Masters Technique
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Boston

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Center for Thoracic Insufficiency Syndrome

EOS: Fuse Early or Fuse Late?

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Disclosures

- Grant Support
  - NORD
  - NIH R21
- Medical Advisory Committee member National Organization of Rare Disorders (NORD)
- Advocate for inventors/companies trying to develop safe and effective devices for children

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The usual debate assignment for Campbell

Early non-fusion intervention, with late fusion

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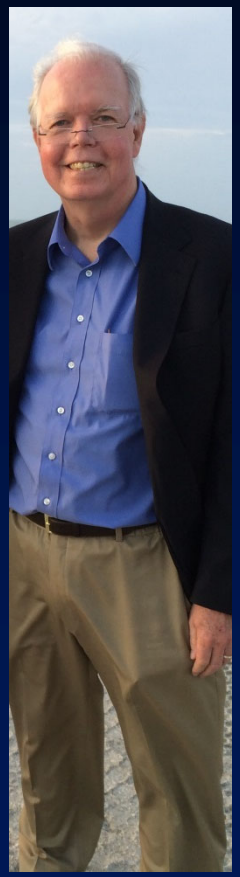
Debating Myself

Early Fusion

Late fusion



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Data? Not much out there

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Rules for Timing of Fusion?

- Evidence Based (Data)
  - Limited Literature
- Opinion Based
  - Akbarnia: trust his opinion, others not so sure
- Principle Based
  - Campbell: May be unorthodox, but solid logic behind it

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What's Early, what's Late, what's Just Right?

- Trained in the 1970's -1980's
  - Irrelevant: Curve progression= fusion
- Trained in the 1990's
  - Doubt begins about fusion before age 10
- Trained in the 2000's
  - Early fusion (infancy) should definitely be avoided, ages 3-10 probably should be avoided

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What's the "Early" in Early Onset Scoliosis

- < 5 years of age
- < 10 years of age

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When is fusion early?

- Age 6 years or younger
  - Kawakami, 2015
- Under age 10 years
  - Conventional wisdom

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Early Fusion

- Pros
  - Definitive procedure
  - Avoids repetitive procedures
- Cons
  - Lose growth in height of spine
  - Pulmonary outcome?

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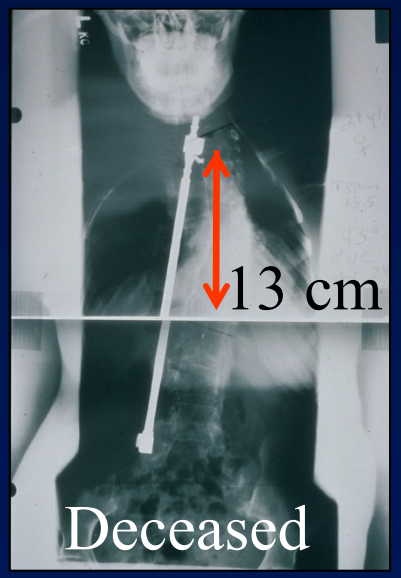
Early Fusion PFTs

- 28 pts, early thoracic fusion before the age 9 years, PFTs at a minimum of 5 years f/u, compared to age matched controls
- Average age at surgery was 3.3 years and at follow up was 14.6 years.
- Thoracic spinal height FVC < 50%

< 18 cm.	63% pts
18 to 22 cm	25% pts
22 cm to normal	0% pts

(normal 28 cm males, 26 cm females)



