Simultaneous Vertebral Column Resection (VCR) and Growing Rods (GR) or Shilla for Severe Early Onset Spinal Deformity (EOS)

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Disclosures:

- *Off-label devices* in pediatric patients discussed:
  - Growing rods
  - Anterior column devices
- *Conflicts of Interest*:
  - John Emans, MD:
    - Medtronics - Consultant
    - Synthes Spine – Consultant, Royalties
  - Peter Newton, MD
    - Axial Biotech
    - DePuy Spine
    - Nuvasive
    - Stryker

Clinical Dilemma in *Early Onset Deformity*:

- Severe *localized deformity* appropriate for VCR, *not adequately treated by GR alone*

  and

- Associated *global deformity*, *not adequately treated by VCR alone*

Traditional treatment options?

- *Local correction/fusion*
  - Global deformity persists
- *Local correction/fusion and global fusion*:
  - Undesirable loss of spine growth
- *Fusion-less treatment alone*
  - Incomplete correction of localized angular deformity.
- *Local correction/fusion and long instrumentation with later removal*
  - Inadvertent long fusion, global deformity recurs

Solution: VCR *and* Growing Rods

- *Localized deformity treated completely by VCR*
- *Global spinal deformity controlled by GR*

- *Deformities controlled but spinal growth still permitted*
- *VCR fixation facilitated by longer instrumentation, local fusion length minimized*

Data:

- Multicenter Retrospective Pediatric VCR Study Group.
  - Two institutions with four simultaneous VCR and GR or Shilla patients:
    - Diagnoses:
      - Paralytic scoliosis (1)
      - Congenital kypho-scoliosis (1)
      - Congenital spinal dysgenesis/dislocation (2)
    - *Age -mean 3 yr (range, 1-4 yr)*
    - Follow-up 1.83 yr (range, 1-3yr)

Technique:

- VCR – 3 of 4 posterior only, 1 with supplemental anterior approach
  - Local instrumentation and fusion
  - Anterior column support in 3 of 4
- GR techniques:
  - *Shilla sliding rods (2)*
  - *Dual posterior distraction-based GR (2)*
    - VCR implants bypassed (1)
    - VCR implants incorporated (1)

Deformity Correction and Spine growth:

- Scoliosis mean:
  - 66˚ pre-op
  - 26˚ post-op
  - 32˚ at last follow-up
- Kyphosis mean:
  - 79˚ pre-op
  - 35˚ post-op
  - 49˚ at last follow-up
- Thoracic height (T1-T12)
  - Mean increase with operation 1.9 cm
  - Mean growth in thoracic height with lengthening after the initial procedure was 0.66 cm/year

Neurologic Complications:

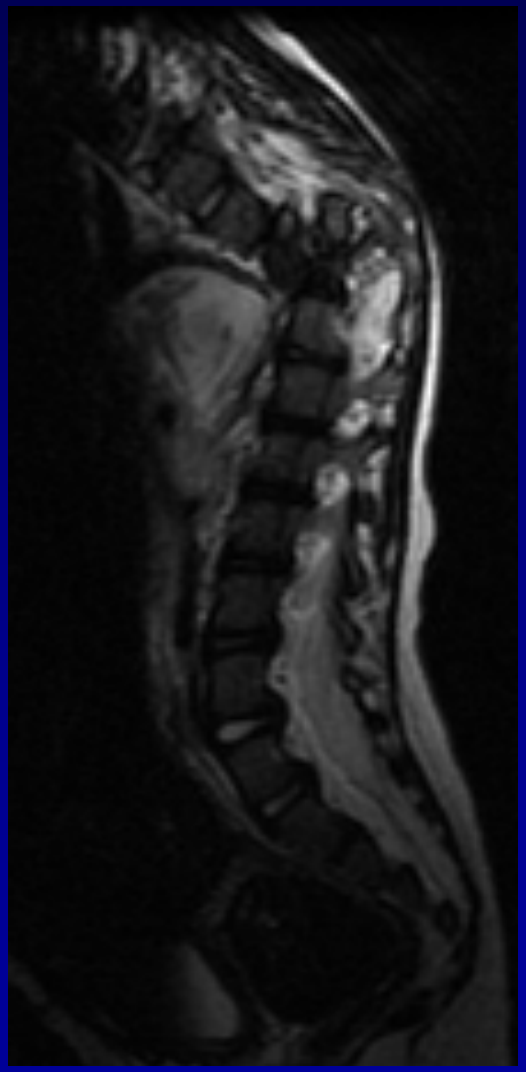
- 3 patients with intact pre-op neurologic exam:
  - 1 transient post-op paraplegia
  - All normal at follow-up.
- 1 patient with trace-only motor strength pre-op
  - Loss in motor strength
    - Partial return at follow-up.

