



# Pelvic Fixation Debate: SAI vs Hooks

Paul D Sponseller MD

November 15, 2018

7:47-7:51

June 5, 2019

# Disclosures

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

# Michael G Vitale, MD

- IPOS Chair
- Founder, Spine Safety Summit
- Director, CSSG
- Vice-President, POSNA
- Co-Director, Columbia Pediatric Complex Spine Fellowship



KINS  
E

# MGV

- Oenophile
- Restaurateur
  - Spina, NYC



# Michael G Vitale MD celebrity look-alikes?



# The Benefits of Screws:

- 3-D control
- Durability
  - Stay where you put them!
- Minimal invasiveness
  - Easy in, easy out

# The questions

- Will they affect Growth?
- Will they impair ambulation

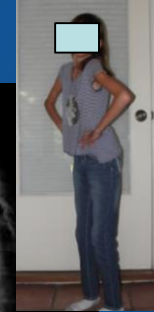
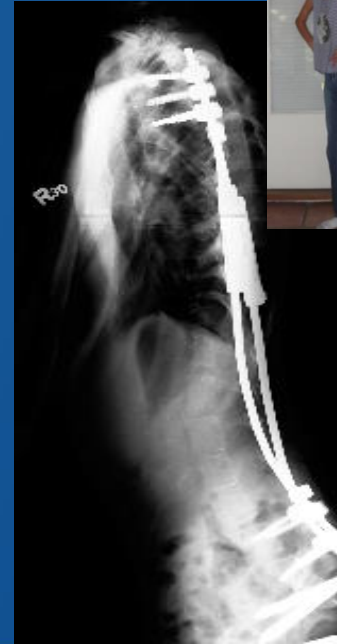
# Limitations of S-hooks

- Not rigid fixation
- Limited sagittal control
- Can only distract
  - differentially
- Drift
- Difficult removal