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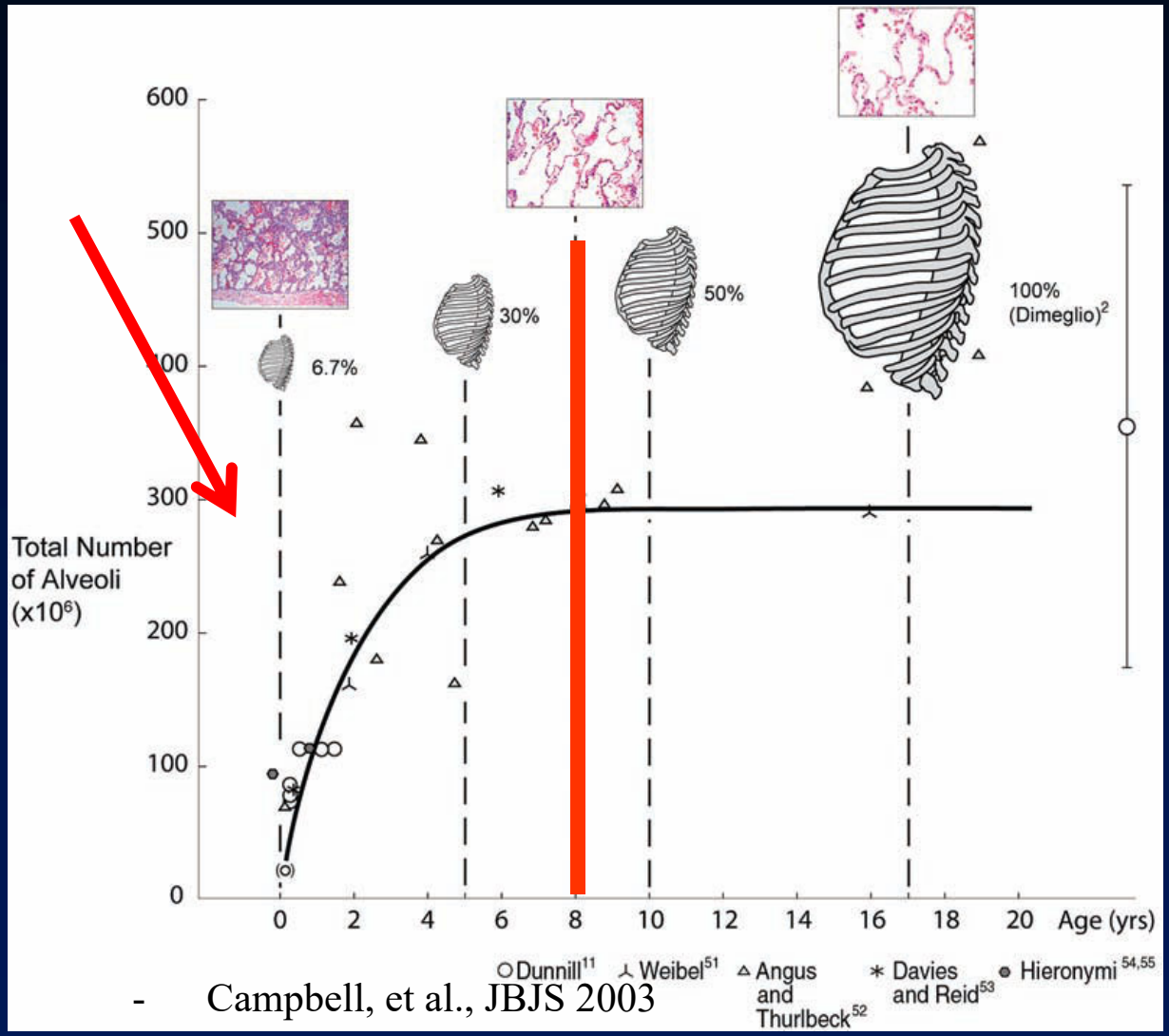
-Karol, et al., Journal of Bone & Joint Surgery Am 2008, 90: 1272-1281.

Thoracic volume increase with growth is important



- Campbell, et al., JBJS 2003

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When is fusion late ?

- After age 10 years

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Late Fusion

- Pros
  - Definitive procedure
- Cons
  - Doesn’t seem a lot

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FINAL FUSION AFTER GROWING ROD TREATMENT FOR EARLY ONSET SCOLIOSIS: IS IT REALLY FINAL?

-Poe-Kochert, C. et al.

100 GR pts that went on to fusion

- Age at fusion 12.2 yrs (8.5-18.7yrs)
  - F/U 4.3 yrs (2-11.2 yrs)
- 22 % of pts needed more surgery
  - Time from fusion to reoperation
    - 1.8 yrs (11d-7.4 yrs)

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FINAL FUSION AFTER GROWING ROD TREATMENT FOR EARLY ONSET SCOLIOSIS: IS IT REALLY FINAL?

