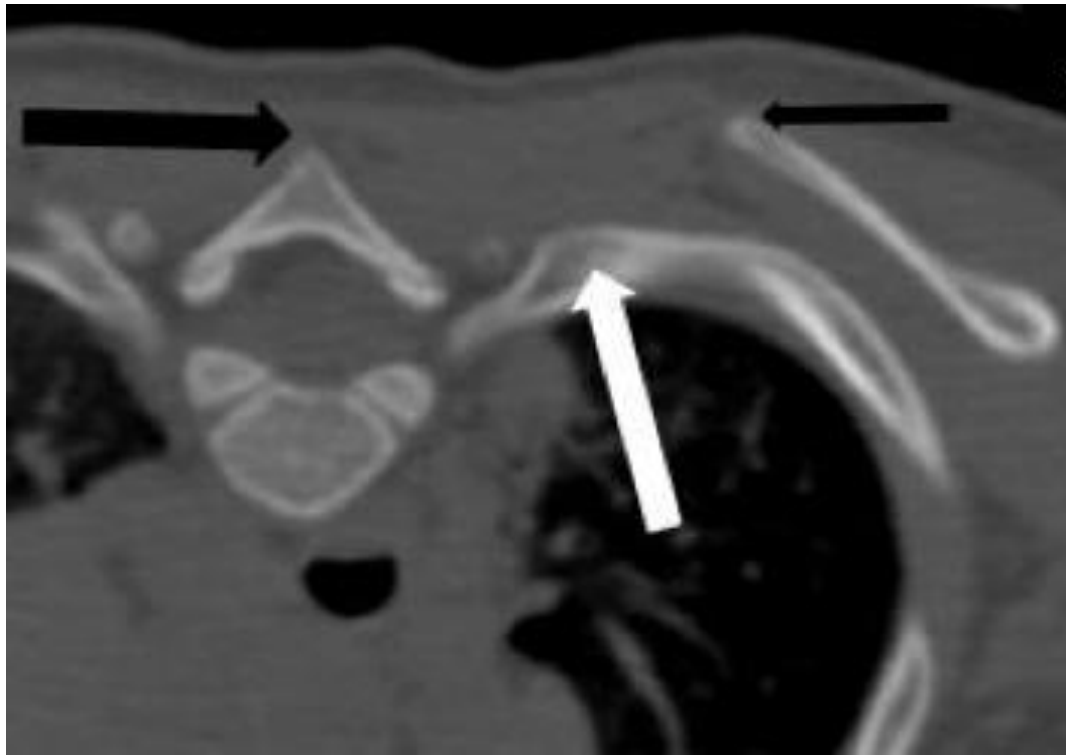
# Rods broke 4X less with rib anchors than spine anchors

**Yamaguchi, Skaggs,, Mansour, Myung, Yazici, Johnston, Thompson,  
Sponseller, Akbarnia, Vitale, Growing Spine Study Group,  
Spine Deformity, 2014**

	Patients	Rod Breakage	Anchor complication
Rib Anchored	34	6%	38%
Spine Anchored	142	29%	33%
		P=0.04	P=0.12