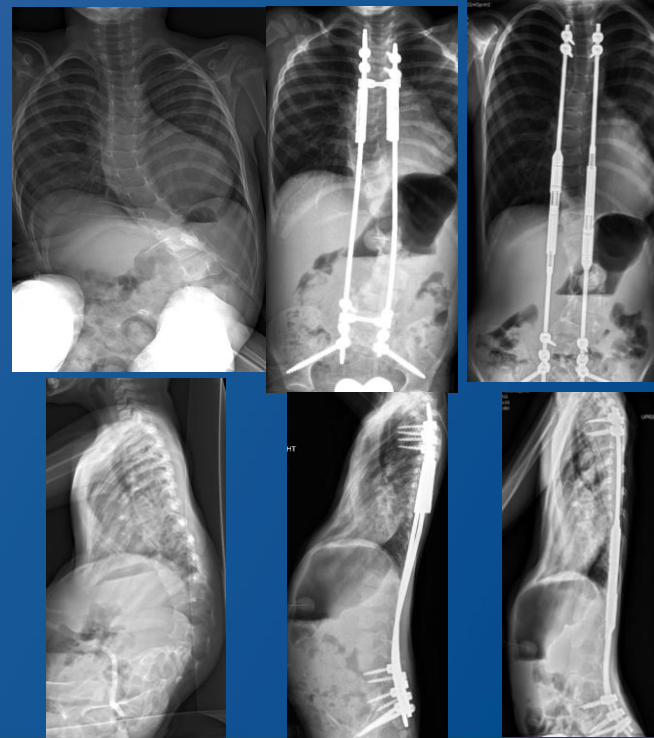
# S hooks in ambulatory patient

- Forward lean progresses



# Infantile Marfan Syndrome

- 2.5 yr old
- 3 heart valves



# Advantages of Screws in Pelvis

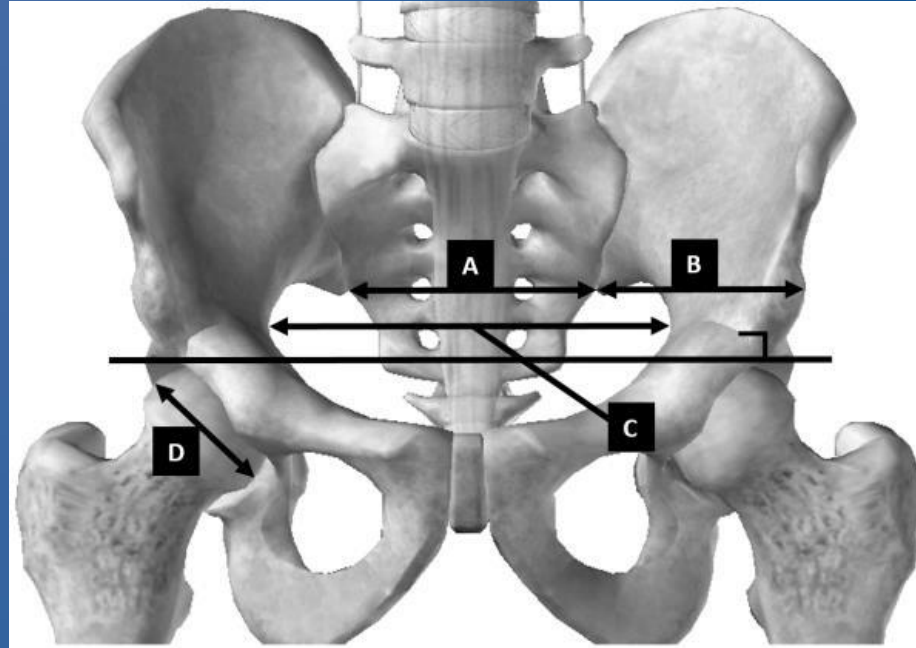
- Strongest distal anchors
- Foundation for rotational control
- Better sagittal control
- Better coronal control
- Better growth control

# Indications for Pelvic Fixation



- Mostly Neuromuscular
  - CP
  - SMA
- Syndromic
  - Marfan
  - LDS

# Parameters of pelvic Growth



# Results: Growth Disturbances

	Iliac Fixation (n=4)	SAI Fixation (n=15)	p-value
Mean growth ratio of sacral width*	0.96 +/- 0.04	0.98 +/- 0.09	0.538
Mean growth ratio of iliac width*	0.96 +/- 0.08	0.99 +/- 0.08	0.844
Mean growth ratio of pelvic inlet*	0.99 +/- 0.06	0.96 +/- 0.05	0.744
Mean, summative percent change in fixation angulation**	90 +/- 30	90 +/- 40	0.467

\*normalized to femoral head diameter; ratio of post-operative to pre-operative growth.

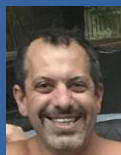
\*\*normalized to pelvic inlet; summative of left and right pelvic fixation

## SRS 2017:

Don't You Wish You Had **Fused** Fixed to the Pelvis the First Time? **Paper 94 Nielsen, Vitale.... Skaggs**

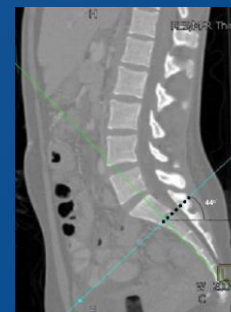
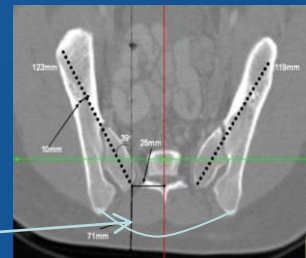
### Take Home Message:

- Advise Families if a second operation to the pelvis is needed
  - it will be as “big” as the first surgery
    - OR time
    - EBL
  - likely end up with less correction