-Poe-Kochert, C. et al.

39 complications

- 9% infection
- 6% instrumentation failure
- 5% painful instrumentation
- 3% coronal deformity
- Pseudoarthrosis, sagittal decompensation, neurosurgical

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What time for fusion is Just Right ?

- The point in time when the advantages of irreversible stabilization of the spine outweigh the disadvantages

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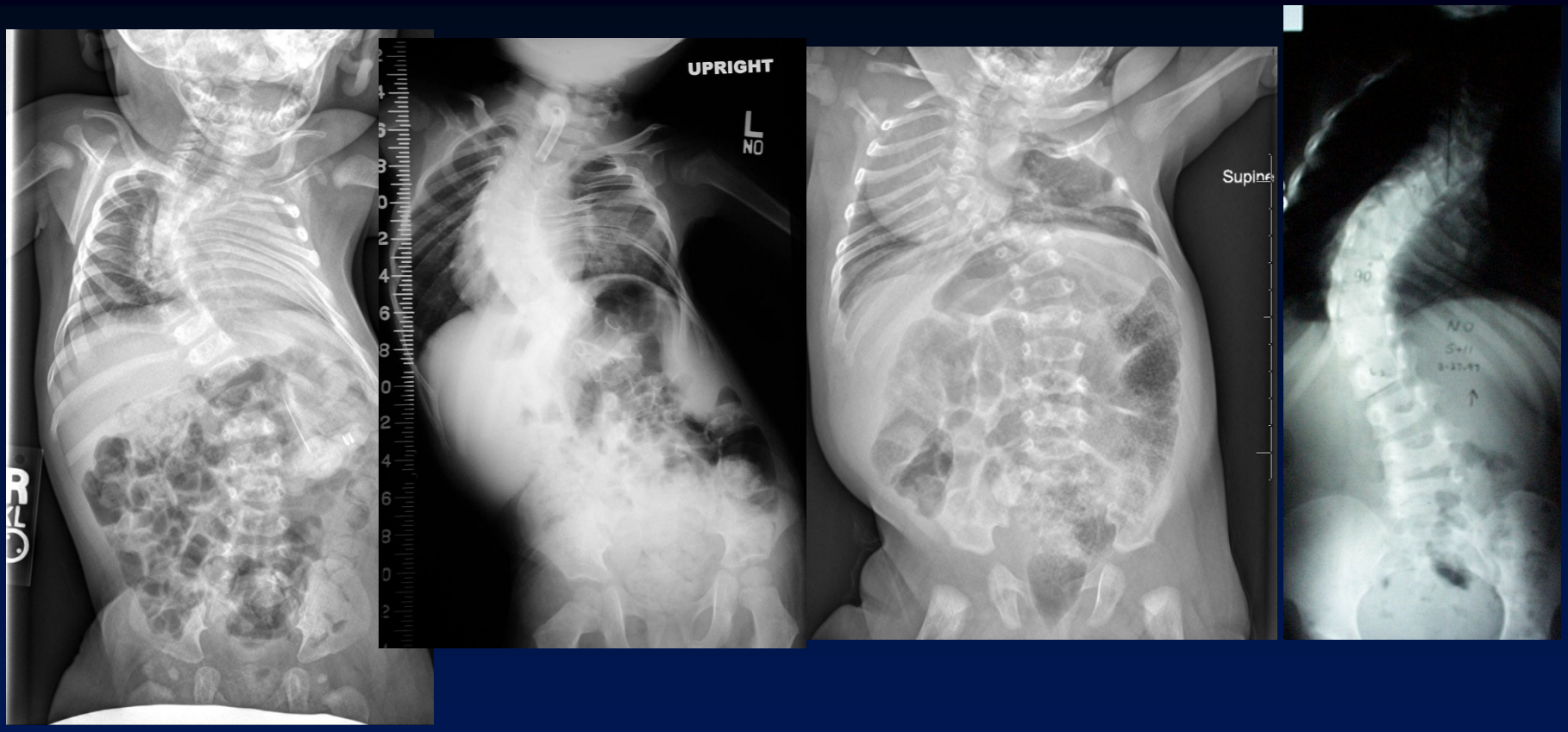
Personalized Medicine