# Hooks Fail Safely Posterior



Rib Hook pullout = Screw pullout  
357 patients, 6 year follow-up

# Screws have failed into spinal cord



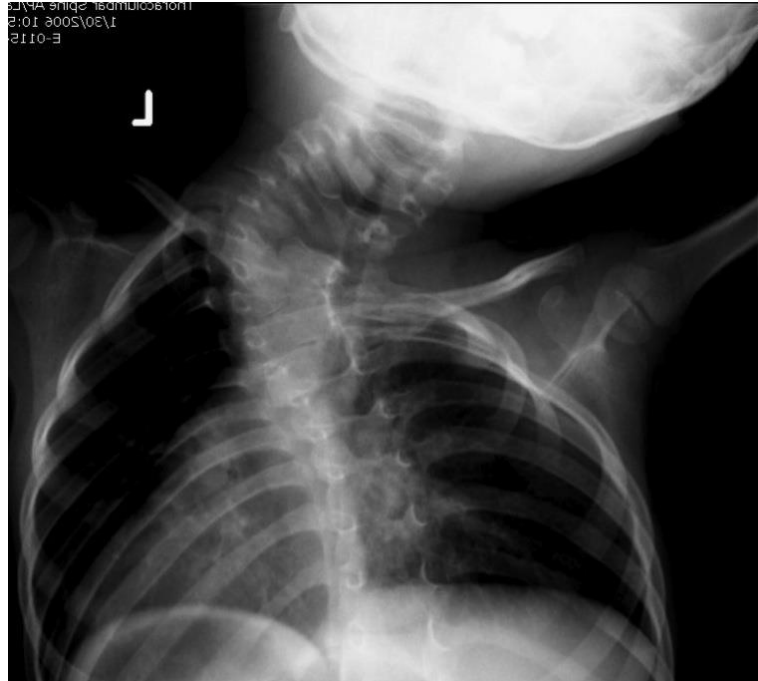
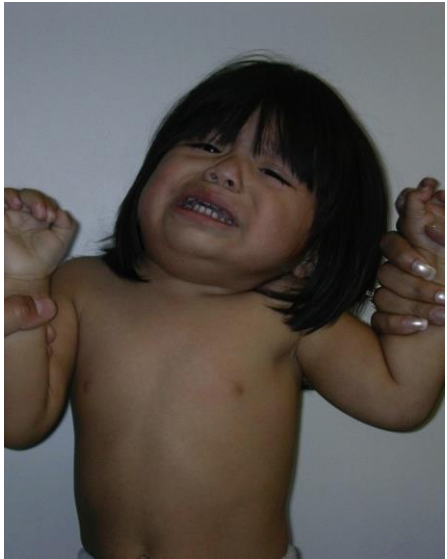
POSNA 2017