# Sacral Alar-Iliac (SAI) Fixation

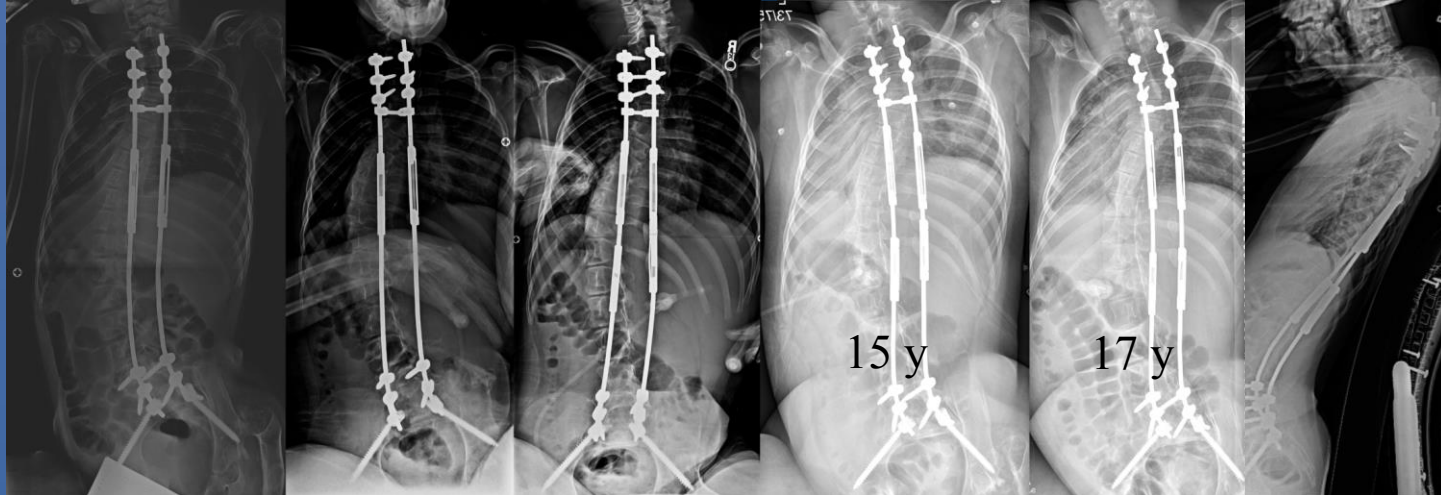
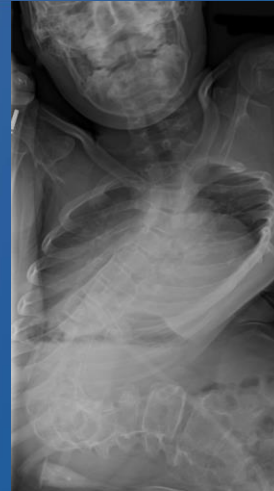
- Iliac Fixation
  - Starting on sacral ala
  - Deeper, within muscle envelope
  - In line with other spinal anchors
  - Ideal for pelvic obliquity correction mechanics
  - Good platform for de-rotation





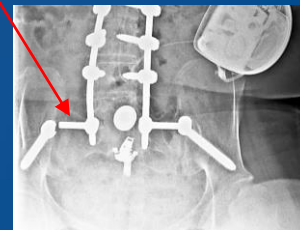
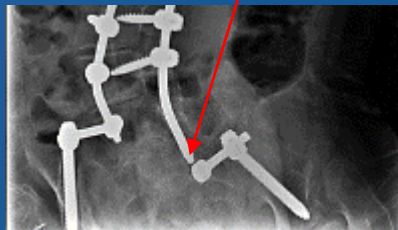
# Neuromuscular EOS

- 7 yrs old
- Now 17
- No Final Fusion



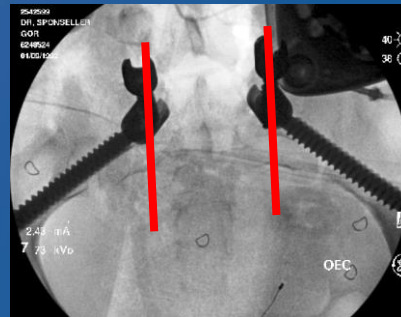
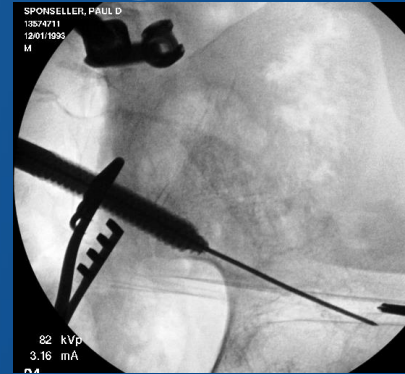
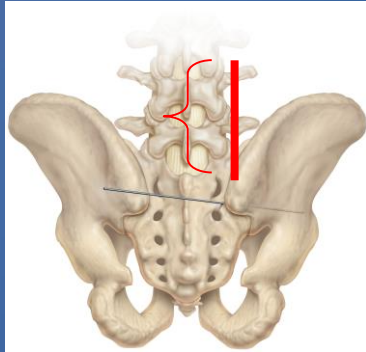
# 5 yr Durability: Pelvic Implant Complications

- SAI Group
  - 0% pelvic implant – related complications
- Iliac Screws Group (14%)
  - 6 Cases:
    - 2 Prominent Screws (not needing reop)
    - 3 disconnections (1 not reop, 2 reop)
    - 1 loose iliac screw that needed removal



# Technique

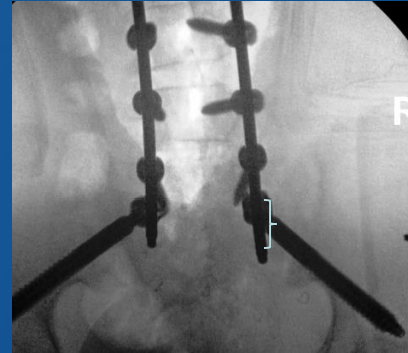
- 6 cm incision
- S1 screws first
- Works for other anchors
  - In midline



