



We Treat Kids Better

Which Osteotomy Should I use in Congenital Scoliosis?

Lindsay Andras, MD
landras@chla.usc.edu

Disclosures

Lindsay Andras, MD: Biomet (d), Eli Lilly (c), Journal of Pediatric Orthopedics (e), Medtronic (d), Orthobullets (f), Pediatric Orthopaedic Society of North America (e), Scoliosis Research Society (e)

- a. Grants/Research Support
- b. Consultant
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- f. Other Financial Support

Background

Treatment of congenital spinal deformity

- 3 column osteotomies
 - hemivertebrectomy (HV)
 - vertebral column resection (VCR)
- Multiple Ponte osteotomies (PO)



Goal: To evaluate the outcomes of patients with congenital spinal deformity treated with PO vs. HV/VCR

Methods

Retrospective review of patients with congenital spinal deformity treated with posterior spinal fusion

Study period: 1996-2013

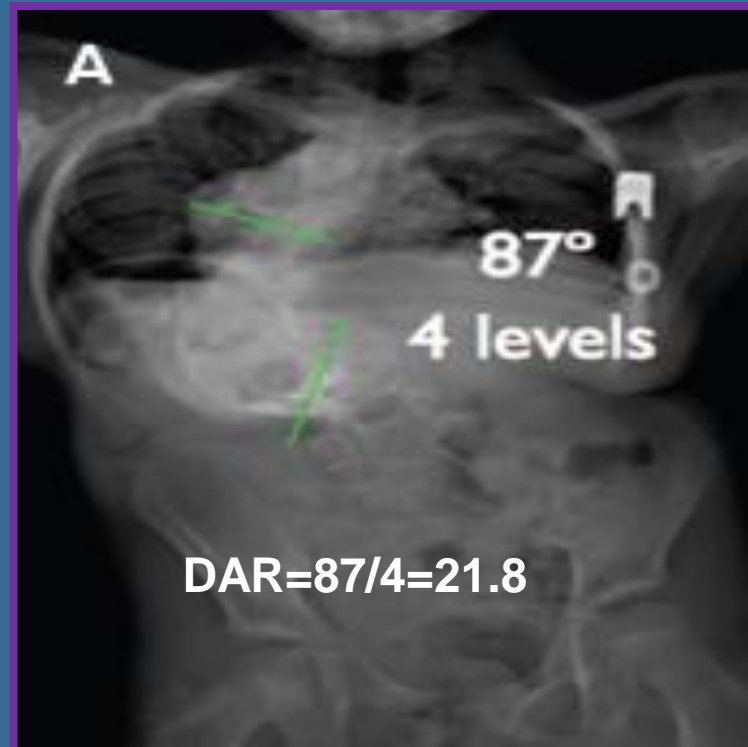
- Exclusion criteria:
 - prior instrumentation
 - isolated cervical deformity
 - growing spine instrumentation
 - < 2 year follow-up



49 patients met the inclusion criteria

- 17 PO
- 32 HV/VCR (26 HV; 6 VCR)

Deformity angular ratio (DAR) calculated for each patient
(curve magnitude/# levels of deformity)



Lewis, Lenke, et al. Spine 2015

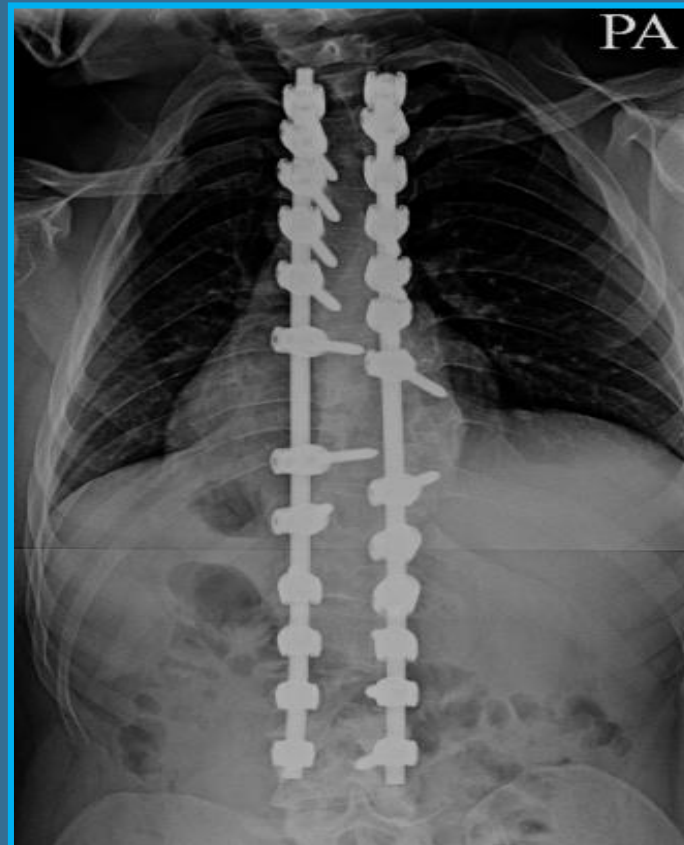
Results

Coronal and Sagittal DAR was similar between groups

	PO (n=17)	HV/VCR (n=31)	P-value
Mean Age (years)	14	7	<0.0001
Mean Preoperative Cobb Angle (°)	65	54	0.031
Mean Preoperative Kyphosis (°)	60	53	0.30
Mean Coronal DAR	12	14	0.17
Mean Sagittal DAR	13	14	0.66
# of congenital anomalies	1.8	2.1	0.43

Results

- More levels were fused in the PO group than HV/VCR group (11 levels vs 5 levels, $p < 0.001$)

