



JOHNS HOPKINS
MEDICINE

Strategies at the End of Growth

Paul Sponseller

4:31-4:37
ICEOS 2016



Background

- “Final fusion” is a common endpoint to growing rod treatment (GR) for early onset scoliosis
- Recent literature suggests that autofusion with growing rods is common, which can limit further correction at definitive fusion (Cahill 2010)



Implications for End of Growth

If final fusion performed, there may be:

- new scars

- Stiff spine

- Obscured landmarks

- Implants needing removal

- drifted anchors

- Focal iatrogenic changes

Fusion at “graduation”

- -Many required osteotomies
- Most gained <50% correction

Growing-Rod Graduates: Lessons Learned from Ninety-nine Patients Who Completed Lengthening

John M. Flynn, MD, Lauren A. Tomlinson, BS, Jeff Pawelek, BS, George H. Thompson, MD, Richard McCarthy, MD, Behrooz A. Akbarnia, MD, and the Growing Spine Study Group

Investigation performed at The Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, and the San Diego Center for Spinal Disorders, La Jolla, California

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Final Fusion After Growing-Rod Treatment for Early Onset Scoliosis

Is It Really Final?

Connie Poe-Kochert, RN, CNP, Claire Shannon, MD, Jeff B. Pawelek, BS, George H. Thompson, MD, Christina K. Hardesty, MD, David S. Marks, FRCS, Behrooz A. Akbarnia, MD, Richard E. McCarthy, MD, and John B. Emans, MD

20% reop!

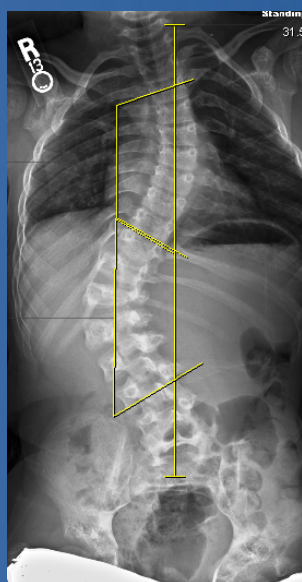
3 Scenarios/ Strategies at maturity



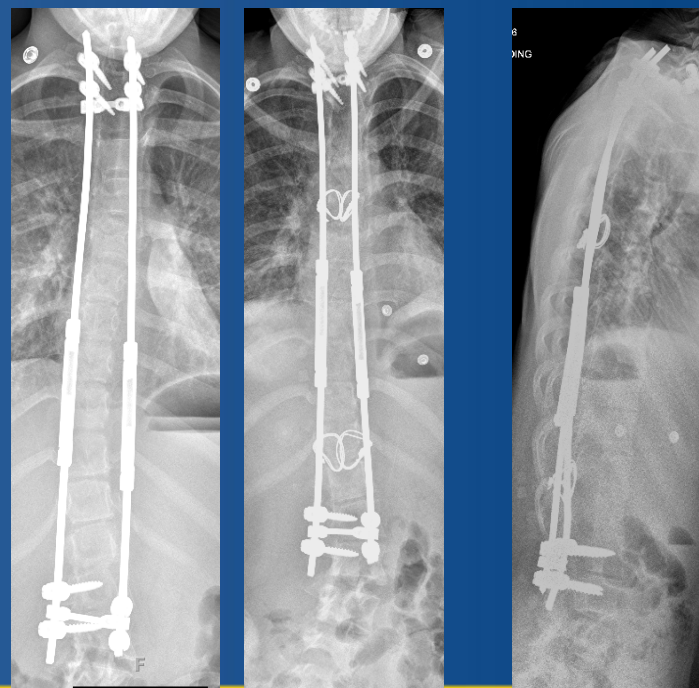
- 1. Straight, not stiff
- 2. Not Straight (unacceptable/unbalanced)
- 3. Straight and stiff

1. Straight but not Stiff

- Recent rod breakage
- Laxity at last distraction
- Connective tissue disorder
- Added wires + graft



