JOHNS HOPKINS
MEDICINE

Criteria for avoiding Final Fusion

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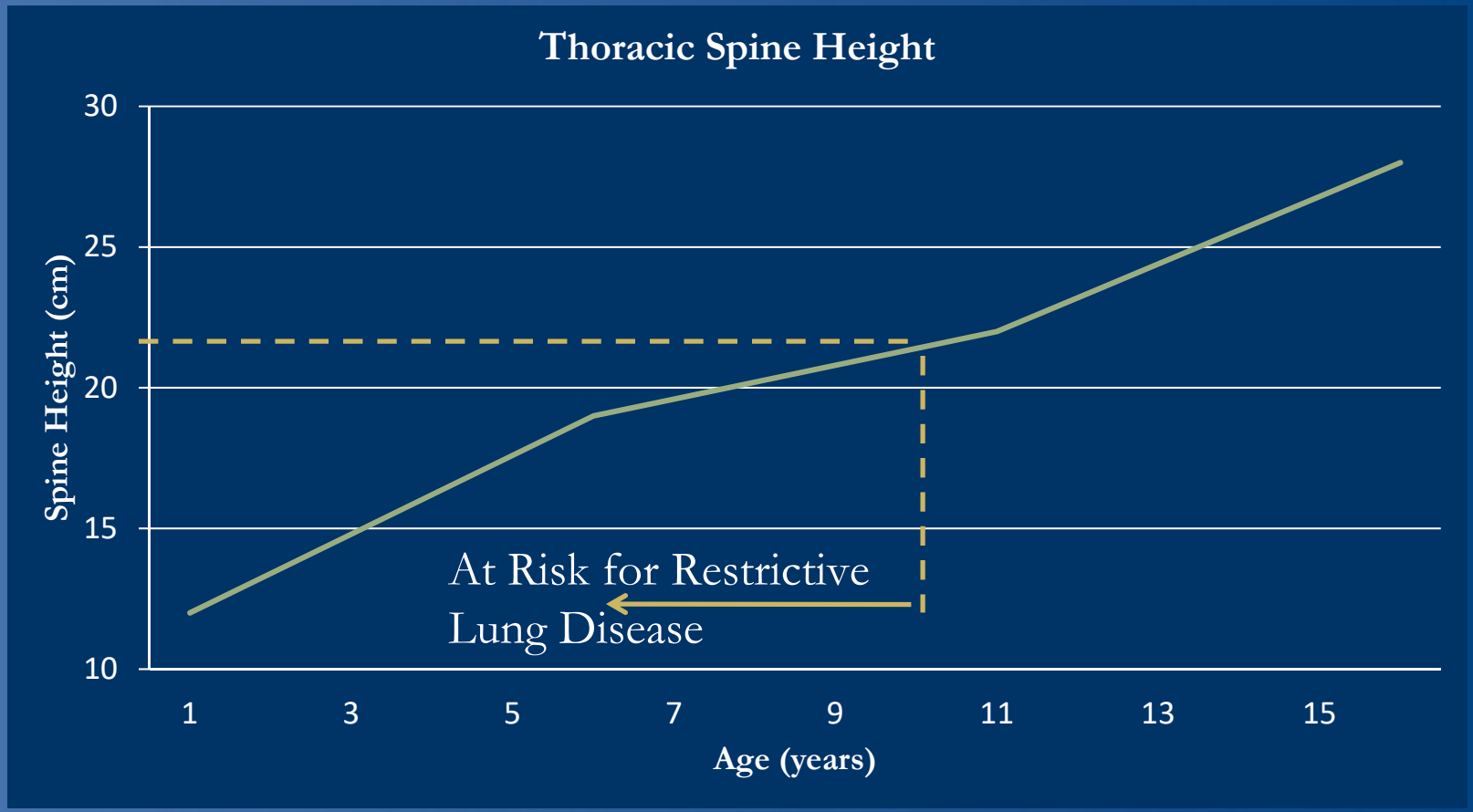
2:40-2:50