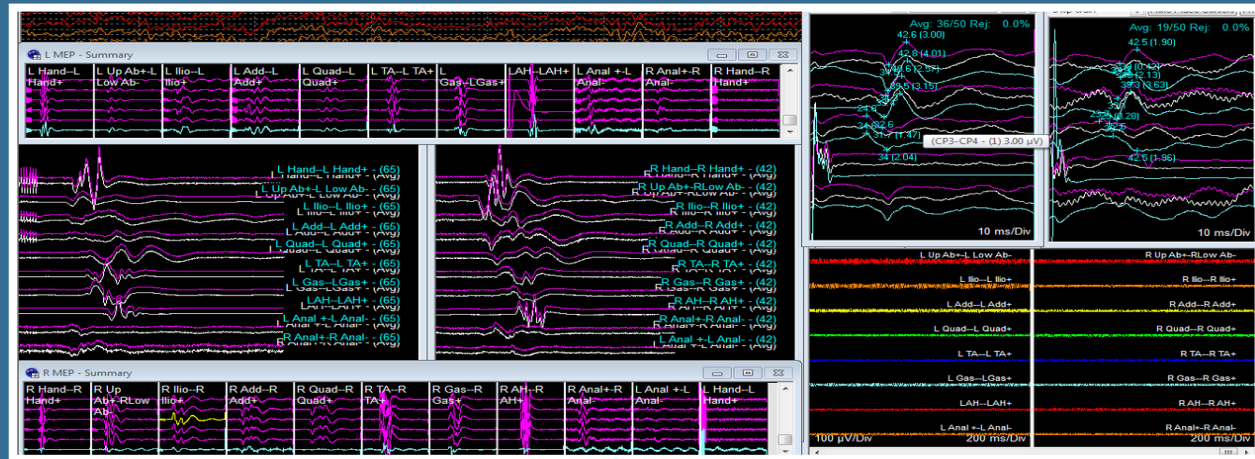


Results

Amount of correction was the same between groups

	PO (n=17)	HV/VCR (n=31)	P-value
Mean Postoperative Cobb Angle (°)	32	25	0.18
Mean Postoperative Kyphosis (°)	40	34	0.21
Mean Percent Correction of Cobb Angle (%)	54.1	54.4	0.78
Mean Percent Correction of Kyphosis (%)	145	127	0.753
Mean Postoperative Coronal DAR	6.0	6.1	0.911
Mean Postoperative Sagittal DAR	8.5	7.4	0.404

Results



Signal changes were significantly more frequent with VCR ($p=0.001$):

- 5.9% (1/17) in PO group
- 3.8% (1/26) in HV group
- 67% (4/6) in VCR group

Results

- VCR group: 2 neurologic deficits
 - 1 resolved by 2 weeks postoperatively
 - 1 had complete lower extremity paralysis
- PO group: 1 neurologic deficit
 - resolved after decompression and staged fusion

Results

Return to OR was higher in the HV/VCR group but was not significantly different (p=0.35)

Reasons for reoperation	PO (n=17)	HV/VCR (n=32)
Total	3 (17.6%)	12 (37.5%)
Decompensation below LIV	0	1
Proximal junctional kyphosis	1	1
Broken implants	0	3
Implant migration	0	3
CSF leak and wound dehiscence	0	1
Pseudarthrosis	0	2
Wound drainage	1	1
Implant prominence	1	0
Progression of scoliosis	0	2



Do you need to operate? When to wait...

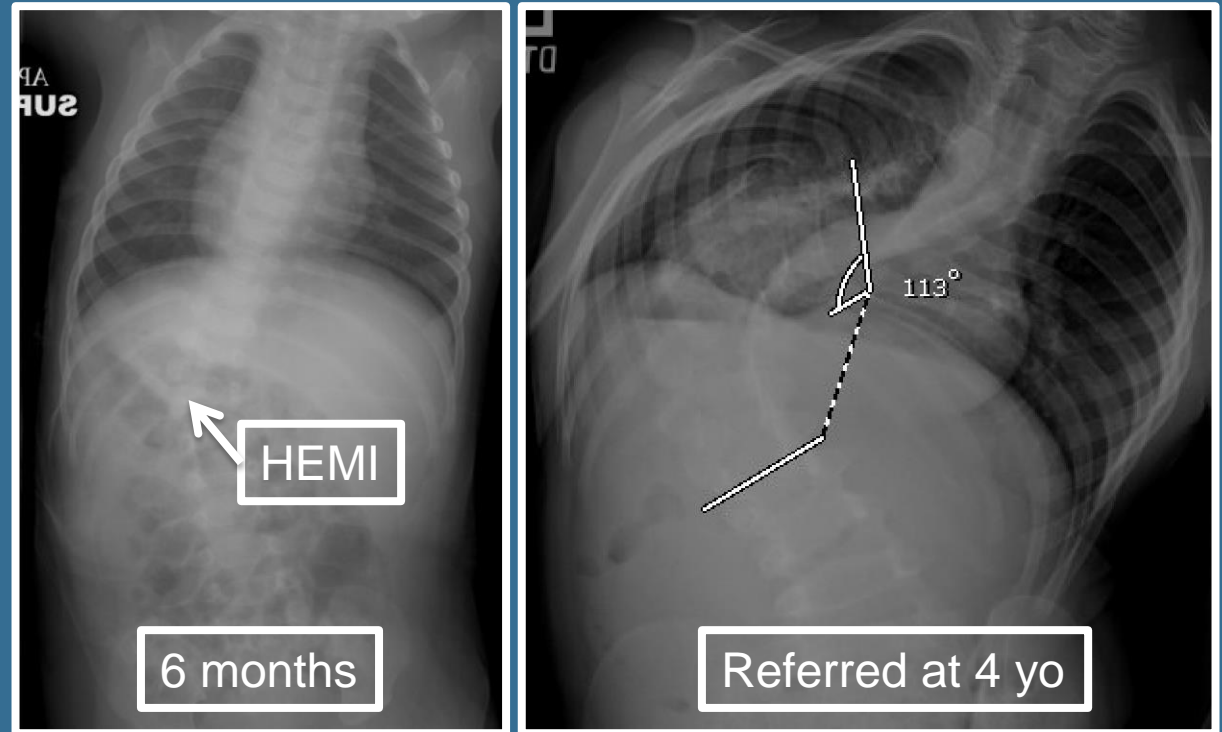
- Asymptomatic
- Nonprogressive
- Slowly progressing and small (<3yo)

Evaluate progression

- Look back at many XR, compare side by side
- High inter and intra-rater variability in measuring congenital scoliosis
 - Loder et al: intraobserver variability +/- 9.6 degrees
interobserver variability +/-11.8 degrees
true progression= >23 degree change
- Facanha-Filho, Winter et al, JBJS 2001:
 - if comparing XR side by side, an accuracy of +/-3 degrees can be expected 95% of the time

Do you need to operate? When to act...

- Progressive
 - if slow try to postpone until at least 3-4yo
- Significant Stenosis
- Poor balance