Baclofen  
pump  
intact

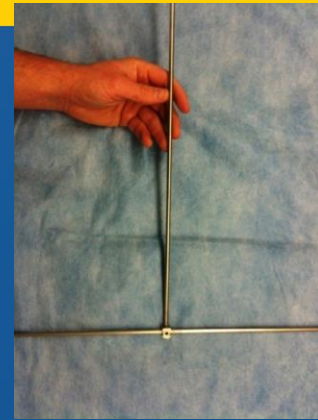
# Standard Correction

- Lock rods in SAI screws distally
  - Leave long ~2-3 cm against sacrum
  - For compression/distraction
- S1 and L4/5
  - Minimizes stress on Screws and caps



# Goals

- To correct pelvic obliquity
  - SAI screws
    - compress and distract pelvis



# Summary

- S-hooks have limited sagittal control
  - Mainly differentially distract
- Drift because of limited transverse profile
- Difficult extraction
- Problems better addressed with screws

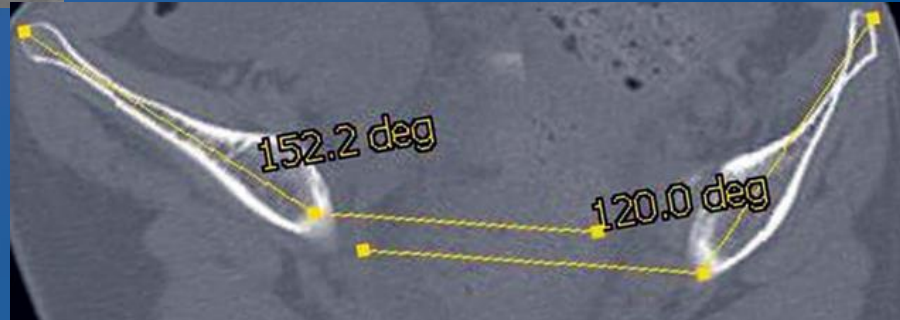
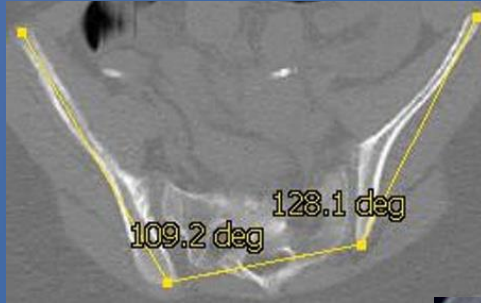


# Thank you



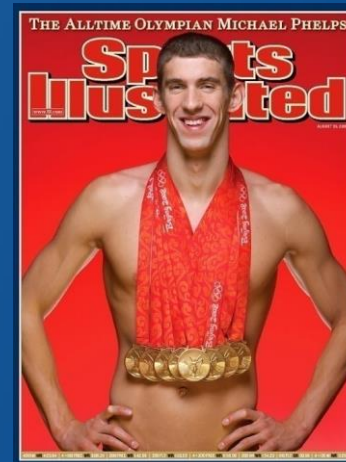
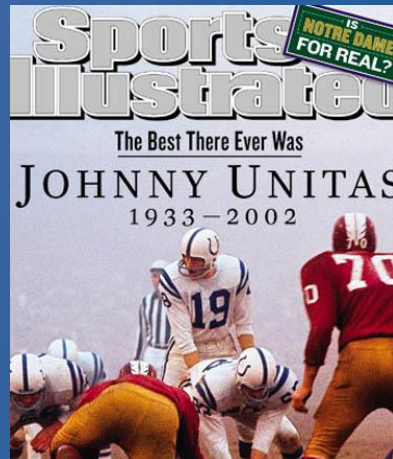
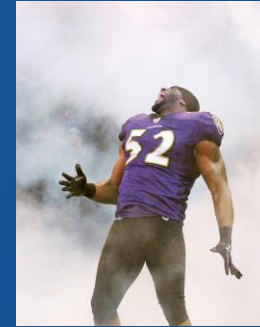


