

Anchors/Instrumentation Techniques in Small Children

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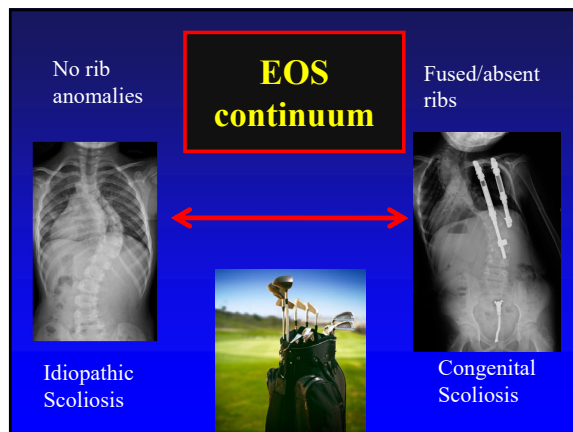
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ICEOS 2010

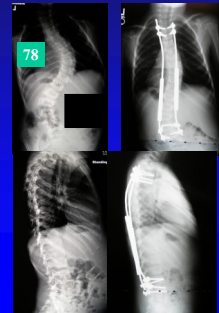
Disclosures

- Speaker's bureau for:
 - Medtronic Sofamor Danek
 - Stryker Spine
- Consultant for:
 - Medtronic Sofamor Danek
 - Stryker Spine
 - Watermark Research Partners
- Royalties:
 - Globus Medical



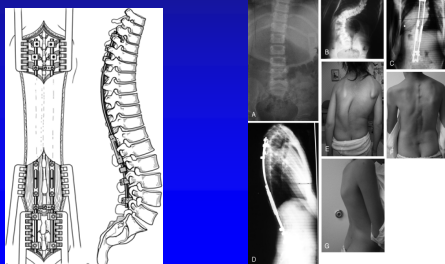
Cephalad Fixation: Spine

- SJL Indications:
 - Spine problem (normal chest), stay on spine
 - Proximal thoracic kyphosis: contour rods. Less kyphogenic with screws?
 - Need minimum 4 fixation points in 2 adjacent vertebra. Consider low-dose CT scan w/ 3-d reconstructions

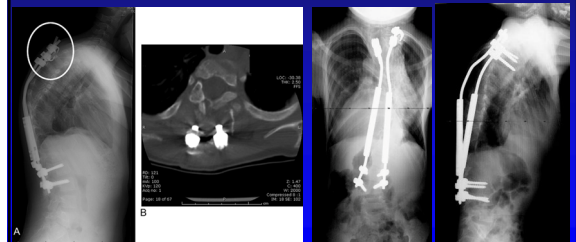


Cephalad Fixation: Hooks

- Akbarnia, Thompson et al



Cephalad Fixation: Hooks



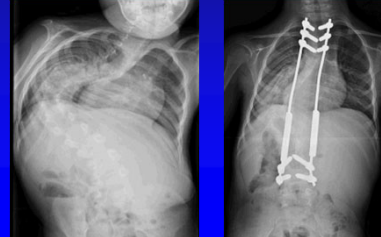
Sankar et al *Spine* 2010

Cephalad Spine Fixation Options

- Pedicle Screws:
 - Harimaya et al (2009 SRS): 948 PS in 88 pts <10 y/o...8 pedicle violations (0.8%)
 - Mueller et al (POSNA 2010): 205 PS w/ 7.7% implant-related complication rate
- Hooks vs. Screws:
 - Mahar et al (Spine 2008): PS fixation better correction than hybrid or hooks at cephalad and caudal levels.
 - Skaggs et al (2010 SRS): 247 pts <10 yrs with GRs. PS complication rate 2.4% vs. hooks 6.9%

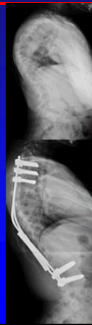
Cephalad Spine Fixation: UIV Selection

- Coronal plane:
UIV at or cephalad to upper End Cobb level



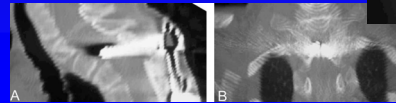
Cephalad Spine Fixation: UIV Selection

- Sagittal Plane:
 - Extend instrumentation past kyphosis (may lessen risk of PJK and failure of fixation)
 - Cephalad motion segment should be neutral or, preferably, lordotic
 - Schroerlucke et al (2010 SRS)
 - More implant failures when T5-T12 >40°
 - 4.9x more complications than neutral group (10-40°)



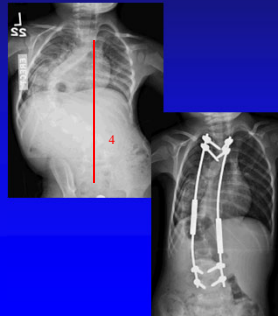
Alanay A et al, Spine 2003

- Don't use crosslinks when using pedicle screws. Prevents toggle and axial pull-out.