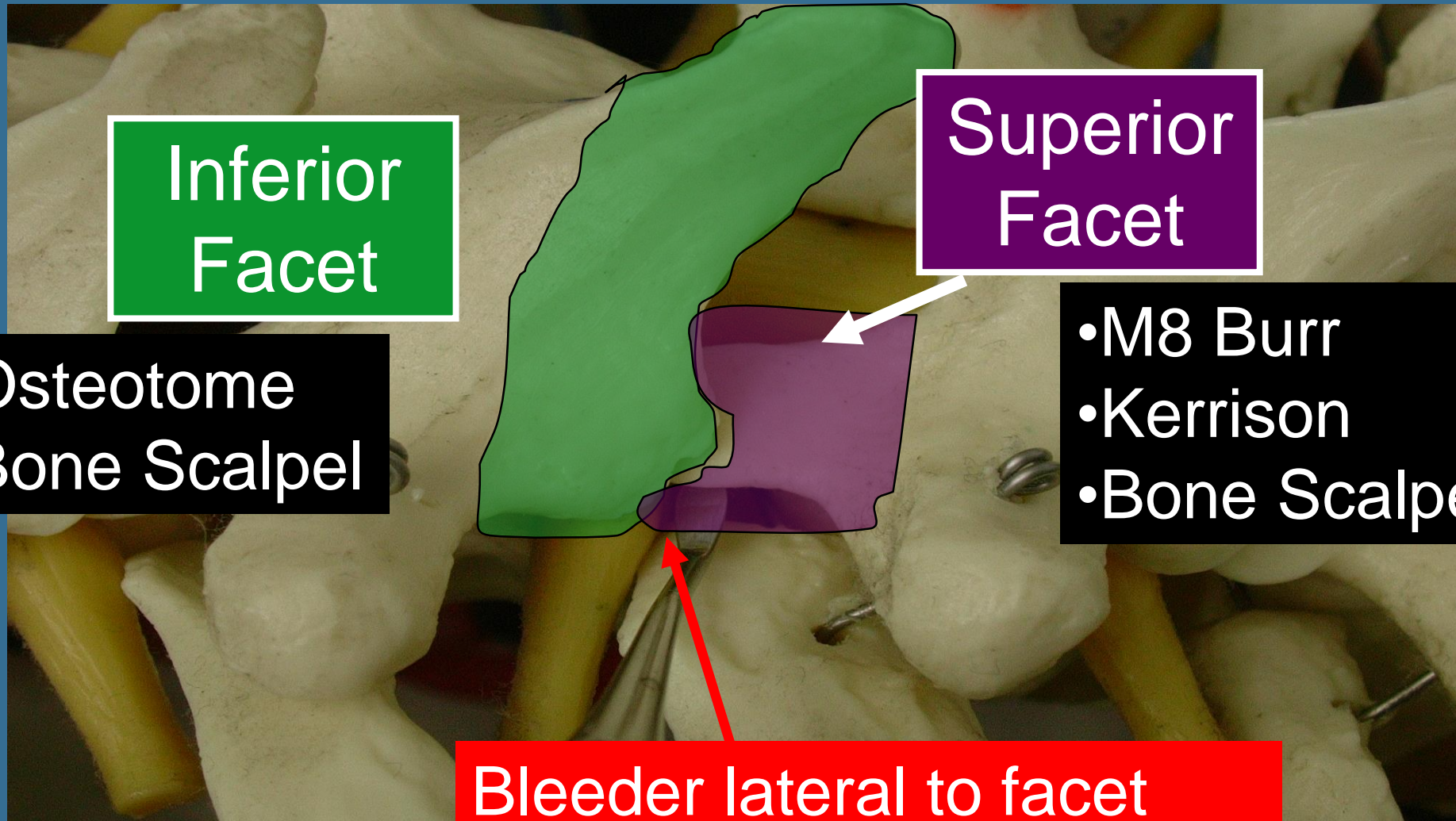


Options in Congenital Scoliosis

- Ponte
- Hemivertebrectomy
- Vertebral Column Resection



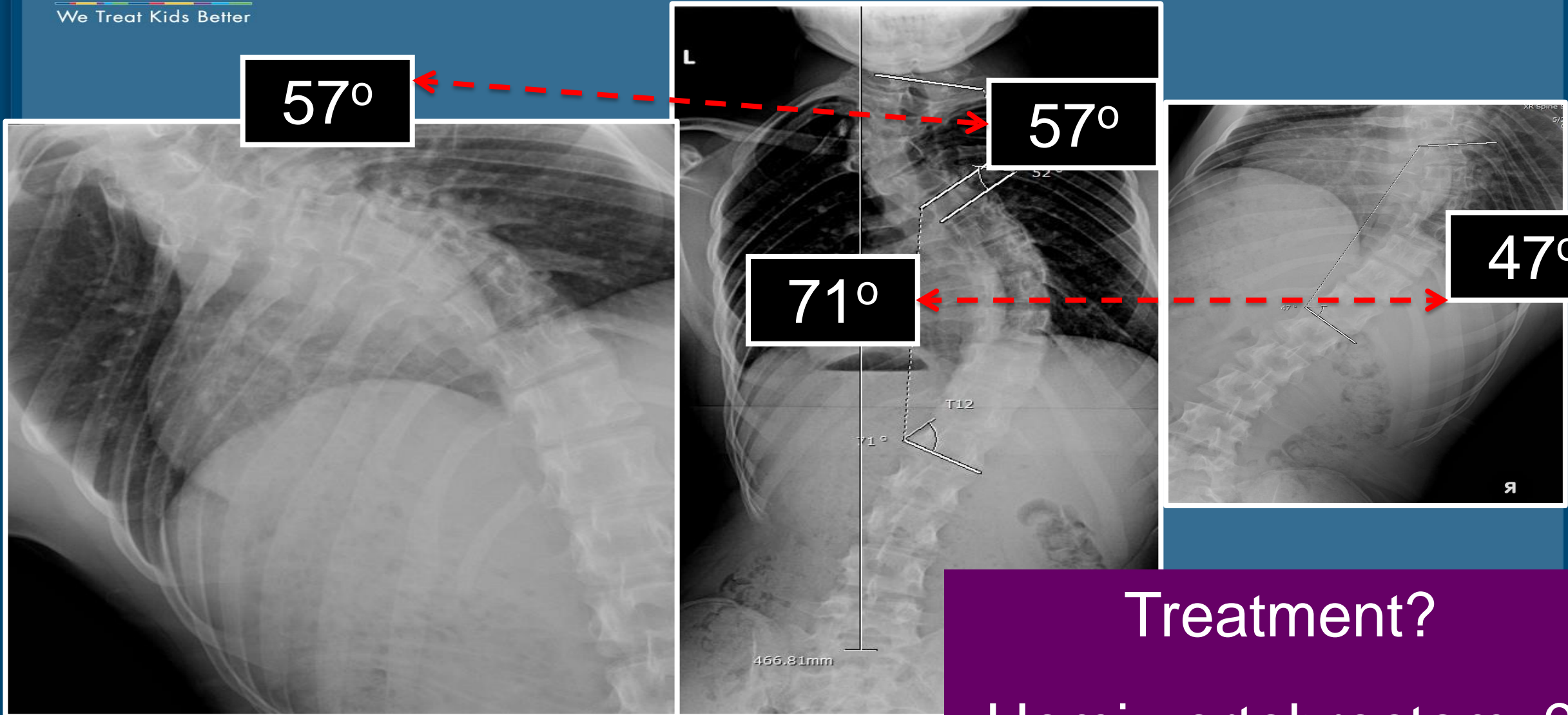
Ponte Osteotomy



- Osteotome
- Bone Scalpel

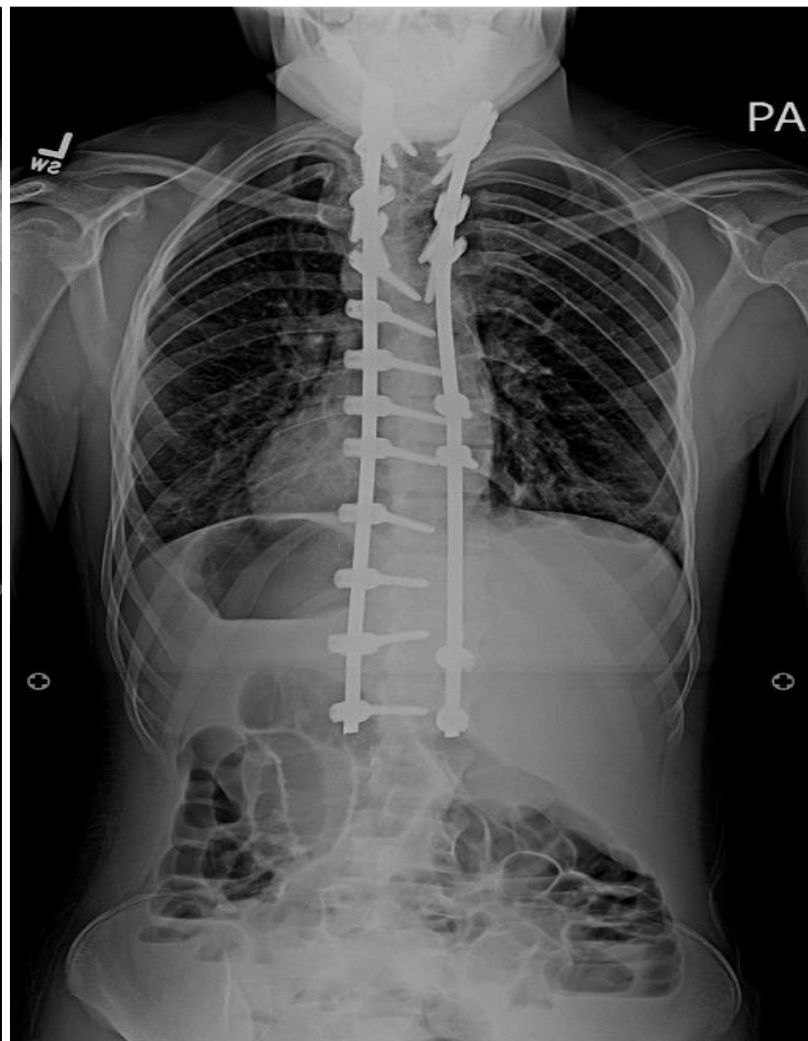
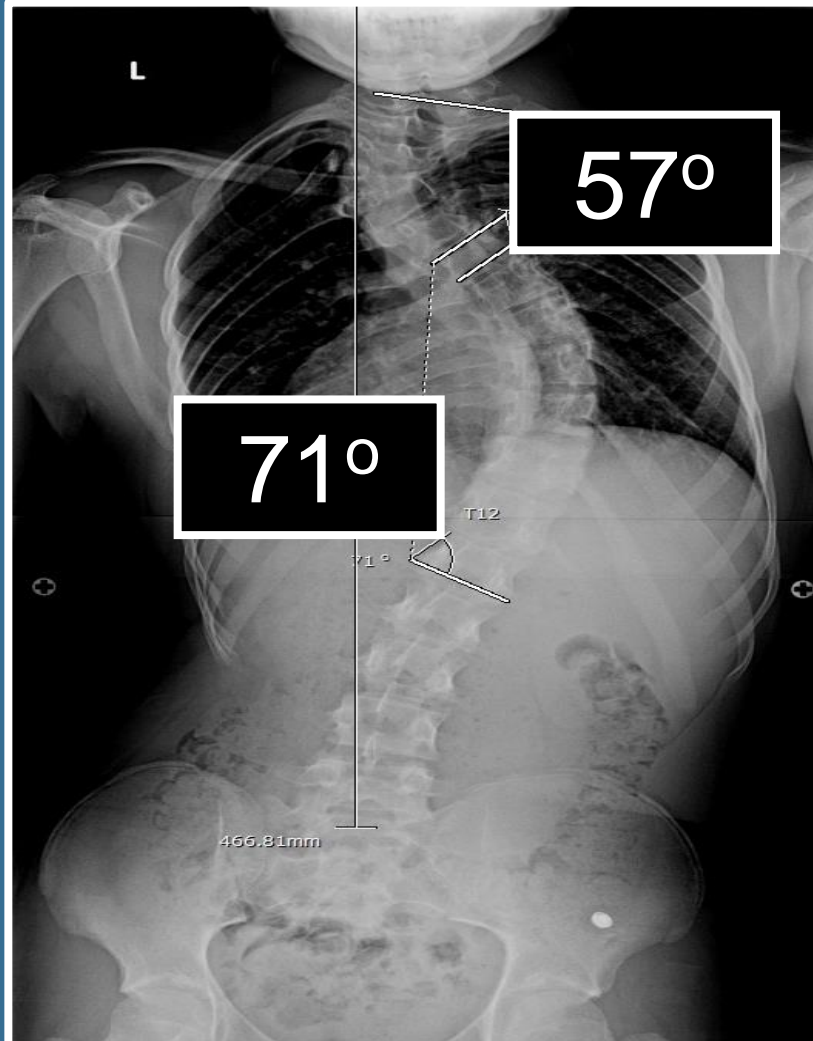