# Transverse-plane pelvic asymmetry JOHNS HOPKINS MEDICINE

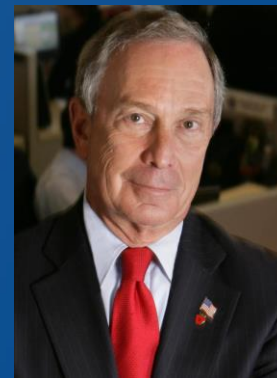
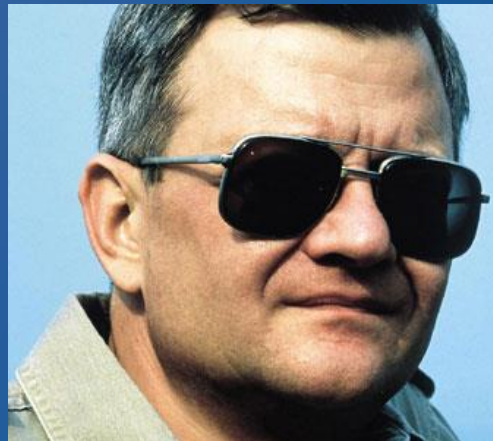
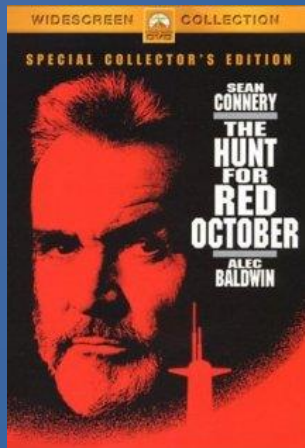




# Baltimore Heroes – sports

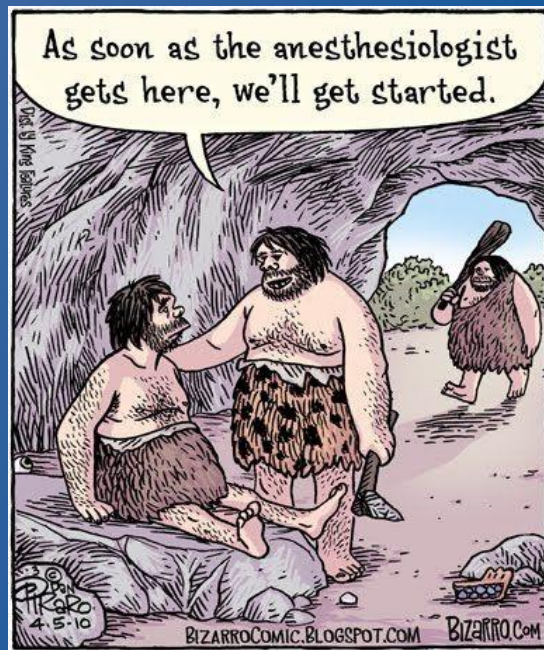


# Baltimore Heroes (?)



# Thank you





# Russell A. Hibbs

Spine  
HISTORICAL PERSPECTIVE

Dr. Russell A. Hibbs  
*Pioneer of Spinal Fusion*


Daniel J. Miller, MD, and Michael G. Vitale, MD, MPH

*To the legitimate orthopaedic surgeon therefore, operative work takes a secondary or minor position, just as the mechanical part takes by far the more important place; and in true orthopaedic surgery, operative work, per se, has no real status.*

*"Dr. Newton M. Shaffer in a report to the trustees of the New York Orthopaedic Hospital (1897):"*

Spinal deformity was a source of significant morbidity during the industrial revolution, particularly in urban areas where tuberculosis (TB) and poliomyelitis were endemic.<sup>2</sup> Although surgical procedures to stabilize the spine date back to Berthold Hadra in 1891, management of spinal deformity at the turn of the 20th century consisted primarily of long-term manipulation and immobilization via casting or bracing.<sup>3,4</sup> The purpose of this publication is to review the contribution of Dr. Russell Hibbs toward the development of an operative technique of spinal fusion and to emphasize the how this technique helped change the paradigm for the treatment of spinal deformity.

**BIOGRAPHY**  
Dr. Russell Hibbs (Figure 1) was born in Birdsville, Kentucky, in 1869.<sup>1</sup> The youngest of 10 children, Dr. Hibbs attended college at Vanderbilt University and graduated from the University of Louisville School of Medicine in 1890. After practicing



*Russell A. Hibbs*

Figure 1. Russell A. Hibbs (1869–1932). Photograph by Doris Ullmann. From The Faculty of the College of Physicians and Surgeons Columbia University in the City of New York: Twenty-Four Portraits (New York: Paul B. Hoeber, 1919), courtesy Archives & Special Collections, Columbia University Health Sciences Library.