Disclosures

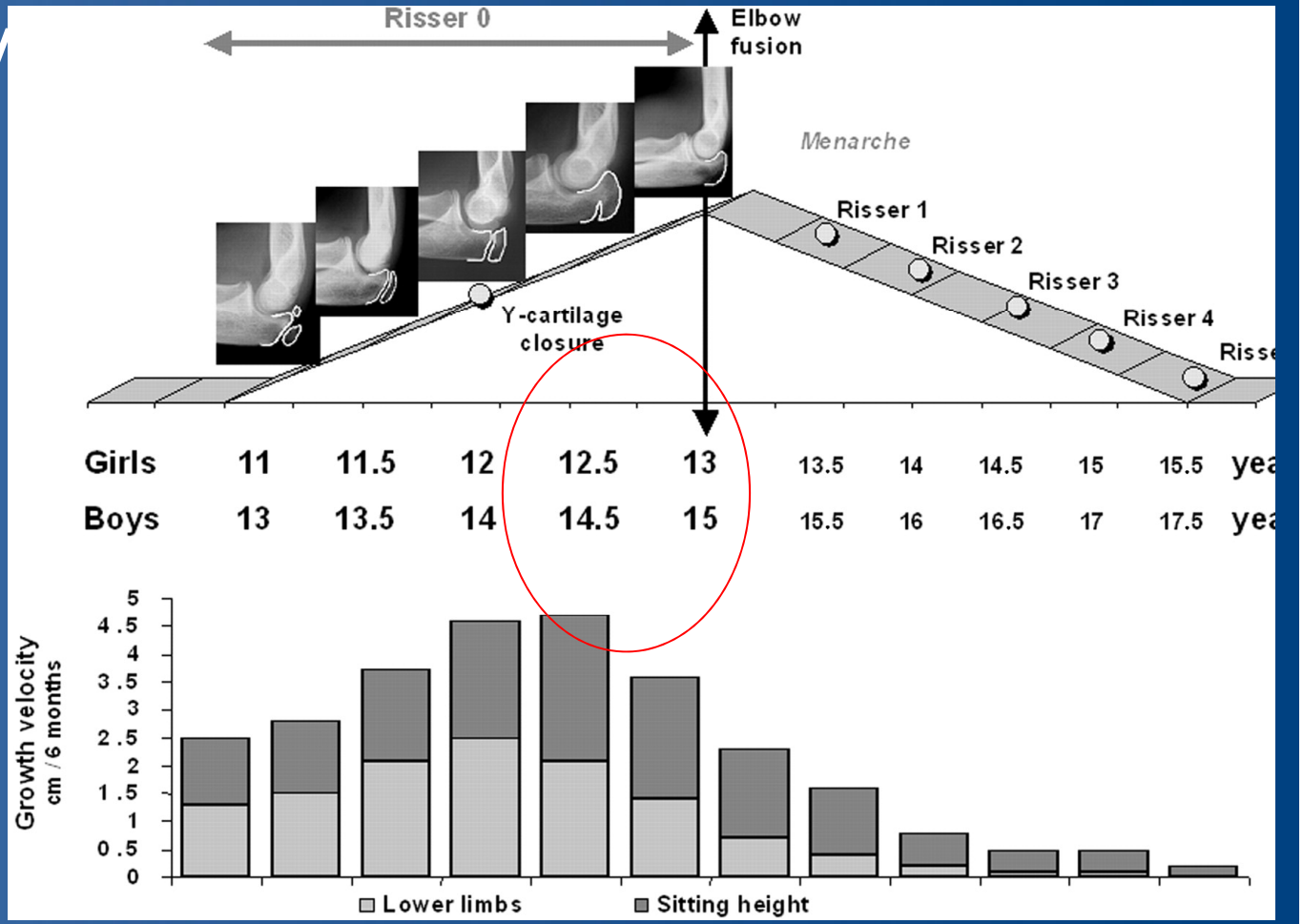
- Medical Education Reviews
- JBJS
- Depuy Synthes Spine: Research, royalties
- Globus: Royalties