Bleeder lateral to facet

15 yo boy - T4 hemivertebrae



Treatment?
Hemi-vertebrectomy?

Multiple Ponte Osteotomies - no resection



Ponte Osteotomies

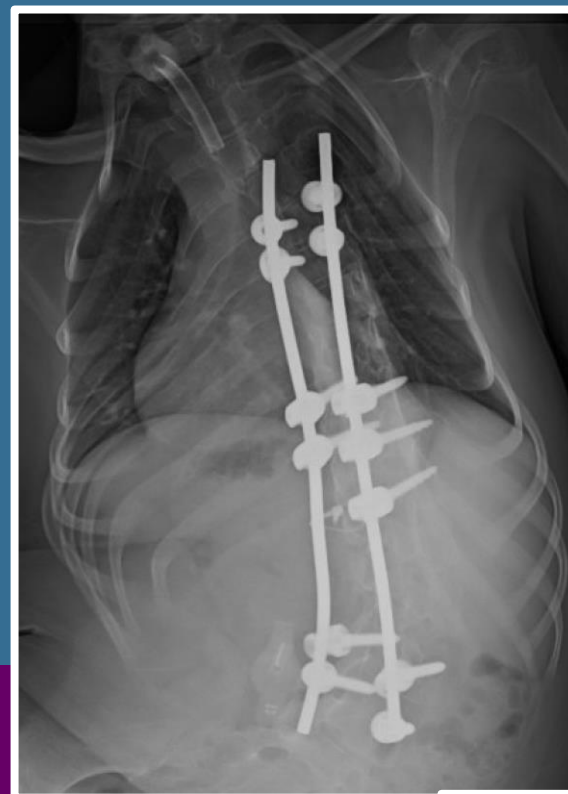
Approximately 10 degrees per level

Improves flexibility for derotation

- 3 degrees per level

(Sangiorgio et al Spine Def 2013)