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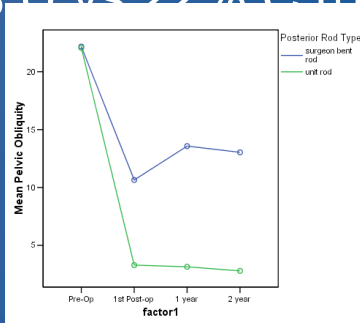
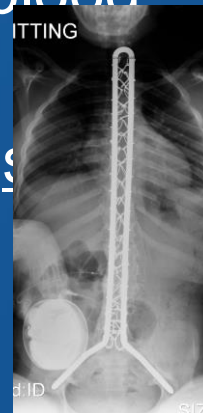


# Advantages of Fixation *Short of Pelvis*

- Increased mobility (if it works)
- Lower infection rate?
- Fewer CSF risks
  - Sacrum often thin or bifid
  - Dural ectasia occurs distally in syndromes

# Retrospective Comparison of Unit Rods vs Screws

- 157 CP patients
- Unit Rod pts required more blood
  - 1010 vs 650cc
- Final major Cobb correction
- **Pelvic obliquity correction**
  - 74% U vs 22% S (p=0.002)

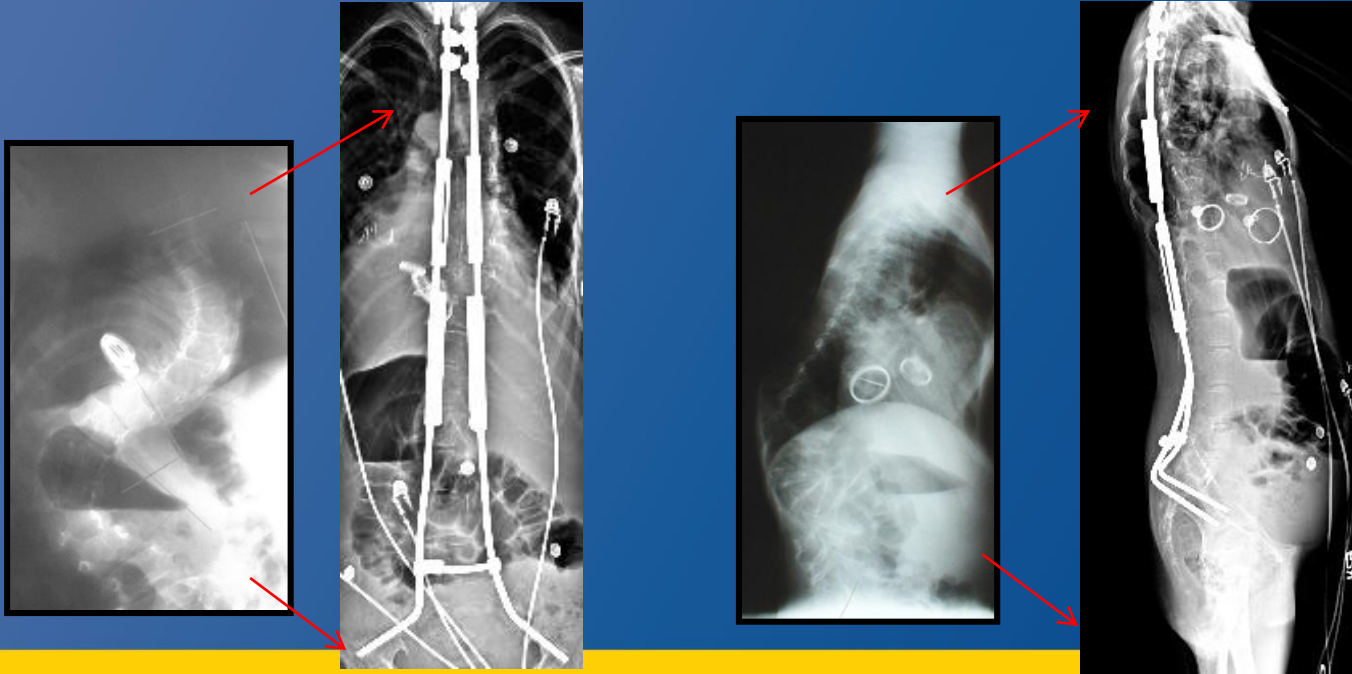


# Early Onset Scoliosis

- Requiring surgery before age 9
- Fusion arrests trunk growth
- Solution: Growing rods