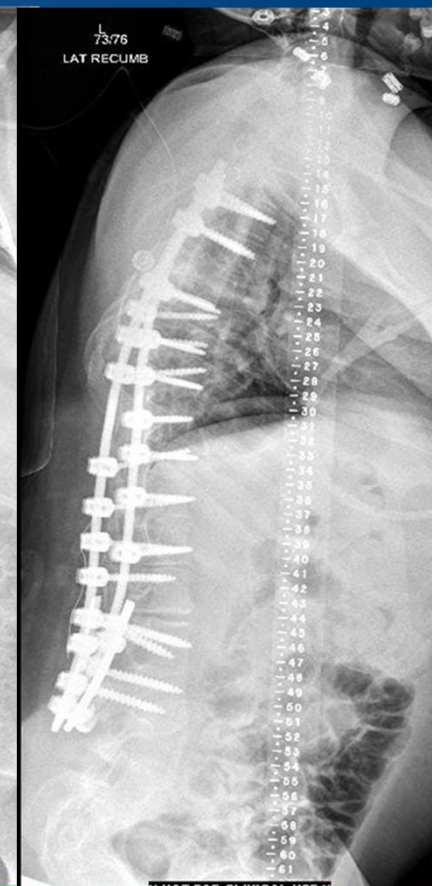
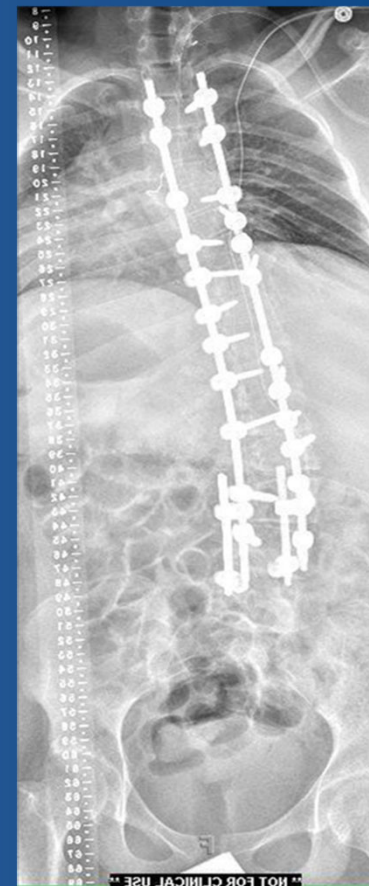
→
7 yrs