Goal- Thoracic growth

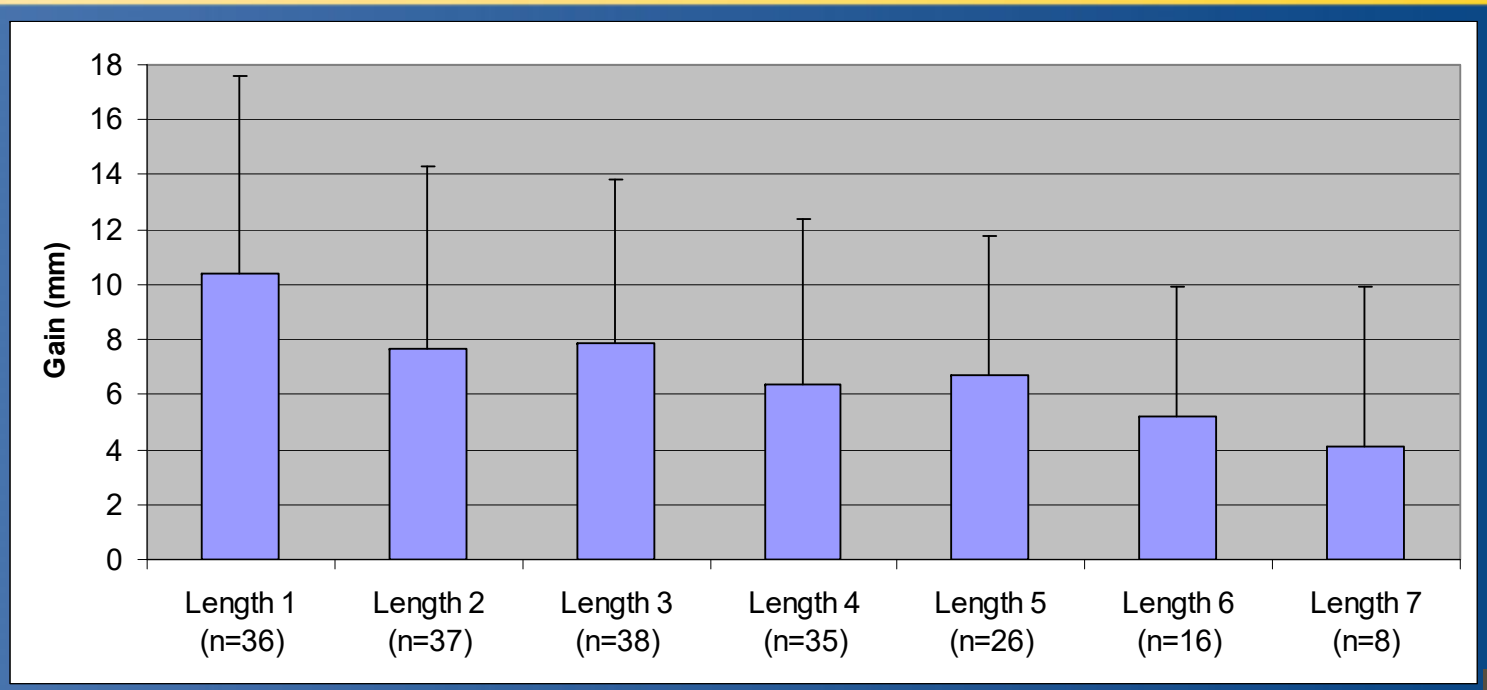


When to stop Lengthening: Growth of Whole Spine

- PHV<13/15y
- Dimeglio



Implications of "Law of Diminishing Returns"



Spine stiffens with time

P<0.05

Sankar and Skaggs

What's Next?
The Growing Spine "Pathway"

- Patients are told they will have
  - Growing Phase, *then*
  - Final Fusion
- Many patients follow this as a matter of protocol

Final Treatment Survey

	GSSG Survey (17 Surgeons)	
Final Treatment	**(12/17) Replace everything, add more anchors** **(1/17) Leave rods add more anchors** **(4/17) Don't fuse if pt having no problem**	

GSSG Survey: Indication for Final Fusion

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(13/17) Skeletal maturity (6/11surgeons use Risser 4)

(14/17) Complications: infection or implant failure

(8/17) Curve progression

(7/17) Failure to distract

Final Fusion- what is it?