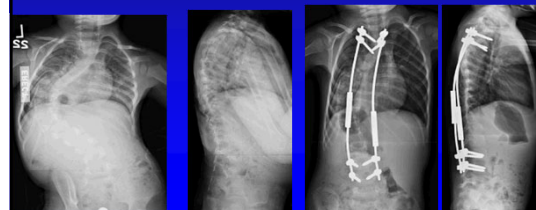
Caudal Spine Fixation: LIV Selection

- Coronal:
 - Last level "touched" by CSVL (with neutral rotation): **possible** endpoint
 - **Stable vertebra: safest**



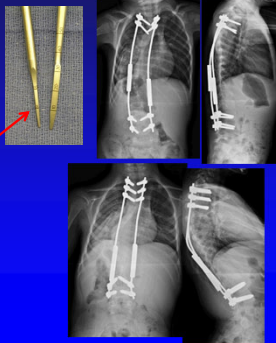
Caudal Spine Fixation: LIV Selection

- Sagittal: caudal motion segment below LIV should be lordotic



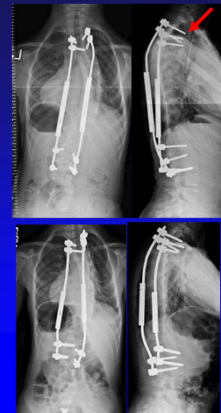
Pedicle Screw Placement

- Intraoperative imaging (fluoroscopy vs. O-arm)...intra-pedicular screws essential
- Small ("baby") pedicle finder
- Minimum 4 fixation points, 6 if osteopenic or increased kyphosis



Pedicle screw placement

- Larger diameter screws are better
- Pedicle screw diameter should be greater than rod diameter...rather revise rod fracture than screw pull-out!



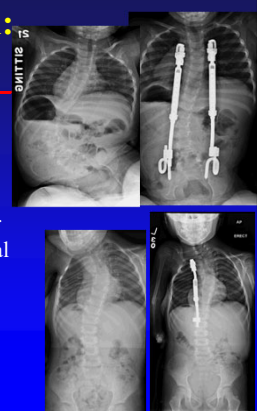
Rod contouring: Avoid hypokyphosis!

- Minimize accentuation of thoracic hypokyphosis during intraoperative positioning
- Bend extra kyphosis into proximal rod to compensate
 - Decrease chance of implant pull-off or PJK?



Cephalad Fixation: Rib

- SJL indications:
 - Chest cage dysplasia (absent and/or fused ribs)
 - Hypotonic neuromuscular scoliosis (MMC, s/p spinal tumor resection, SMA)
 - Congenital scoliosis proximal thoracic spine (precludes screw fixation of UIV)



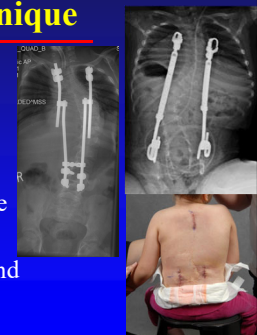
Cephalad Rib Fixation: Selection of Levels

- Avoid
 - Thin, gracile ribs (if possible)
 - T1 rib
- **Sagittal:** Above apex of kyphosis
- **Coronal:**
 - Concave: at or 1 level below End Cobb level
 - Convex: at or 1 level above End Cobb
- SJL preference: 2 rib fixation



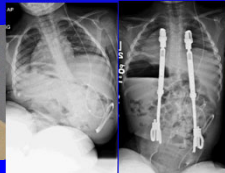
Cephalad Rib Fixation: Placement Technique

- Constructs
 - VEPTR (SJL preference)
 - Spine-based system
- 1-rib vs. 2-rib fixation
- Surgical incisions: midline vs. paraspinal
- Minimize dissection around rib (minimize devascularization)



Caudal Fixation: Pelvis

- S-hooks on sacrum
- Iliac screws
- S-hooks on bilateral ilia:
 - SJL preference for pelvic obliquity



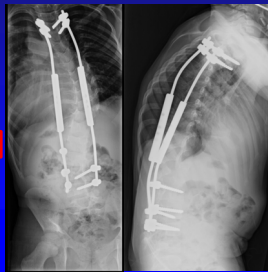
Growing Rod Graduates: Lessons from 58 patients who Have Completed their Lengthenings

Flynn J et al, 2010 SRS paper

- 91% underwent fusion
 - 60% of fusions were longer than GR constructs by mean 1.6 levels
- Correction:
 - No correction in 7%
 - Minimal (<20%) in 25%
 - Moderate (21-50%) in 53%
 - Substantial (>51%) in 15%

Other construct factors

- Metal:
 - Stainless steel
 - Titanium
 - Cobalt-chrome
- Rod diameter: 3.5 - 6.0 mm
- Connectors
 - Axial:
 - Short vs. long
 - Static vs. dynamic
 - Side-to-side domino



Thank you