2. Not Straight (Unacceptable)

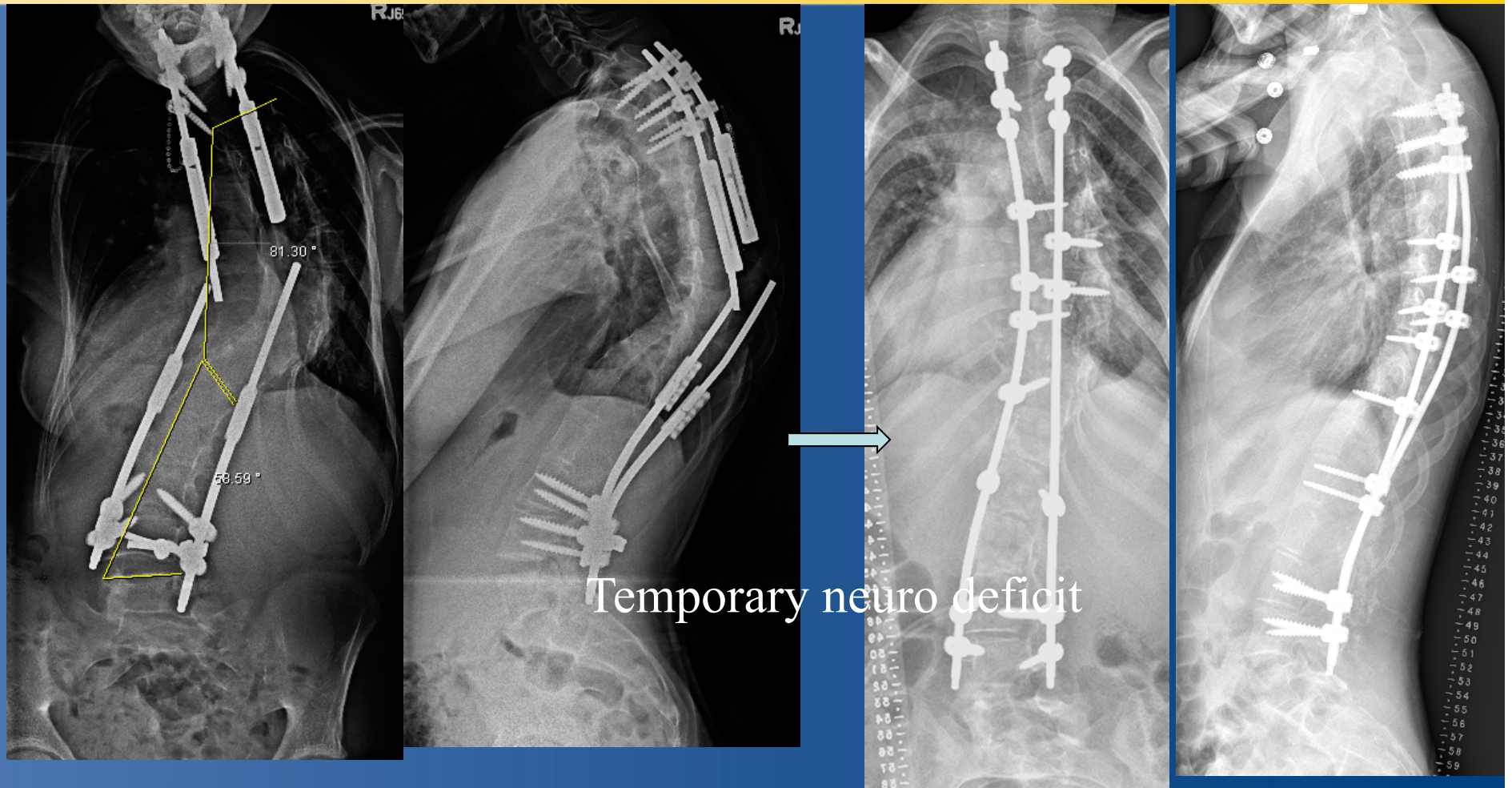
- Osteotomies needed
- Discectomy if extreme/stiff
- VCR if high DAR
- Increased EBL
- RE-check anchors; don't assume screws are safe

15 y.o. IIS



Temporary neuro deficit

15 y.o. LDS



3. Straight and Stiff

- -No final fusion is an option

No Final Fusion

- Final fusion may not be necessary for a subset of EOS patients who have reached skeletal maturity with good alignment
 - Risser 3-4
 - No rod fractures in prior 2 years
 - “Diminishing returns”; <1 cm at last distraction

GSSG study

- Patients who reached skeletal maturity.
- 137 patients had final fusion (FF)
- 30 patients did not have a final fusion surgery (NF)
- Ages and diagnoses comparable

Results:

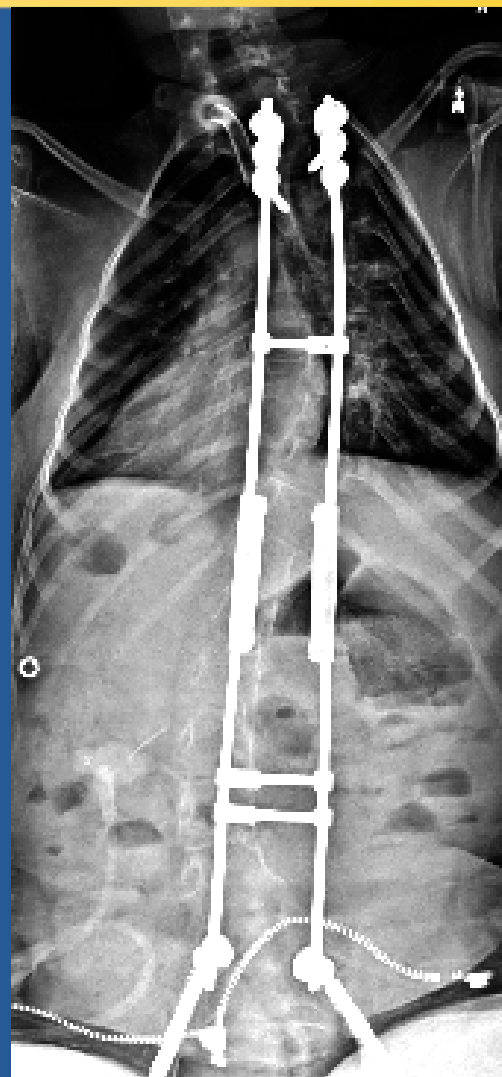
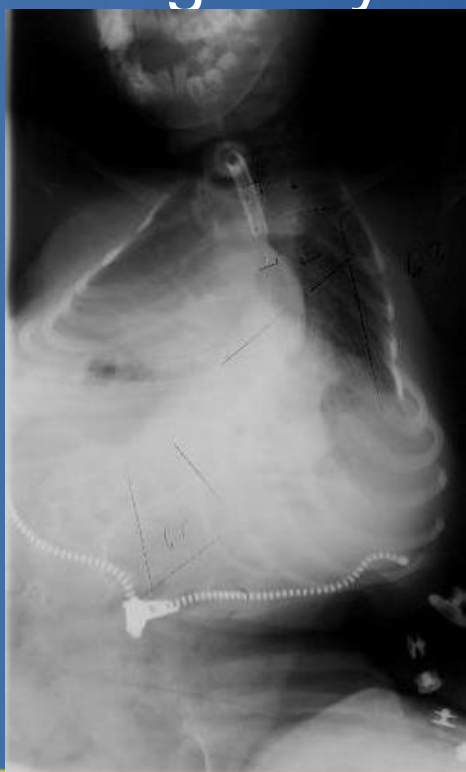
Radiographic Outcomes