Flynn JBJS 2013

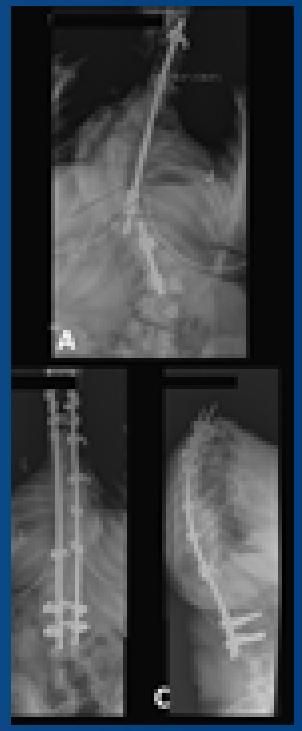
- 99 patients at maturity or fusion
  - 92 had fusion
- Mean of 5 years with GR

- 34% of patients
  - indication for fusion not given

Findings at Fusion

- Mean age of 12.5 yrs
- 62% completely stiff
- 50% got only moderate correction
- 25% required osteotomies

- 19% had worsening post-fusion



Final Fusion is not always Final

- Thompson et al
- > 20% require additional surgery

Assessing Spontaneous Stability:

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When can we avoid final fusion procedures in Growing Rod patients who have reached skeletal maturity?

- How can patients not needing final fusion be identified?
  - Clinical and radiographic predictors
- Is CT needed?

Proposal

Final fusion may not be necessary for adequate correction in a subset of patients who:

- Have been treated with growing rods for over 3 years
- Are maturing (Risser >1-2) and have adequate correction/balance
- Have no implant problems (no infections, no rod breakage within past 2 years)
- Have had diminishing returns at distraction

A Growing Rod Story

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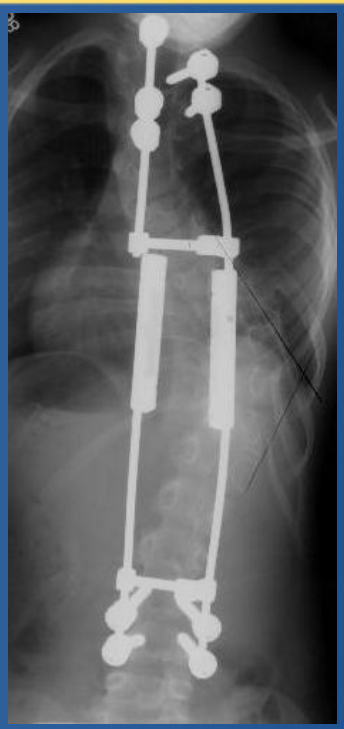
Age 6

Age 8



Age 9

Patient with idiopathic early onset 95 degree curve at age 6. Rods fractured multiple times; each time repaired with distractions.