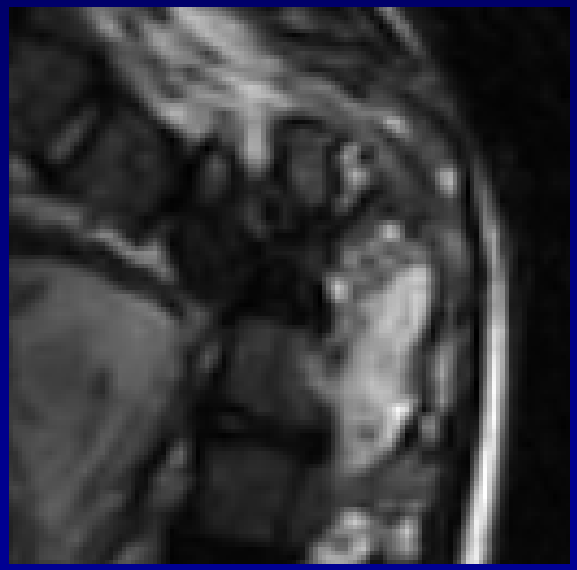
VCR and Growing Rods – Dysgenesis/Dislocation Example 1

Birth

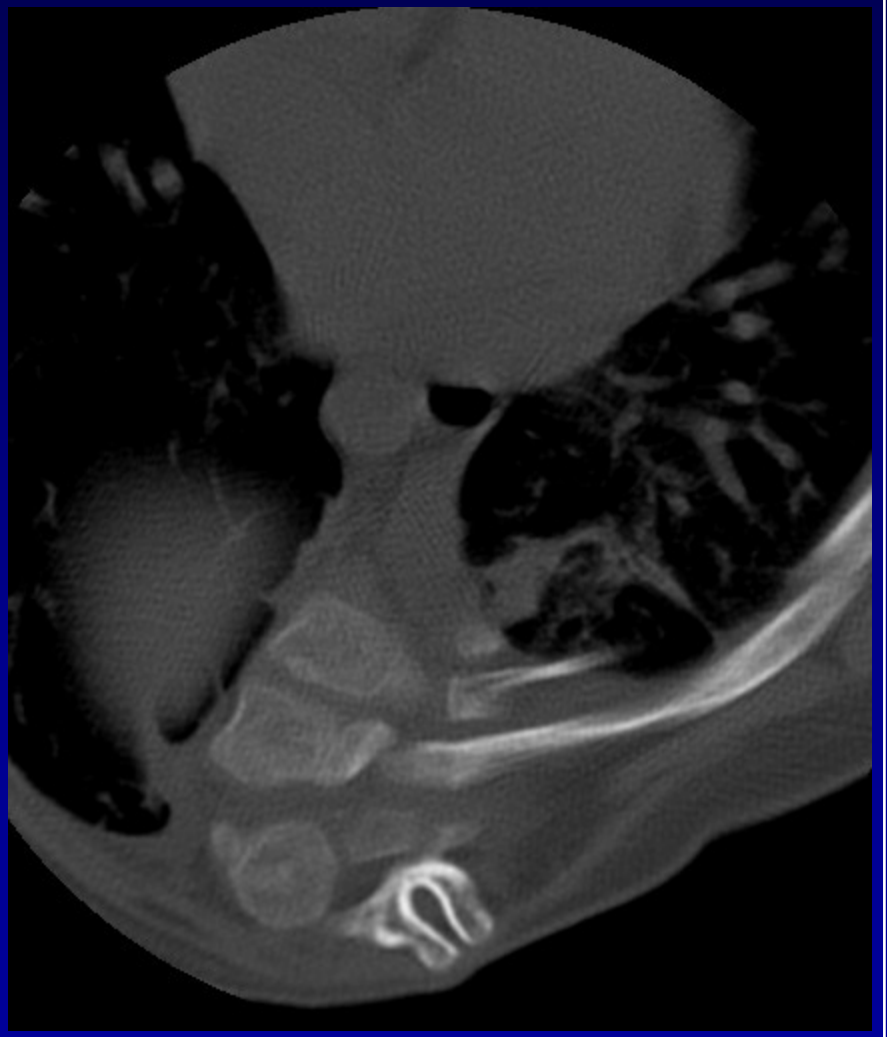
Age 14 months

VCR and Growing Rods Dysgenesis/Dislocation example 1