- Older Children having longer fusions
- Revisions/ Prior fusion mass
(esp growing rod/VEPTR conversions)



s/p guided growth
With apical fusion
At OSH with continued
progression

Ponte Osteotomies

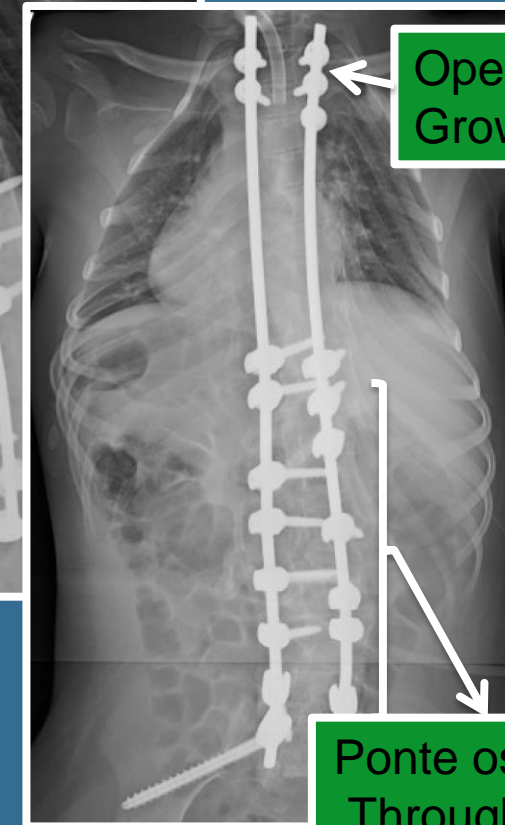
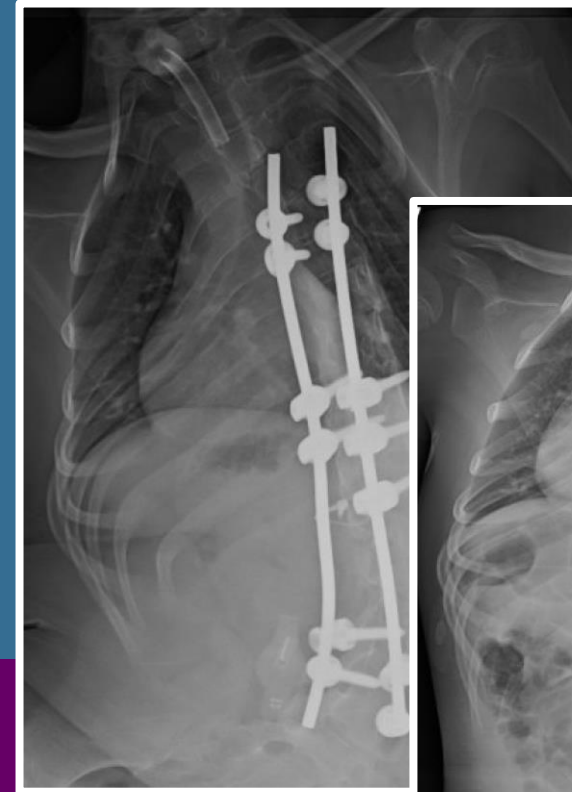
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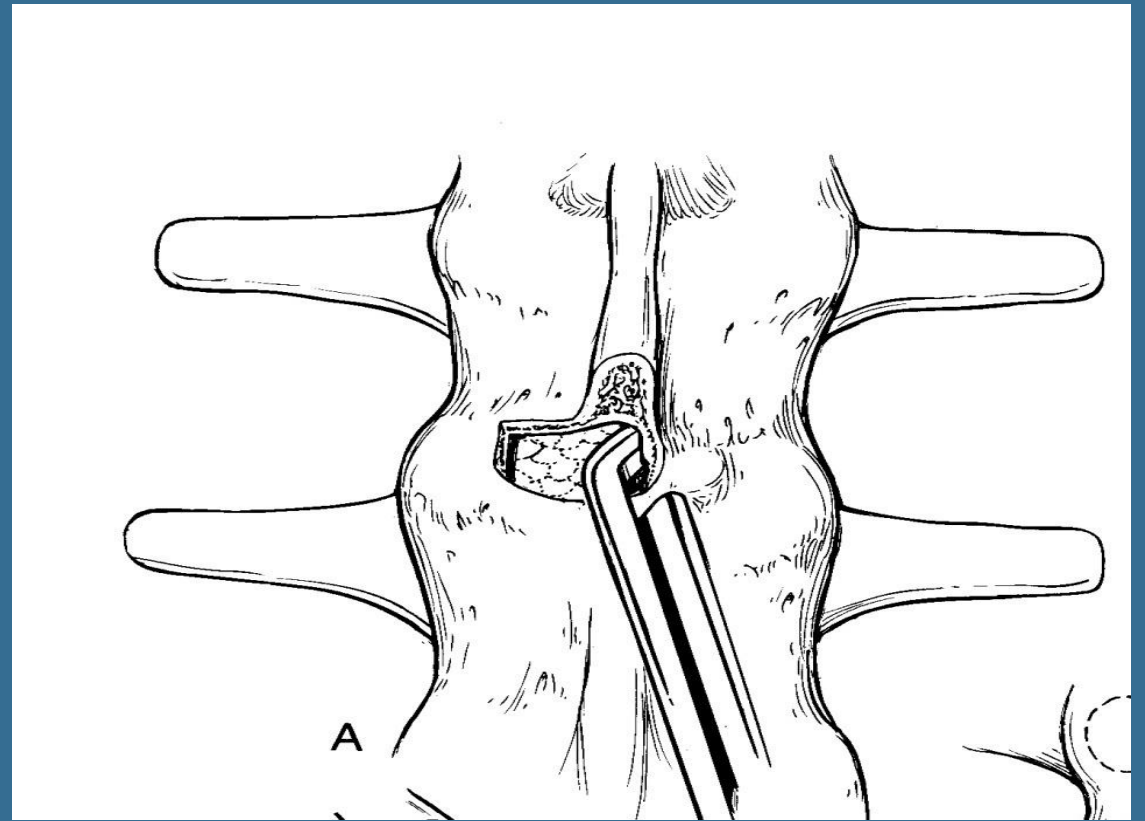
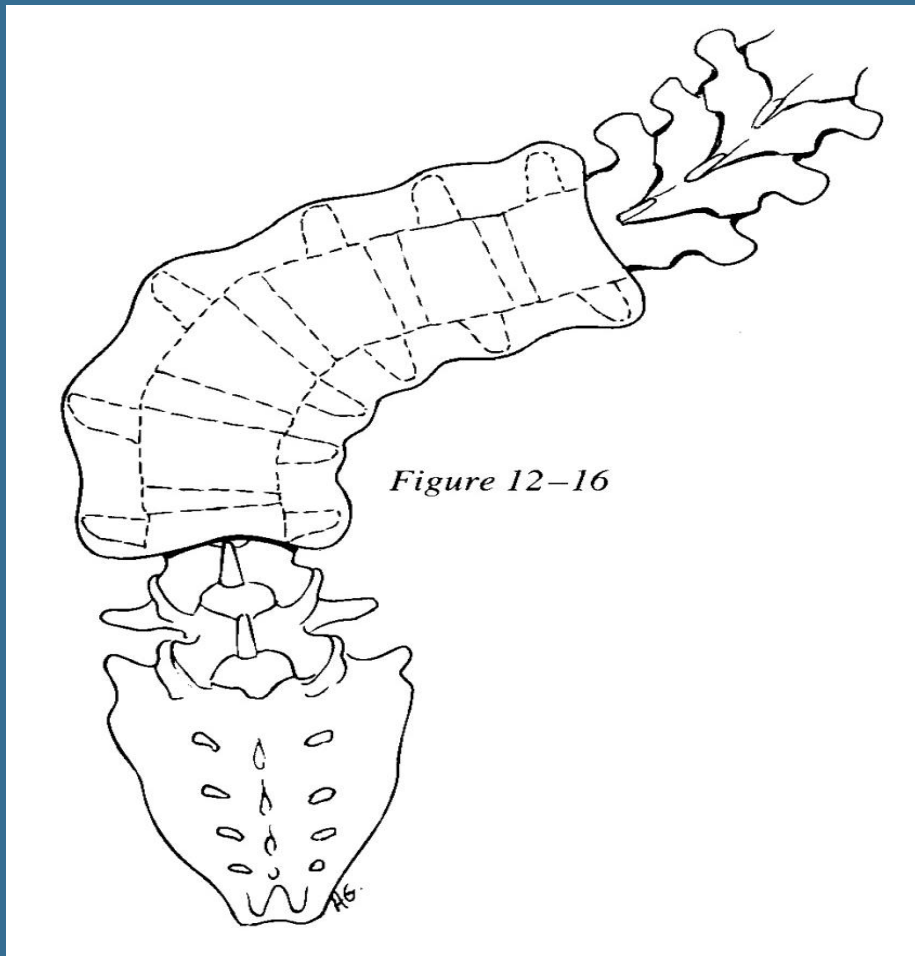