- **Correction of major curve**
 - ☐ NF group: 48% correction (from 79 to 41)
 - ☐ FF group: 38% correction (from 74 to 46)
 - ☐ **No significant difference ($P=0.31$)**

- **Increase in trunk height (T1-S1 length)**
 - ☐ NF group: 31% (29.2 cm to 38.1 cm)
 - ☐ FF group, 35% (26.8 cm to 36.1 cm)
 - ☐ **No significant difference ($P=0.64$)**

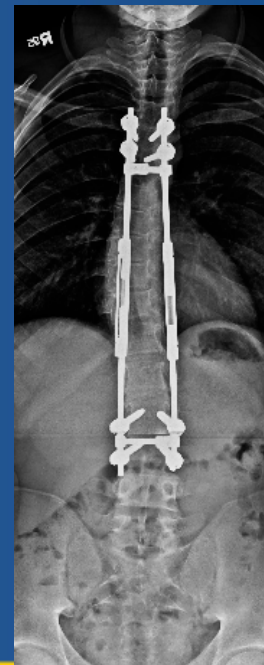
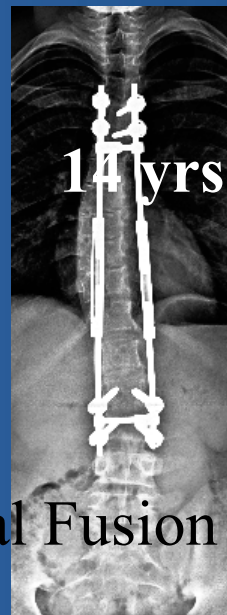
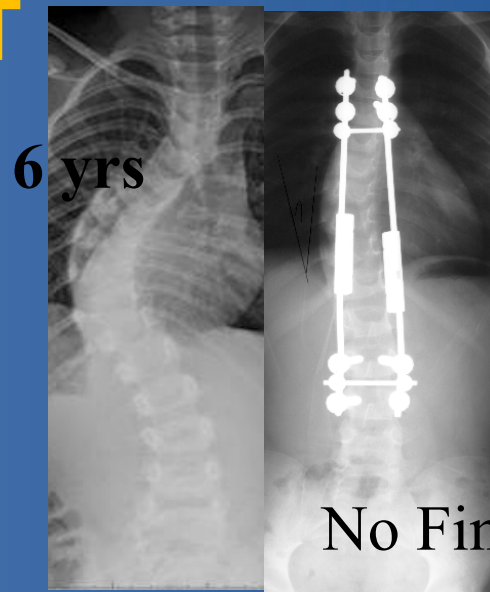
End of the Saga

- SMA
- Now age 17
 - No surg x 4 yrs



NF Follow up

- 26 /30 patients had rods retained
 - 4 rods removed due to infection.
- In NF group, **no rod fractures** and no clinical evidence of **pseudarthrosis**
- **No CT**