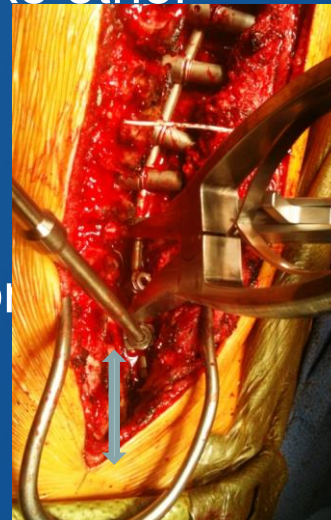
JOHNS HOPKINS  
MEDICINE





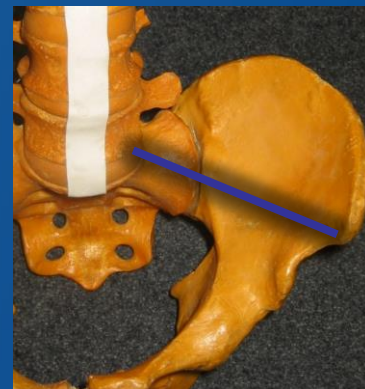
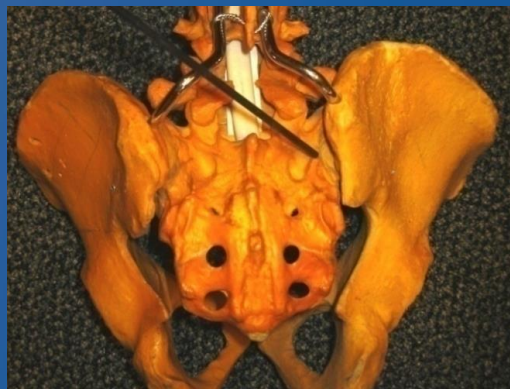
# Technique- Finishing

- Pelvic anchors can be manipulated like other spinal anchors
- Allows compression and distraction
  - improves pelvic obliquity correction
  - and derotation of TL spine
- “T-square of Tolo”
  - *JPO 2013*



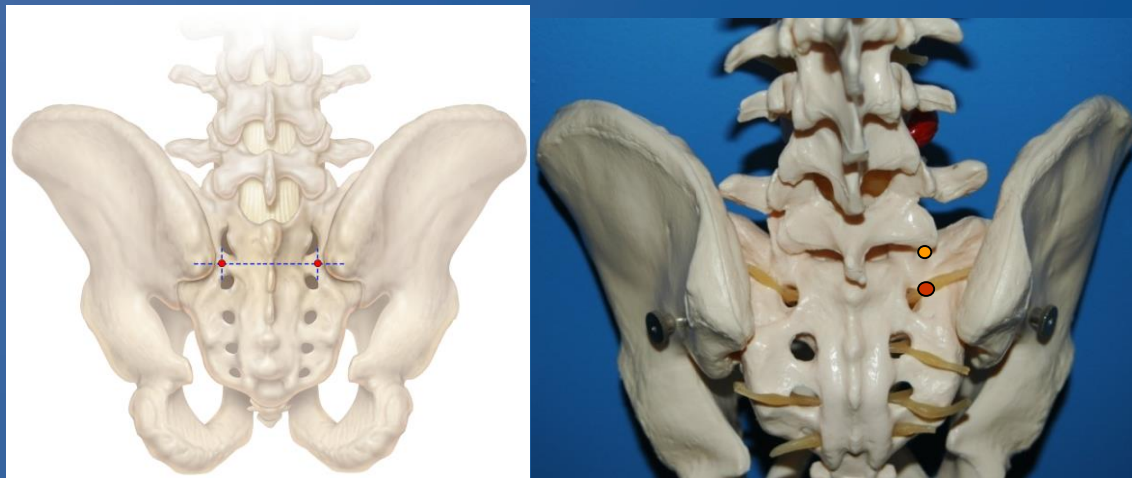
# Technique - Passage

- Aim for A.I.I.S.
- Resistance increases at SI joint
- I like using awl; others like drill
- Continue to PSIS or lateral cortex