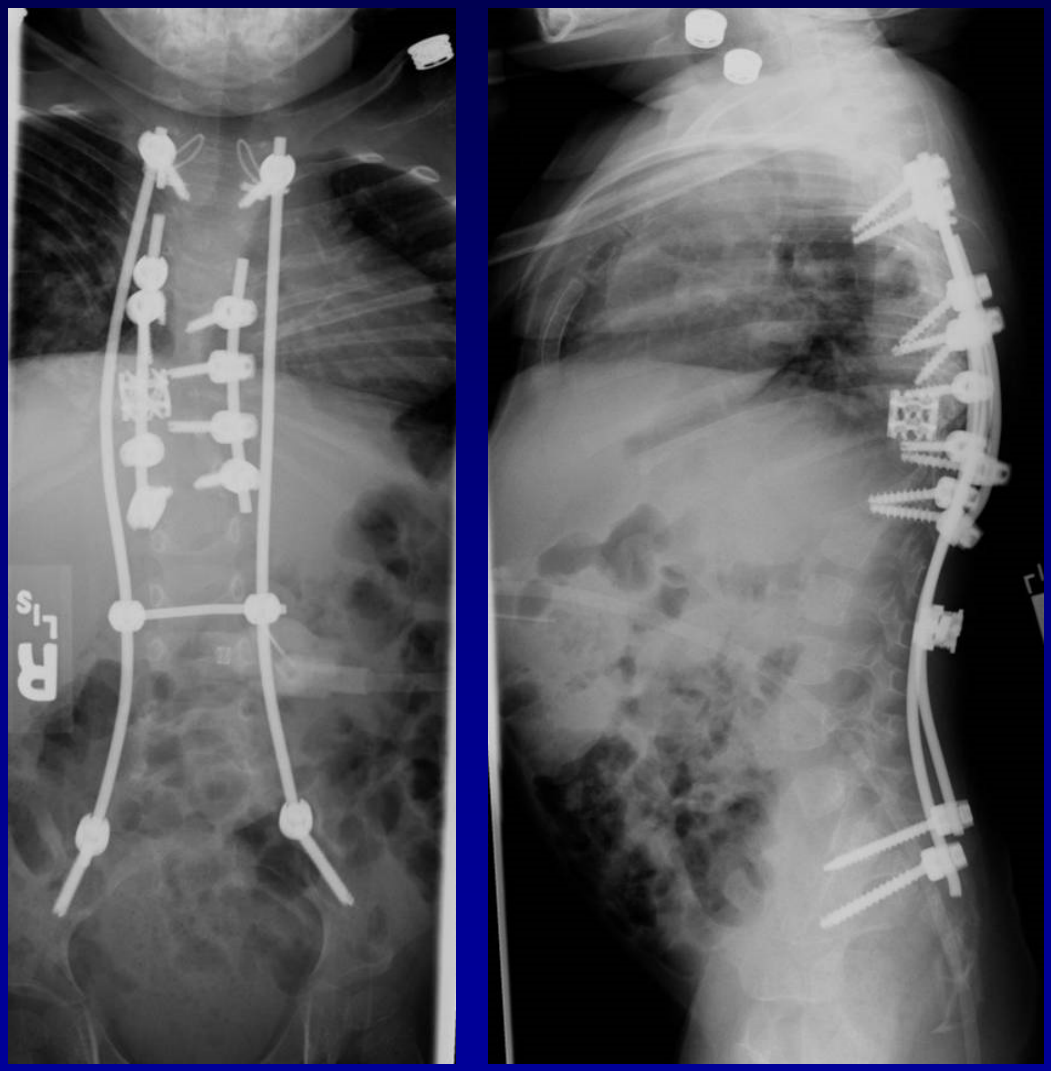


VCR and Growing Rods example 1



Simultaneous GR and VCR at 14 mos

- VCR for dysgenesis
  - *Local Deformity Rx*
- Growing Rods (3.2 mm)
  - *Global Deformity Rx*