End of the saga

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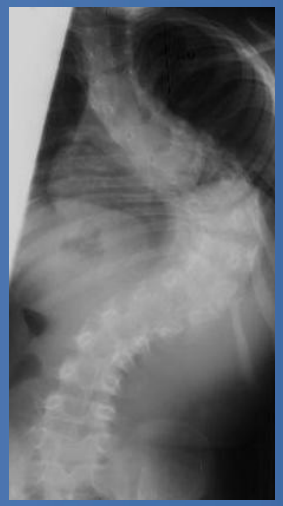
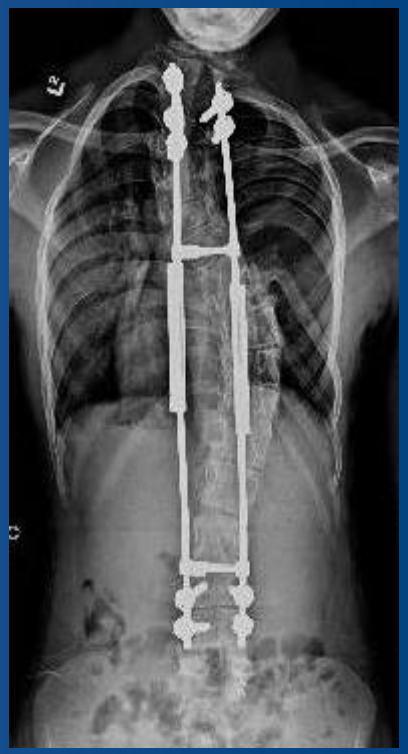
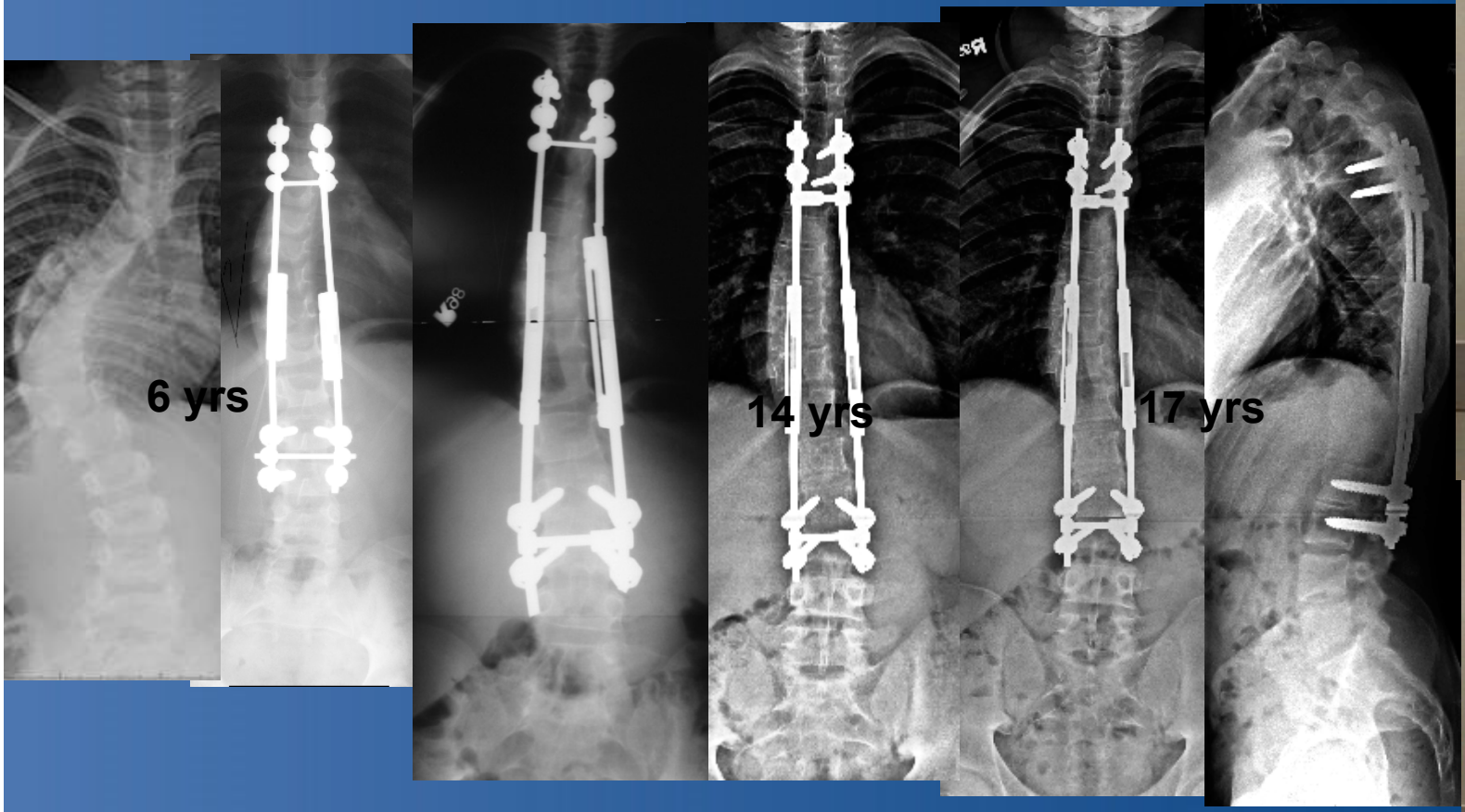
Age 6 Age 14 Age 15 Age 16





Construct has been stable for 5 yrs at skeletal maturity.
No final fusion has been performed