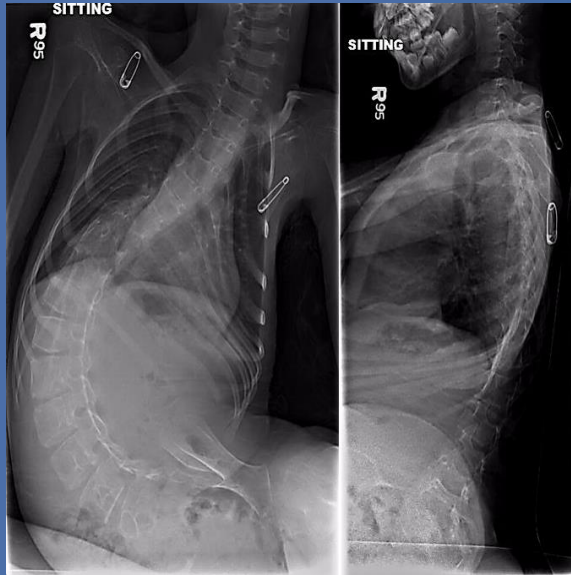


# Starting Point

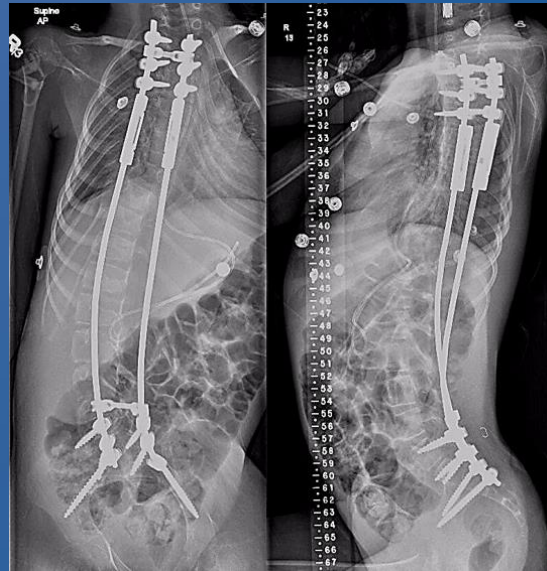
- ~25 mm below S1 endplate
- ~25 mm lateral to midline



# Results: SAI Fixation



Pre-Operative: 9.7 yo  
Major Curvature: 129°  
Pelvic Obliquity: 46°



3 Days Post-Operative  
Major Curvature: 29°  
Pelvic Obliquity: 9°



2 Year Follow-up  
Major Curvature: 23°  
Pelvic Obliquity: 5°

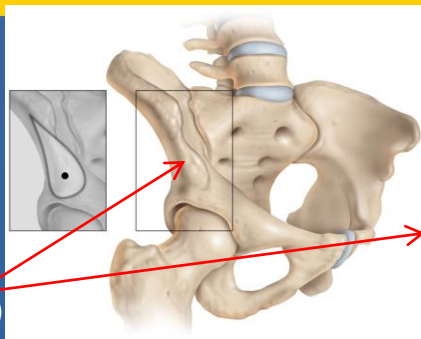
# Screws in SMA patient

- SS

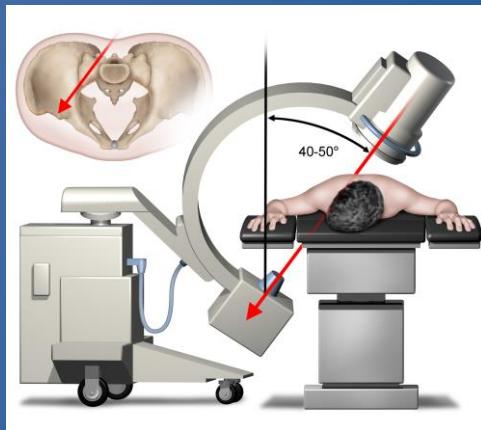


# Technique

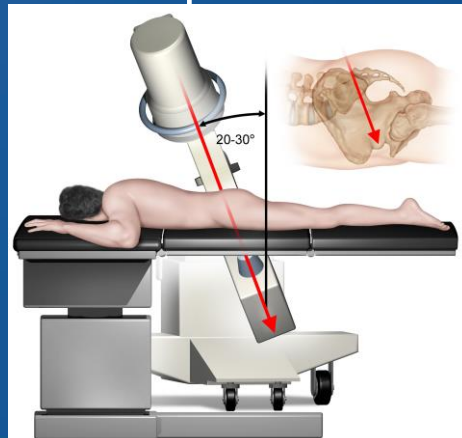
- Check “teardrop”
- (obturator oblique)
  - Start more laterally if “vertical” hemipelvis
  - Seat screw heads at same depth as & in-line



JOHNS HOPKINS  
MEDICINE



bone



# Many means of Pelvic Fixation

## Ideal Implant Qualities:

- Low profile
- Long/thick enough for strength
- In line with spine



# Indications for fusing short of pelvis

- Apex above L1
- End vertebra L4 or higher
- Upright balance
- Stander or independent sitter
  - With level pelvis
  - Pelvic Obliquity  $< 15^{\circ}$



# Pitfalls

- Difficult CP
  - Use teardrop view to line up
  - Start more laterally
    - Ko JPO 2009