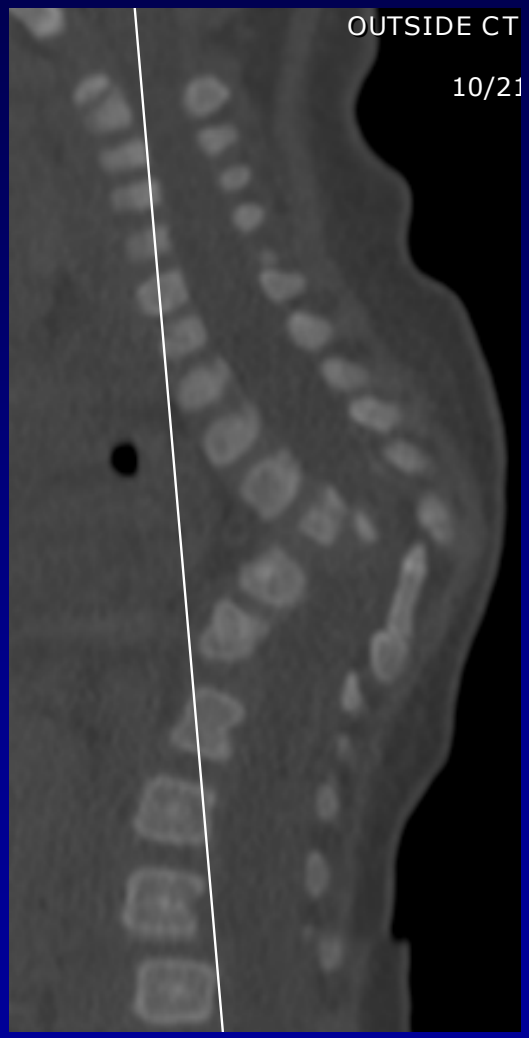


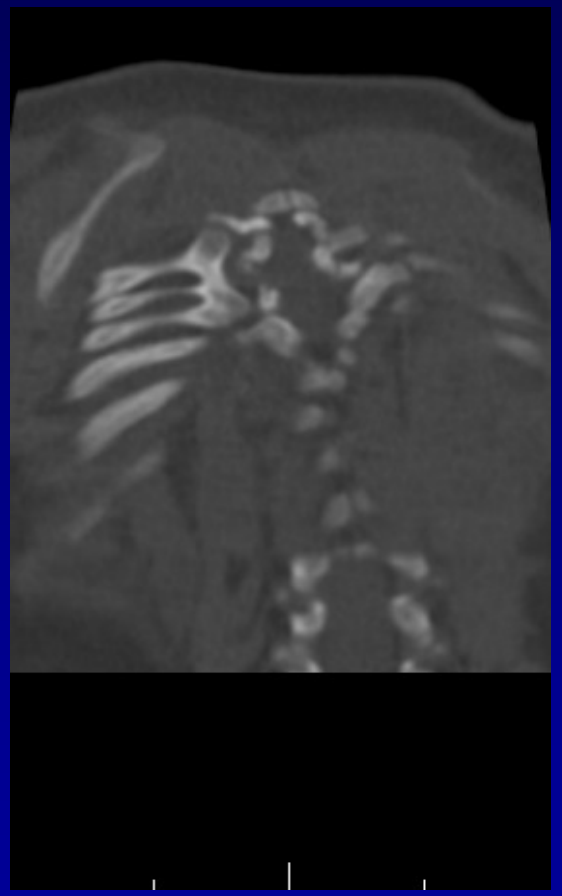
Age 8 ½. Lengthened for 4 years, then growing rods removed electively after torso control improved.