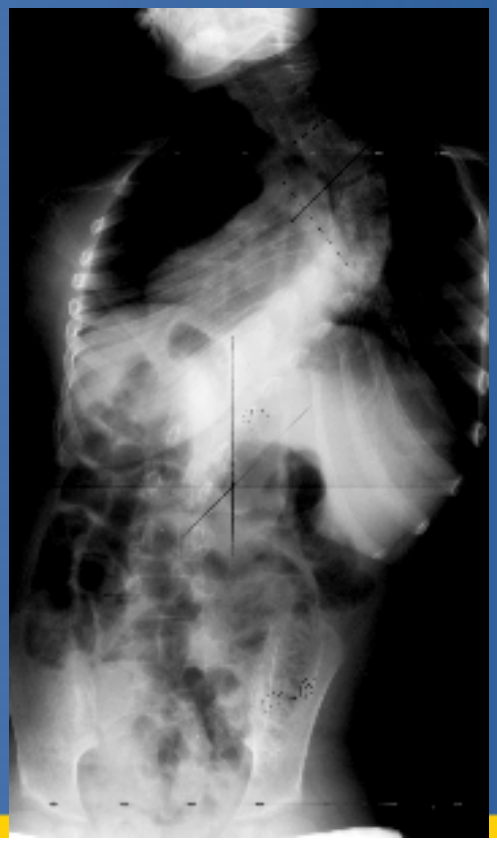
Another example -IIS

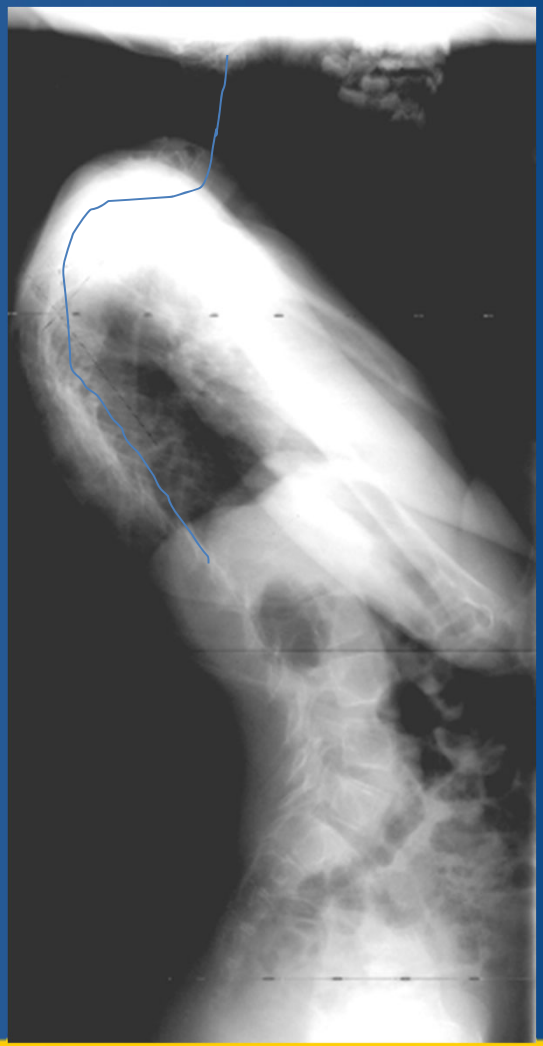


No Final Fusion planned

Example: 8 yo congenital myopathy

- 85° kyphosis C5-T5
- 87° scoliosis T1-T10





In Tx

Follow up: Myopathy -age 12

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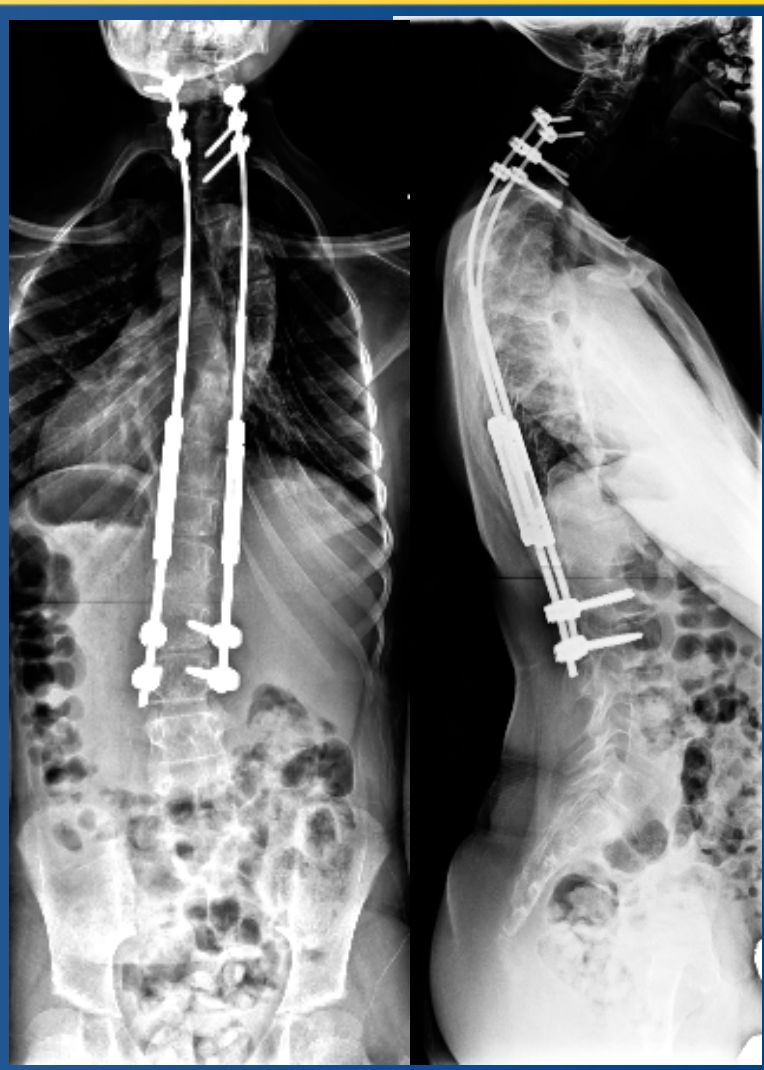
No fusion performed
4 yr follow up