Implant Removal

- High rate of decompensation
- Worsened balance, function
 - Yazici ICEOS 2016

Growth-Friendly surgery

- Can be an incremental process
- Preventing and managing deformities in safe steps
- Avoiding need for higher-risk surgery

Implications

- Need to focus not only on minimizing procedures, but:
- Not allowing deformity to progress to need for riskier surgery
 - Progressive 2-plane deformity
 - Uncontrolled junctional deformity

Conclusion

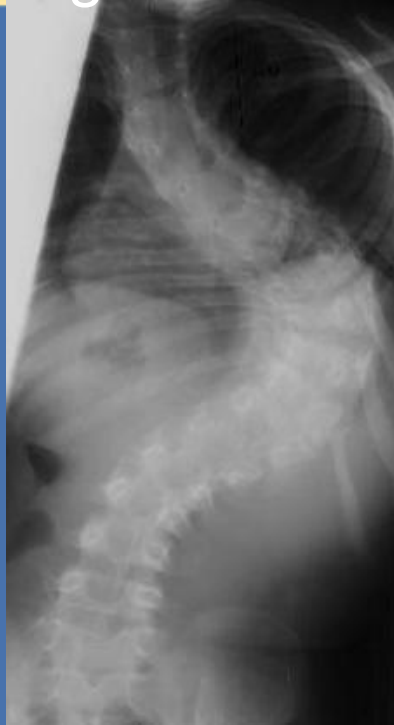
- Consider the End-Game at all points
- Intervene with progressive deformity
- “No final fusion” at maturity is a viable option for patients with GR who have satisfactory final alignment
- Further followup of non-fusion patients required to better understand long term implications
- Implications for Shilla, MAGEC to be seen

Thank you



A Growing Rod Saga

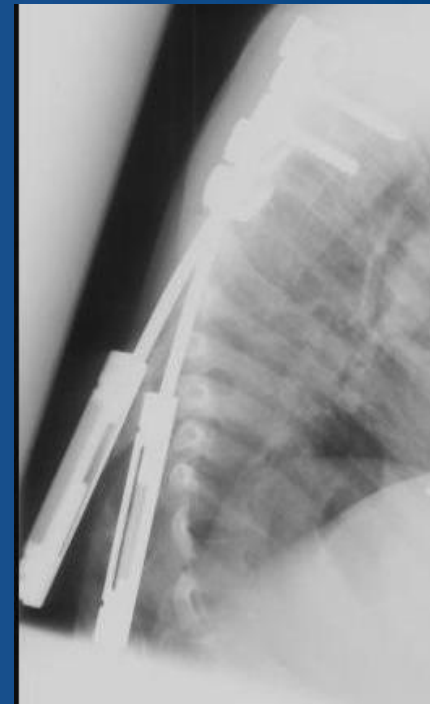
Age 6



Age 8



Age 9



EOIS 95° at age 6. Rods fractured multiple times

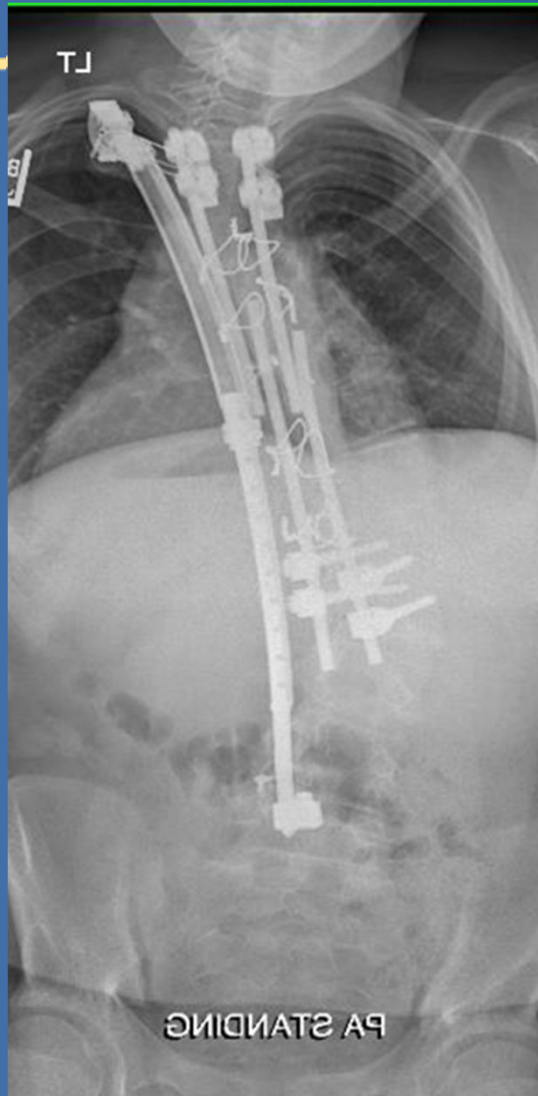
Results:

Surgical Characteristics

Also comparable in:

- **Number of lengthening** procedures: 5.4 ± 3.2 (NF) vs. 5.7 ± 3.9 (FF), $P=0.69$
- Overall **treatment time** (from index to last procedure): 5.7 ± 2.5 years (NF) vs. 8.9 ± 11.2 years (FF), $P=0.12$

2013



Methods

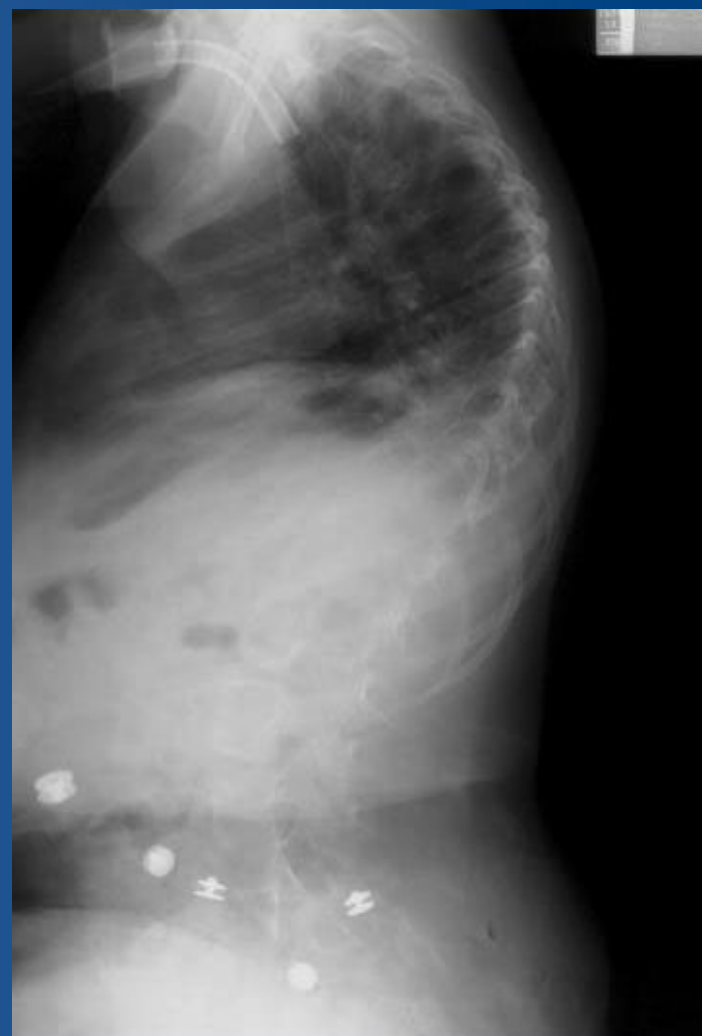
Groups comparable in:

- **Age** at start: 7.1 ± 2.0 years (NF group) vs. 6.1 ± 3.4 years (FF group), $P=0.13$
 - 6 yrs in treatment
- **Diagnoses (C-EOS)** ($p=0.84$)

	NF	FF
Idiopathic Scoliosis	7	33
NM Deformity	10	48
Congenital Deformity	2	15
Genetic or Syndromic Deformity	11	41
TOTAL	30	137

SMA 7 yrs old

- preop



End of the saga

Age 6

Age 14

Age 15

Age 18



Construct stable for 4 yrs at maturity. No final fusion planned