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SMA II/III: natural history and fusion FVC

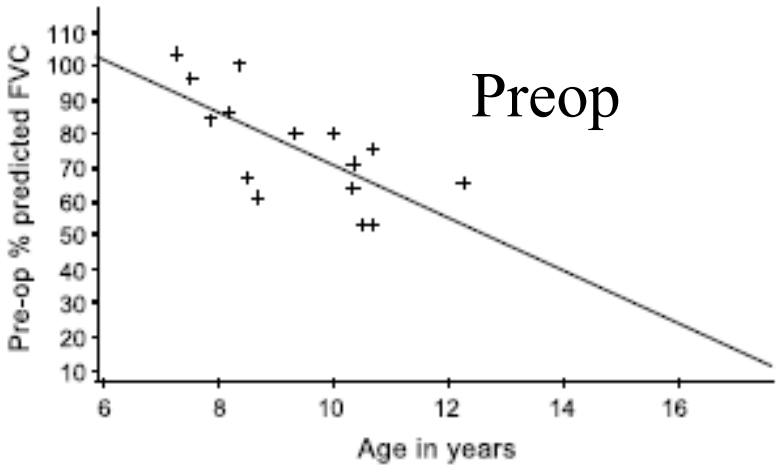

Fig. 1 Pre-operative percentage of predicted forced vital capacity (FVC) versus age in years.

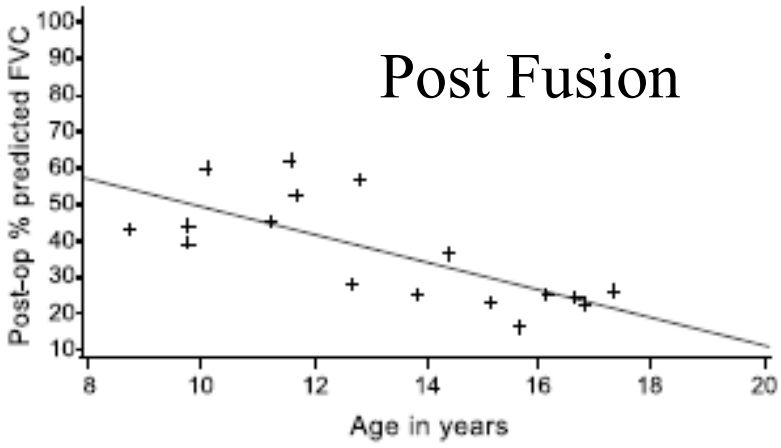

Fig. 2 Post-operative percentage of predicted forced vital capacity (FVC) versus age in years.

-Chng, et al, J Ped Child Health, 2003

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Treatment Complications:

- A catastrophe?
- Or something fixable?

Complications

- Compare the complications of treatment
- To the complications of natural history

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Complications

VP Shunt Treatment Complications

- Infections in 3-27%
- Failure 70% first year
- 5% annually afterwards
- Pretty dismal