Open Guided
Growth Screws

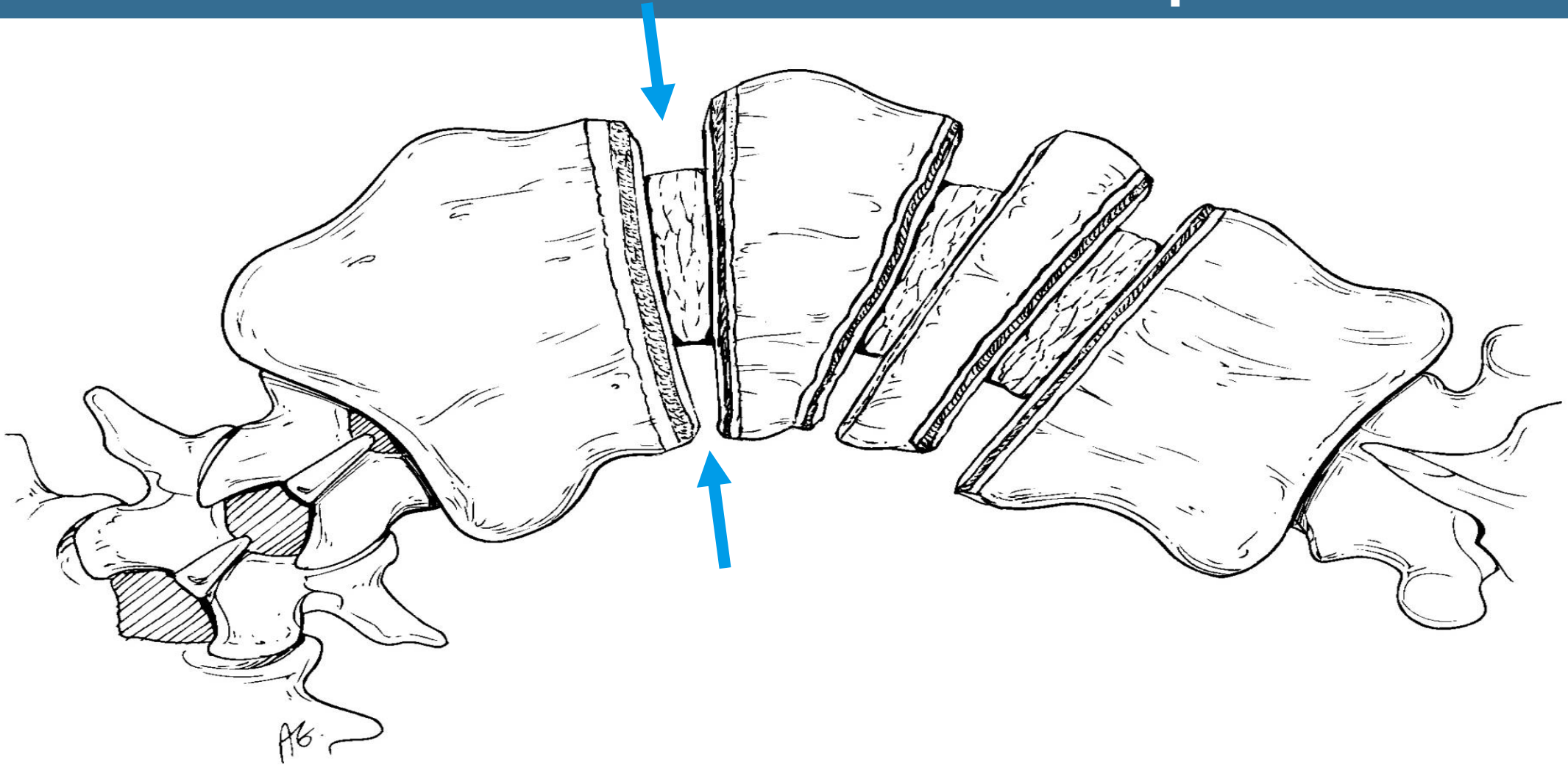
Ponte osteotomies
Through Lumbar
Spine

Posterior Osteotomies Previous Fusion

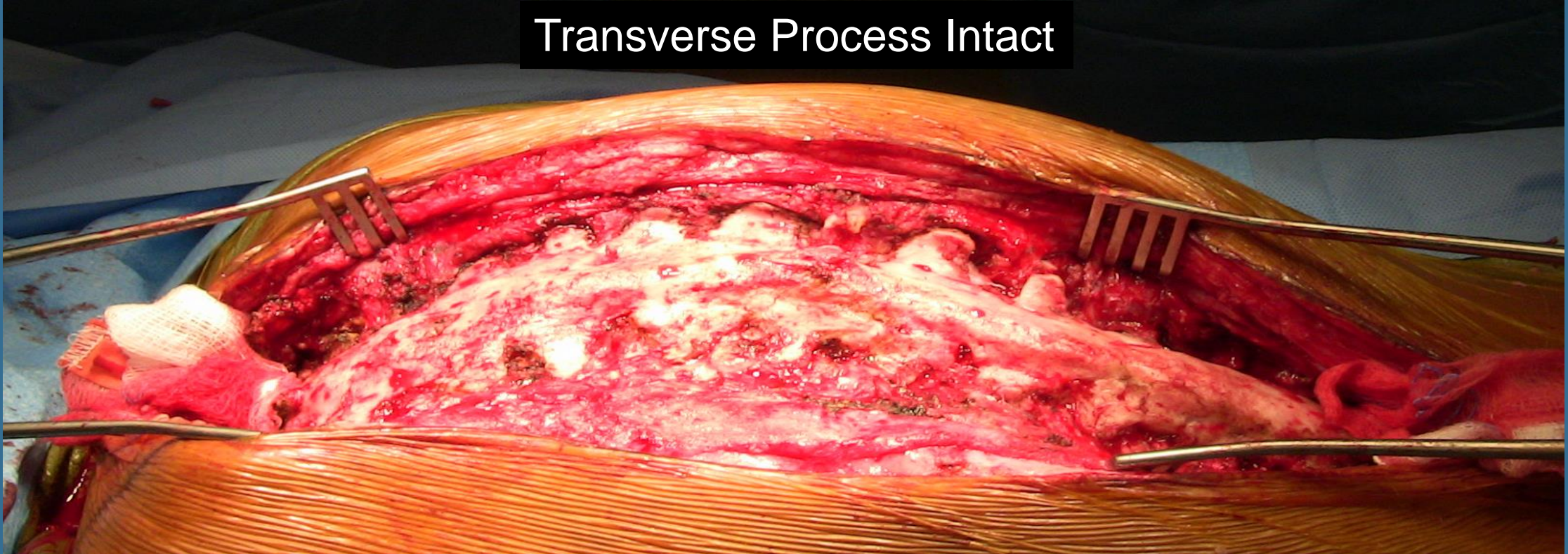