Kira Skaggs,

# Ribs can provide better moment arm than pedicle screws

3 yo Pre-op

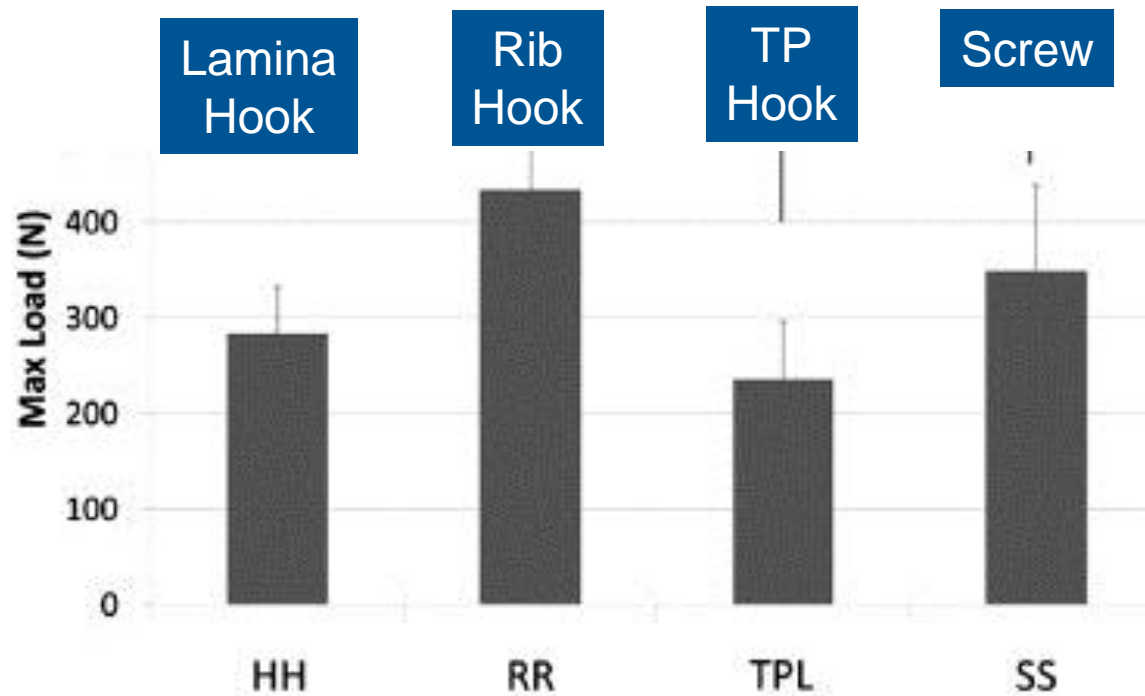
15 yo



# Biomechanical Evaluation ... Are Rib Anchors Comparable to Spine Anchors?

Akbarnia et al, Spine Deformity, 2014

Rib Hooks = Pedicle Screws > TP or Lamina Hooks



# Use $\geq 5$ Anchors Minimizes Failure

- 22% (77/357) patients anchor pullout
- Type of Anchor (screw vs spine hook vs rib hook) did not affect pullout rate ( $p=0.850$ )