Natural History Complications

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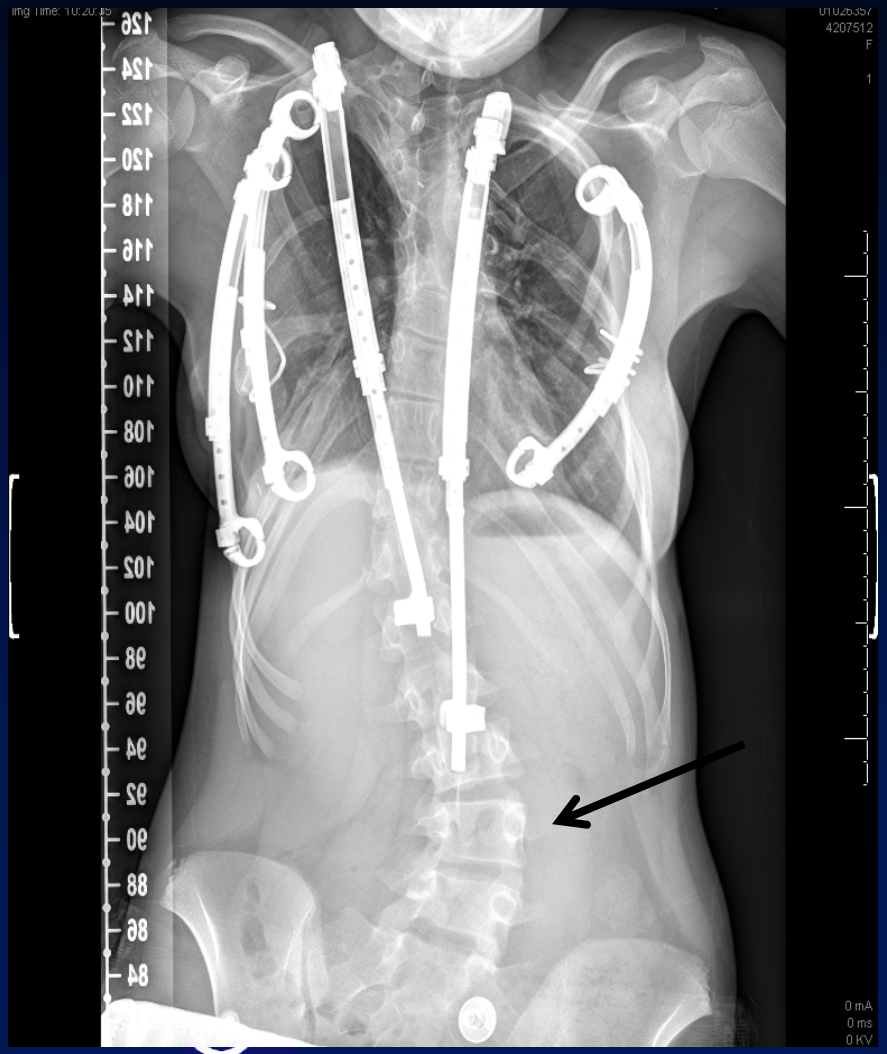
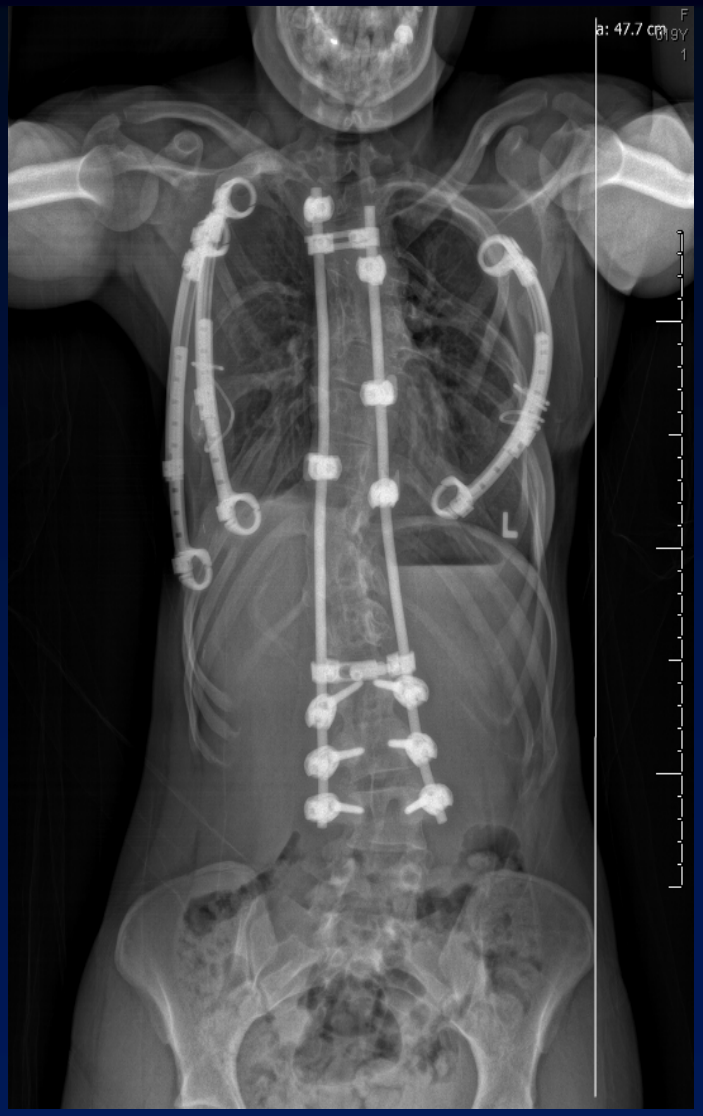
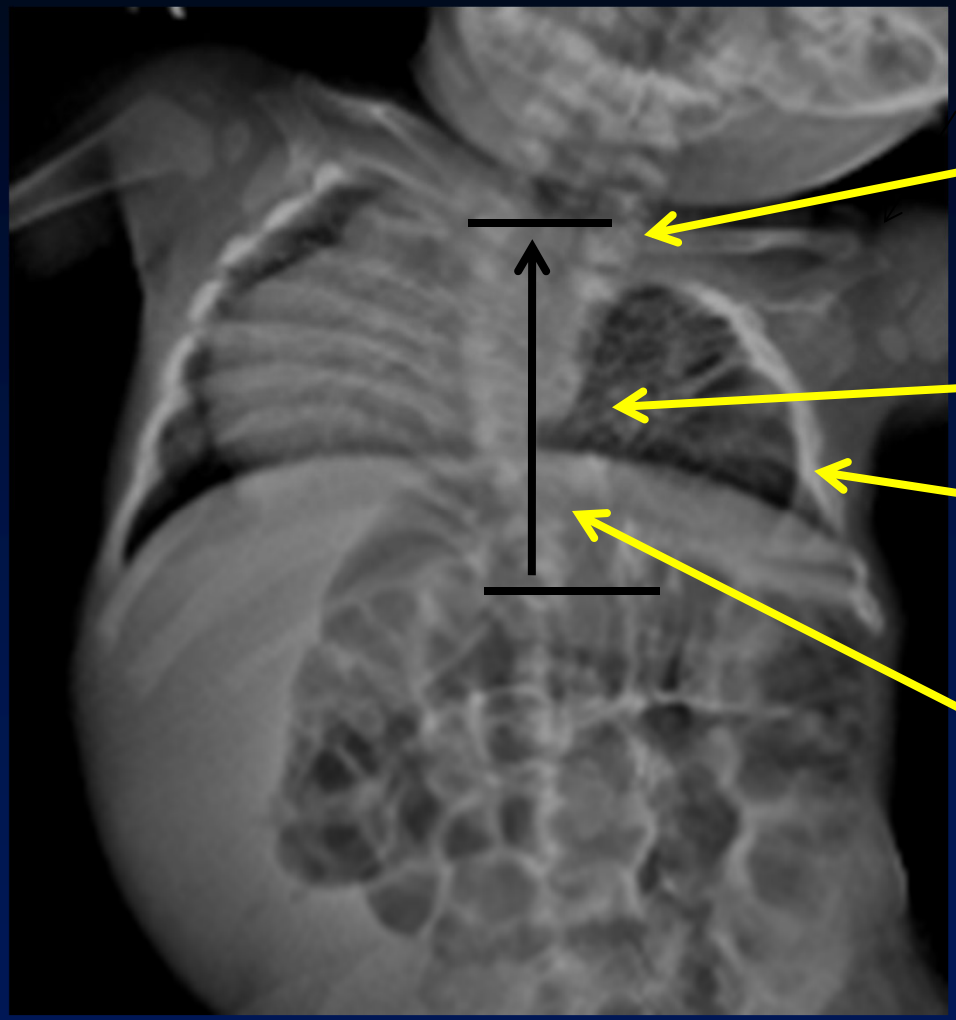
An Easy One





A Tough One



Thoracic Spinal height
60% normal

Congenital curve

Fused rib cage
will grow poorly

Symptomatic
spinal segmental
dysgenesis

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- -Limited posterior T/L fusion
- -Concave VEPTR exp thoracoplasty
- -VEPTR Eiffel Tower

Principle based approach to fusion timing

Customize the approach

- Casting/bracing/growth sparing instrumentation as long as possible during growth, especially if the thorax is small and growing poorly
- Consider fusion
  - Early: To cut your losses
  - Late: Once thoracic spinal length is maximum

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Thank You!