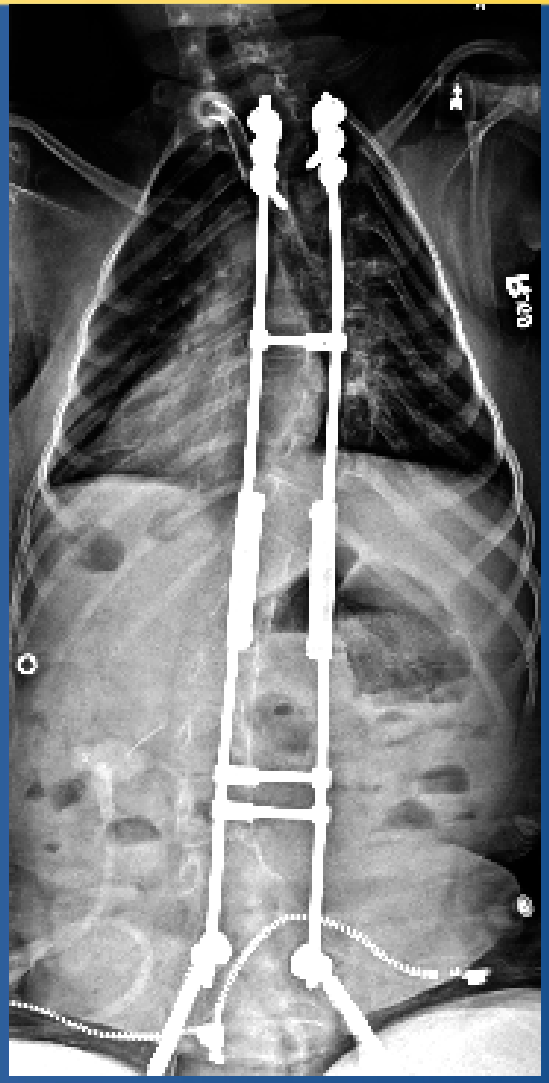


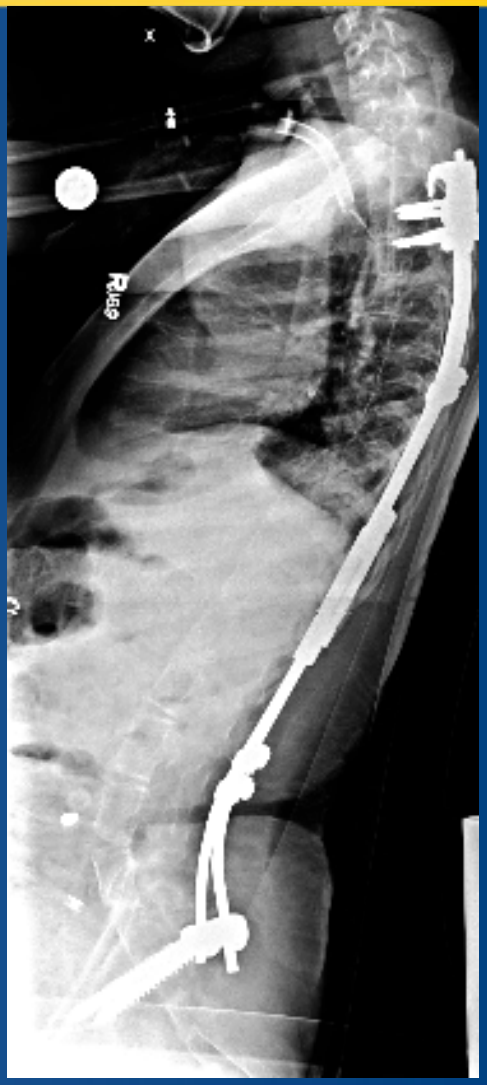
SMA 7 yrs old

- preop

SMA 5 yrs post-op

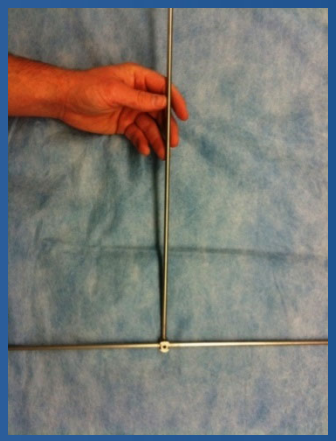
- 5 distractions
- Now age 17
- Risser 5
- End game:
  - No surg x 4 yrs





Implications-
"*begin with end in mind* "

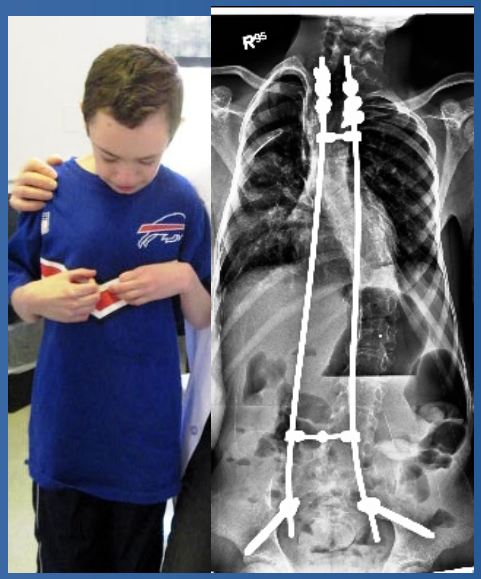
- Plan each lengthening to maintain balance
- Consider coronal and sagittal planes
- Check pelvic obliquity with T-square
  - If indicated



Challenges to the plan

- Infection
- Unacceptable deformity

10 yrs



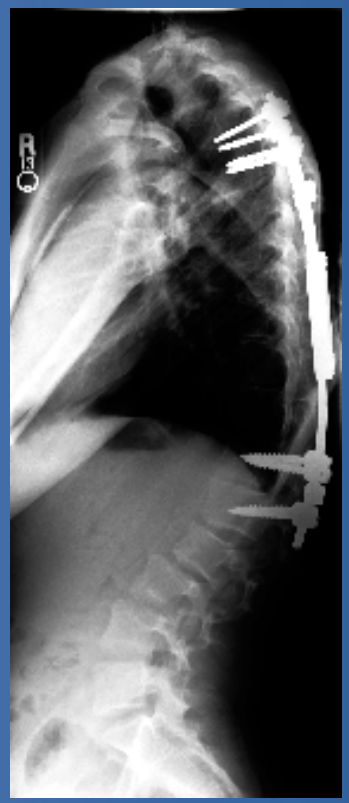
Infection

Implant and ankylosis work together

- Implant removal – increase in coronal and sagittal plane
  - *Shah 2010*
  - *Alpert 2014*

Final fusion

- If deformity correction not satisfactory



Other types of implants

- Luque-Trolley
- VEPTR
- MCGR

- Do different mechanics and lengthening patterns have same implications?

Summary:

- Final Fusion if:
  - Inadequate alignment
  - Symptomatic pseudarthrosis
    - But Large procedure, blood loss
- Implant removal if:
  - Infection
    - May need another procedure later
- Observation if
  - Good balance, no problems
  - Needs validation over time

Thank you