Anchors	Pullout
$\geq 2$	22%
$\geq 3$	20%
$\geq 4$	20%
$\geq 5$	12%
$\geq 6$	10%

IMAST 2016, POSNA 2017



2,3,or 4 Vs. 5 or 6 anchors

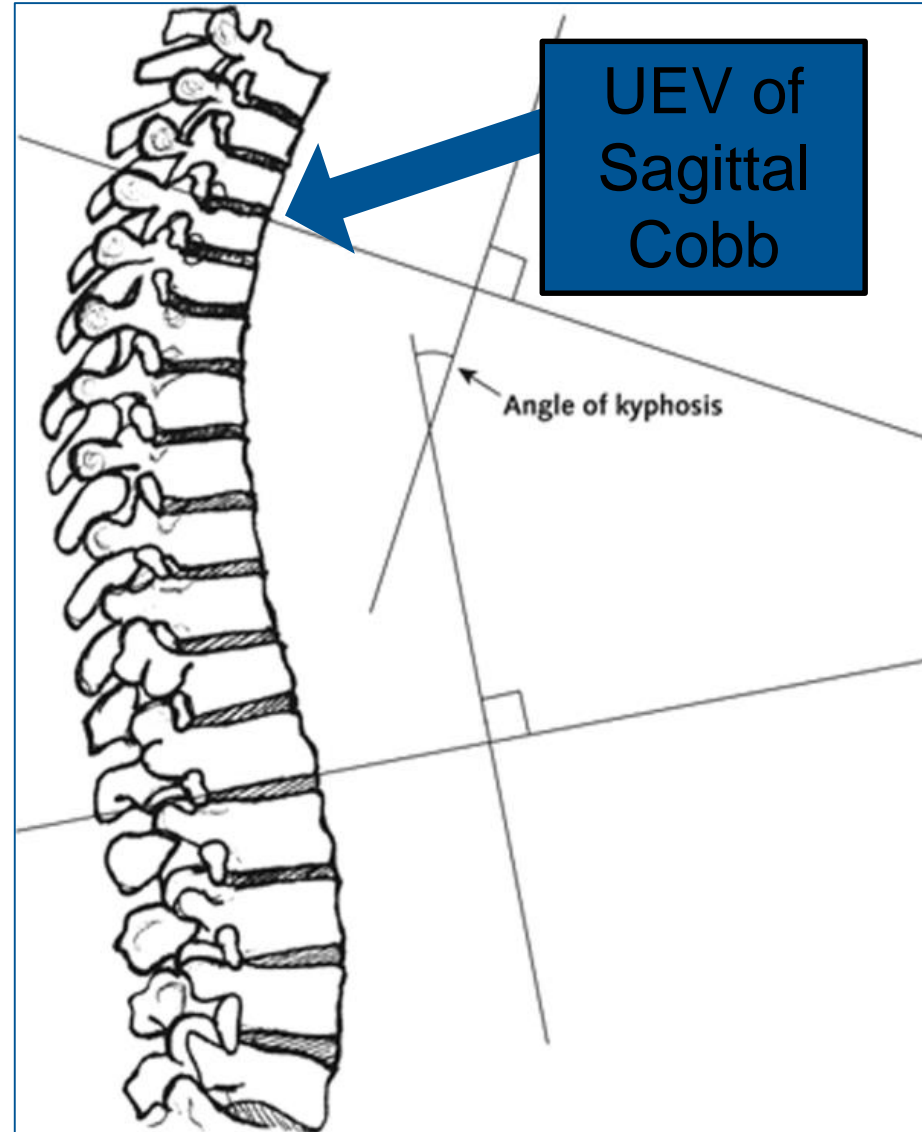
$p=0.01$

# Anchors at or above UEV Minimizes Proximal Extension

(final fusion or revision growth friendly implants)

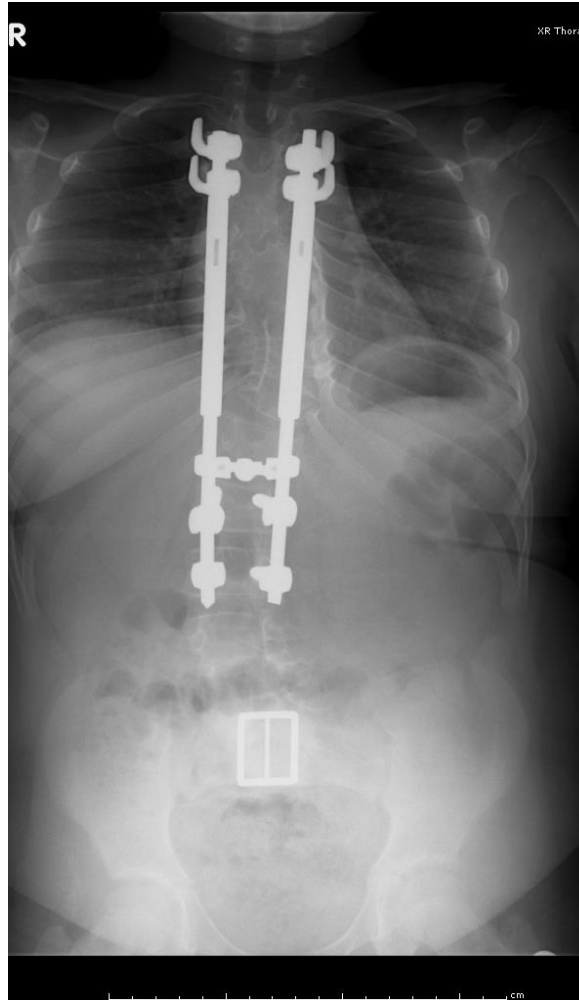
- at or above UEV: **20%** (26/130)
- UEV: **30%** (21/70) ( $p=0.026$ )

IMAST 2016, POSNA 2017



# Advantages of Rib Anchors

- Avoid proximal fusion
- Lower Profile
- Less rigid system
  - Less rod breakage
- Safer failure mode
- Better Moment Arm



# No Difference Rib and Spine

- Pullout Strength
- PJK
- Failure Rate

# Pre-Course Faculty Prefer Rib Anchors for Distraction Based Growing Rods

## 8 to 3

Ribs	Indications	Spine	Indications
Andras	<8 years	Glantzbecker	
Blakemore		Samdani	
Farrington	<8 years	Sanders	
Luhmann	<7-9 Years		
Sawyer	<8-9		
Skaggs			
Smith	always		
Vitale	<6 years		

# Thank You