- Identify transverse processes
- Need Open discs
- Note which goes with which
 - Image to identify pedicles



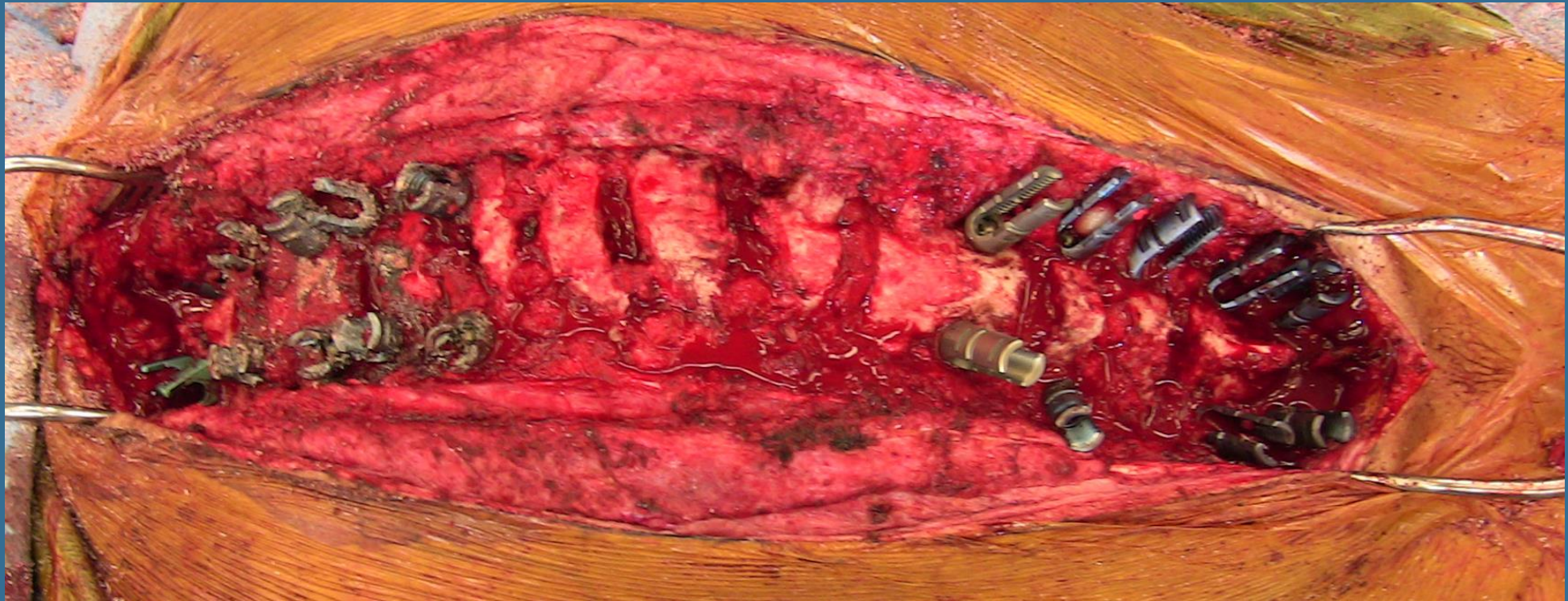
Motion Essential confirm w/ Laminar Spreader