Example 2: VCR and GR Spinal Dysgenesis

- tethered cord (L5)
  - detethering @ 6 mo
  - Residual mild distal weakness
- imperfortate anus
  - s/p colostomy, s/p ileo-anal pull-through, colostomy take-down
- Small chest
- Worsening clinical deformity

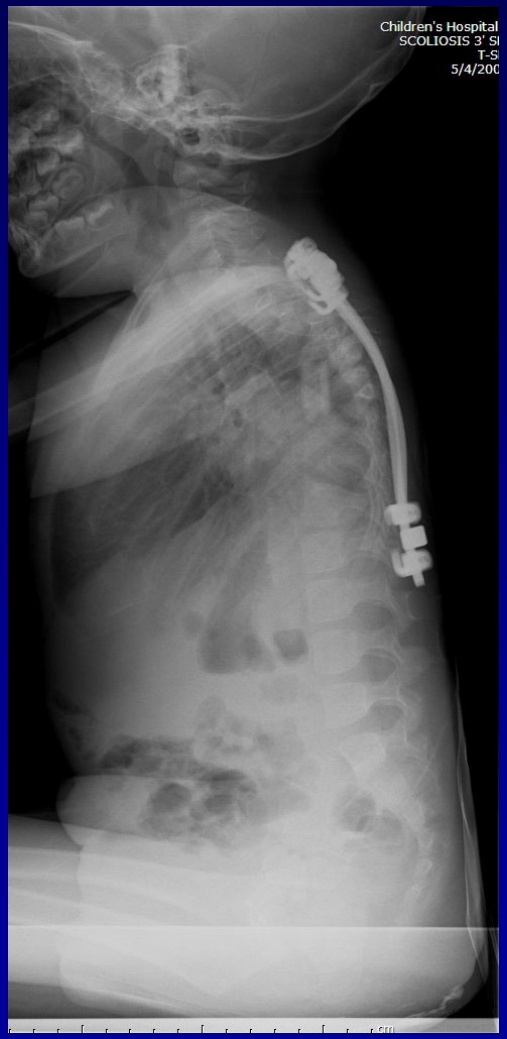
Example 2: VCR and GR

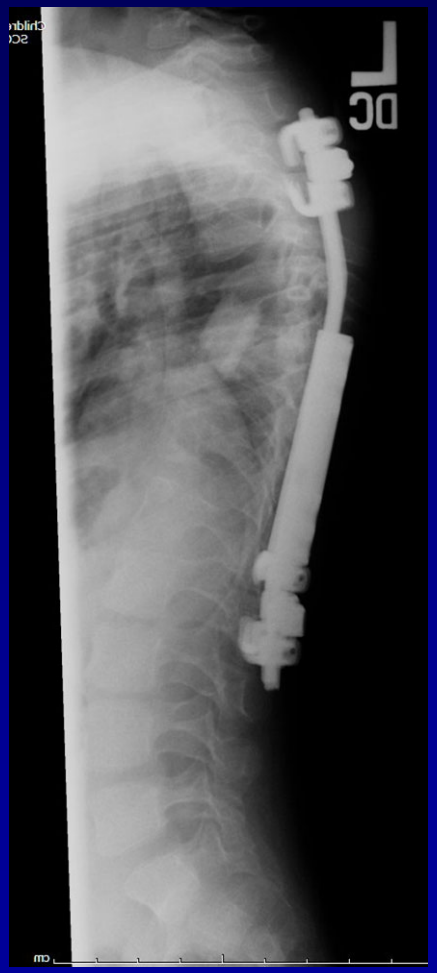




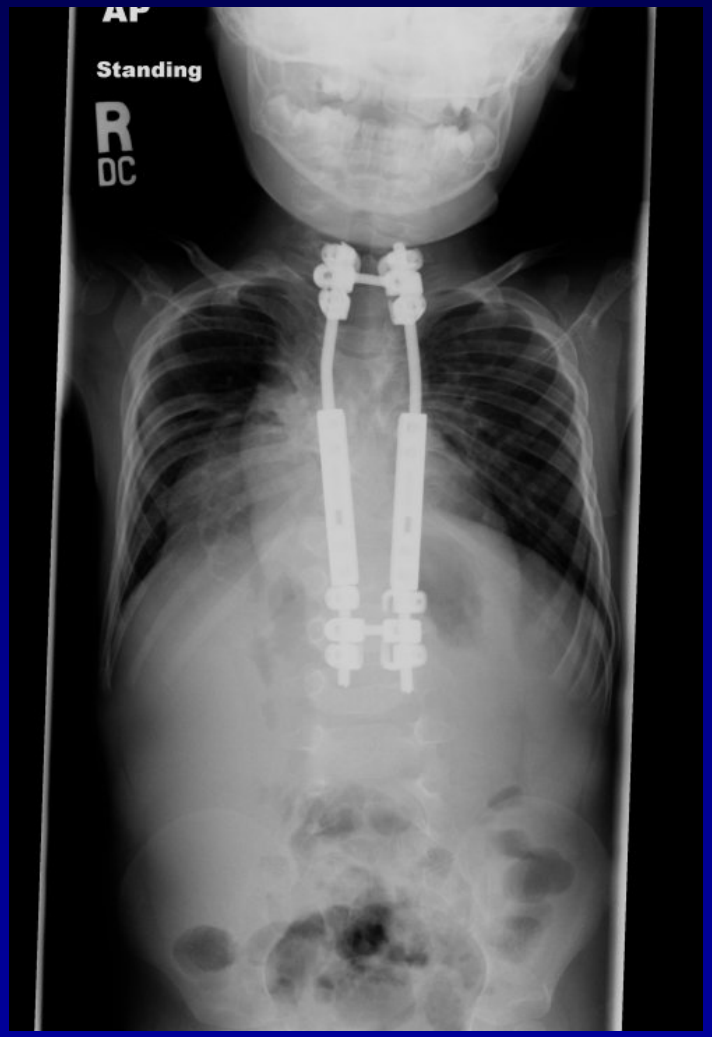
Example 2: Spinal dislocation/dysgenesis

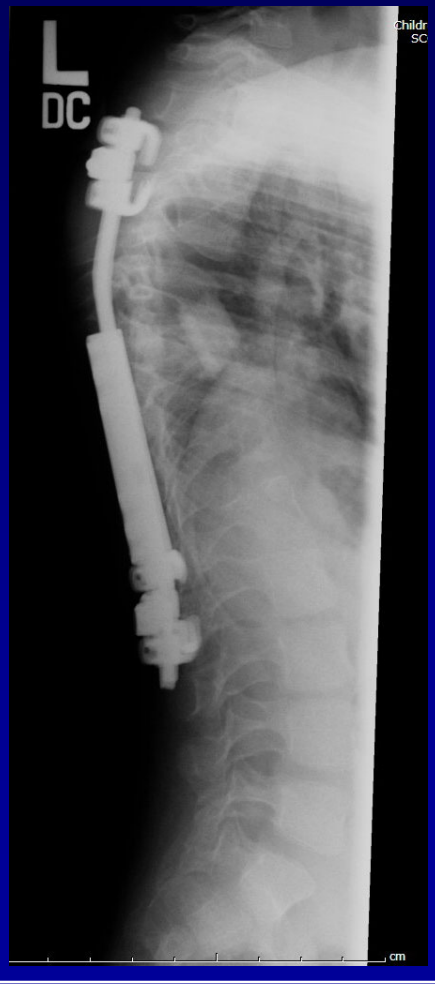
- VCR, unilateral costo-tranvesectomy, posterior elements left, allograft fibula.
- Growing rods (3.5 mm)
  - Expansion connector later





WH – 5 months later – GR conversion





Age 7, one rod exchange, multiple lengthenings

Conclusion: Simultaneous VCR and growth-friendly technique

- Severe EOS with *rigid local deformity* as well as *global deformity* challenging.
  - VCR combined with GR or Shilla permits control of both while allowing continued spinal growth.
- Of growth-friendly techniques, Shilla particularly appealing in this situation if anchor points large enough for sliding screws
  - 2 patients under 18 months of age better managed with VCR/GR
- Other option: VCR and temporary long fixation