Transverse Process Intact



Multiple Osteotomies



Hemivertebrectomy

Best for : Isolated hemivertebrae with focal deformity

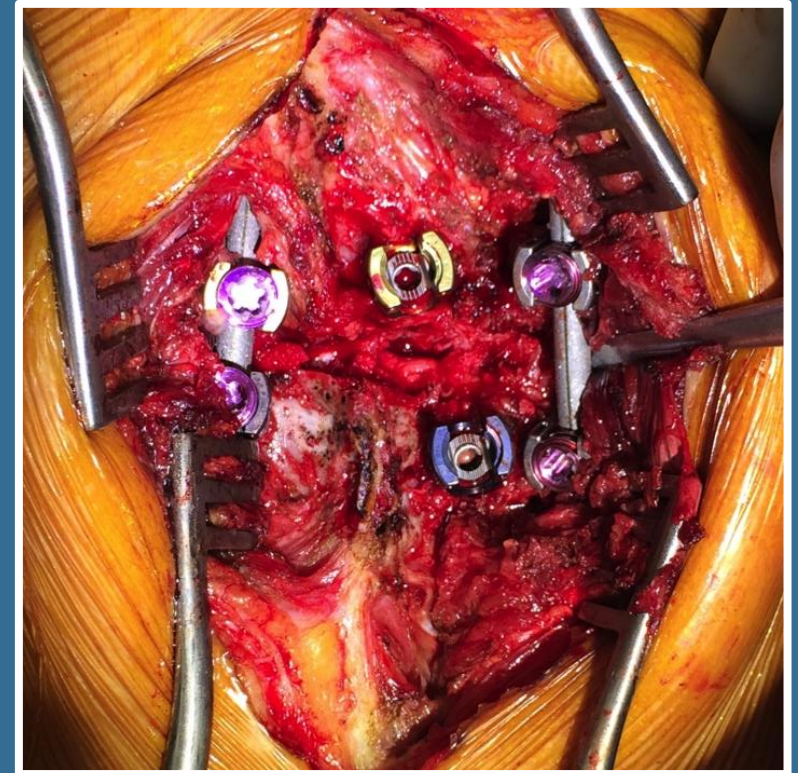
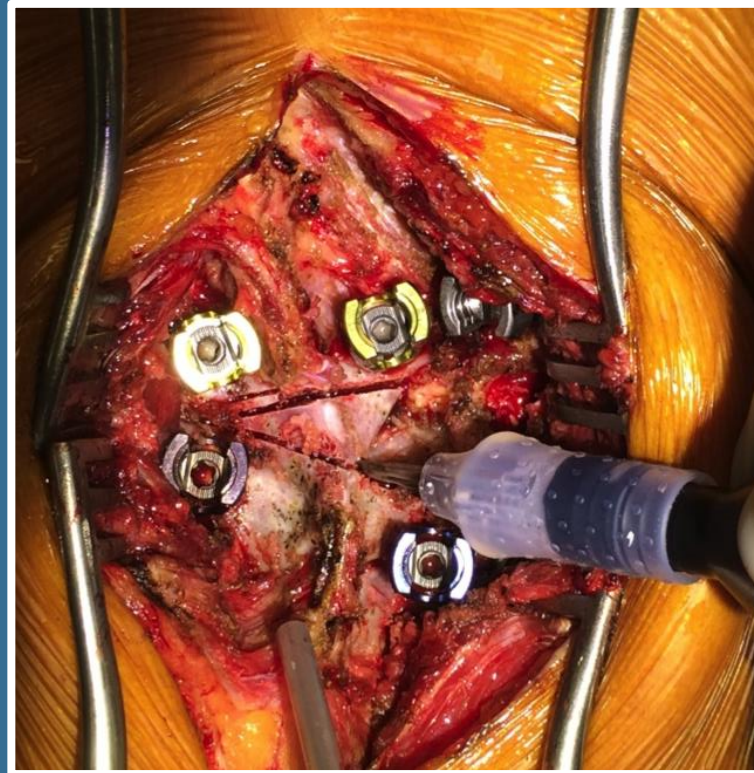
- esp in small children
- try to postpone until 3 yo or older
if not rapidly progressing

Template with 3D CT

- Evaluate pedicles above and below
- Often abnormality posteriorly doesn't mirror deformity anteriorly

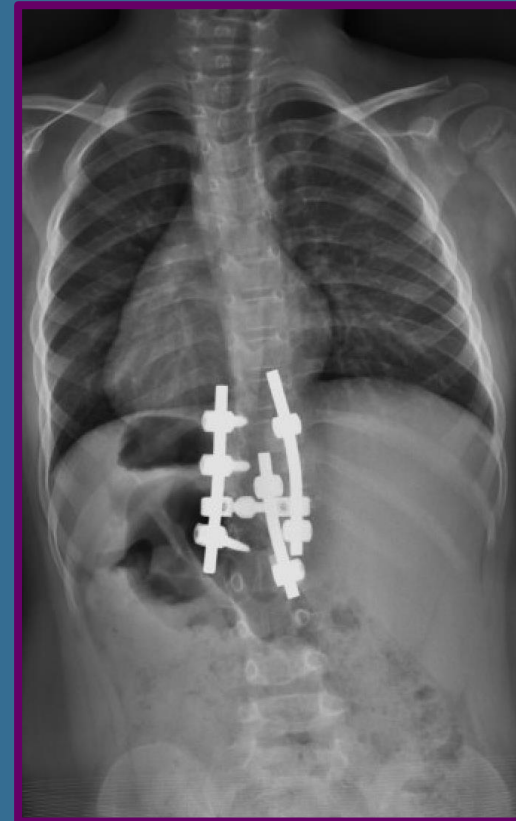
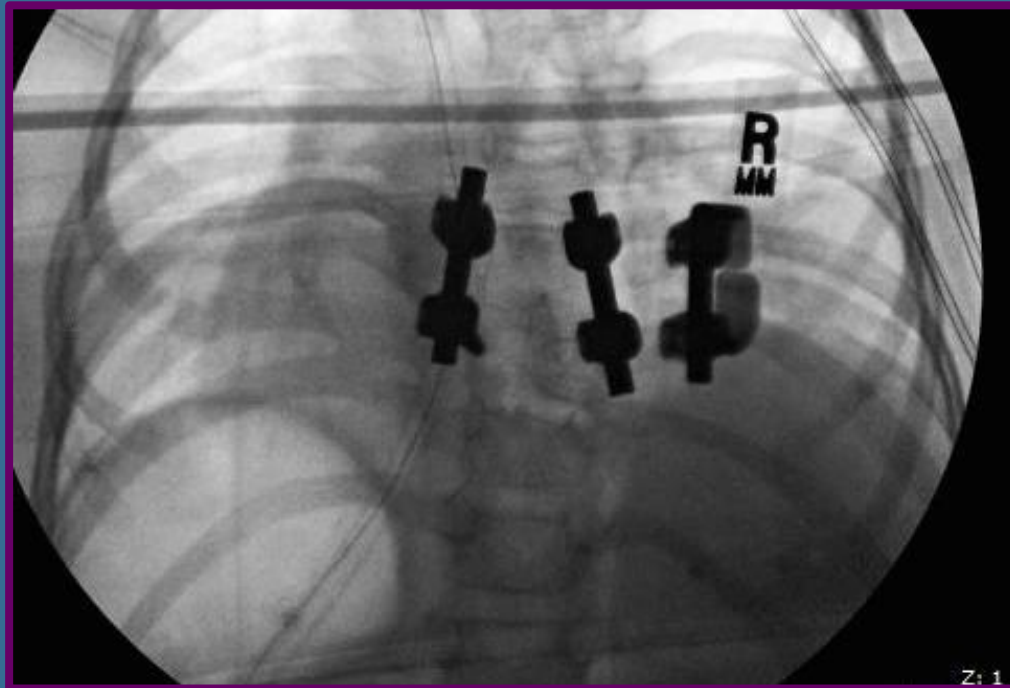
Hemivertebrectomy

- Bone Scalpel



Hemivertebrectomy

- Consider Hooks a 3rd rod to close osteotomy with hooks on ribs or lamina



Vertebral Column Resection

- Rarely needed in young patients
- Highest neurologic risk
- Consider other options
 - halofemoral traction

Summary

Hemivertebrectomy

- Short focal deformity
- Younger children
- More Revisions



Ponte Osteotomies

- Longer segments
- Older Children
- More Derotation
- Fewer Implant Issues