

When to Operate on a Child with Spinal Deformity

Understanding the Differences Between
Deformities

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Deformity

- a condition in which part of the body does not have the normal or expected shape
- Synonym
 - Flaw
 - Blemish
 - Distortion
 - Disfigurement
 - Defect



Spinal Deformity

- Scoliosis
 - Idiopathic
 - Adolescent
 - Juvenile
 - Infantile
 - Early Onset
 - Neuromuscular
 - Congenital
 - Syndromic
- Kyphosis
 - Scheuermann's
 - Post Traumatic
 - Iatrogenic
 - Post Surgical
 - Congenital
 - Neuromuscular

Are these curves not the same?

- 15 yo M 11 yo M w/CP 14 yo M



Scoliosis Surgical Indication

- Adolescent Idiopathic
 - Spinal Instrumentation & Fusion around 50° in the thoracic spine
 - Consider 45° in the lumbar spine
 - Possibly as low as 40° in the lumbar spine with a large trunk shift (clinical deformity)
 - If no intervention then progression of the deformity into adulthood (1° per year) (Weinstein)
 - Can lead to Pain, worsening deformity, & back, lung, and heart problems

Scoliosis Surgical Indications

- Adolescent Idiopathic Scoliosis
 - Cor Pulmonale & R Heart Failure (>90-100° curve)
 - Pulmonary function is limited in severe scoliosis (>70°)
 - Chest wall deformity can cause restrictive lung disease
 - Thoracic Lordosis decreases lung volumes
 - Higher rate of back pain in adults with AIS vs. controls (65% vs. 35%) at 50 year f/u (Weinstein)
 - Psychosocial Impact
 - Lower Marriage rates, Self Image issues, Parental unacceptance

AIS

- 19 yo F



15 yo male



15 yo F



AIS



Adult Sequela of AIS

- 32 yo Female



Adult Sequelae of AIS

- 40 yo Female



Adult Sequelae of AIS

- 40 yo F
— Post op

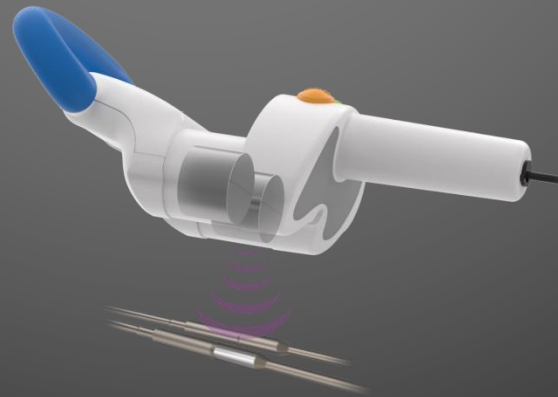


Scoliosis Surgical Intervention

- Juvenile/Infantile Idiopathic
 - Indications much more variable
 - Goals:
 - Control the spinal deformity
 - Allow for continued growth
 - Delay spinal fusion
 - Interventions variable
 - Based on curve size
 - Growth remaining
 - Progression of the curve

Scoliosis Surgical Intervention

- Juvenile/Infantile Idiopathic
 - Intervention Options
 - Bracing
 - Risser Casting
 - Growing Rods
 - Magnetic Rods
 - Schilla Rod Techniques
 - VCR



Scoliosis Surgical Indication

- Juvenile/Infantile Idiopathic
 - Progressive
 - Conservative intervention failure (brace/Risser)
 - Moderate to Large Size Curve
 - Growth preserving



Scoliosis Surgical Indication

- Juvenile/Infantile Idiopathic

1+10 yo



3+2 yo



3+7 yo



Scoliosis Surgical Indication

- Juvenile/Infantile Idiopathic



Scoliosis Surgical Indication

- Juvenile/Infantile Idiopathic

5+0 yo



5+6 yo



Scoliosis Surgical Indication

- Adult Sequela of Juvenile Idiopathic Scoliosis
 - 49 yo Female
 - Diagnosed at 6 yo
 - Brace until Mature
 - Curve was 50°/50°



Scoliosis Surgical Intervention

- Neuromuscular

- Goals

- Sitting or Standing Balance (Coronal and Sagittal)
 - Encourage Independence
 - Assist mobility (gait & transfers)
 - Prevent Progression
 - Maximize Cardiopulmonary Function
 - Improve Hygiene
 - Improve patient/caregiver quality of life

Scoliosis Surgical Indication

- Neuromuscular
 - Older literature states similar indications as AIS
 - $>50^\circ$ Curve
 - No new literature regarding this subject
 - But risk of progression is high due to NM condition
 - Proactive vs. Reactive Approach
 - Risk of Progression ($>50^\circ$)
 - After patient/caregiver have significant challenges

Scoliosis Surgical Indication

The Pros and Cons of Operating Early Versus Late in the Progression of Cerebral Palsy Scoliosis

Steven M. Hollenbeck, Burt Yaszay, [Paul David Sponseller](#), Carrie E. Bartley, Suken A. Shah, Jahangir Asghar, Mark F. Abel, Firoz Miyanji, Peter O. Newton

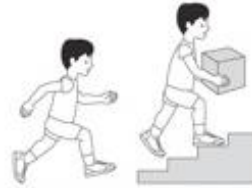
Scoliosis Surgical Indications

- Neuromuscular – Proactive vs. Reactive
 - Being proactive ($< 70^\circ$) has no advantages
 - No decrease in risks
 - No improvement in quality measures
 - Being Reactive ($> 90^\circ$)
 - Increased risk of infection
 - Increased blood loss
 - Increased need for anterior/posterior surgery
 - Increased operative time
 - Trend towards lower quality of life
 - Ideally surgery recommended on curves $< 90^\circ$

Scoliosis Surgical Indications

- Neuromuscular
- GMFCS Classification System

GMFCS for children aged 6-12 years: Descriptors and illustrations



GMFCS Level I

Children walk indoors and outdoors and climb stairs without limitation. Children perform gross motor skills including running and jumping, but speed, balance and coordination are impaired.



GMFCS Level II

Children walk indoors and outdoors and climb stairs holding onto a railing but experience limitations walking on uneven surfaces and inclines and walking in crowds or confined spaces and with long distances.



GMFCS Level III

Children walk indoors or outdoors on a level surface with an assistive mobility device and may climb stairs holding onto a railing. Children may use wheelchair mobility when traveling for long distances or outdoors on uneven terrain.



GMFCS Level IV

Children use methods of mobility that usually require adult assistance. They may continue to walk for short distances with physical assistance at home but rely more on wheeled mobility (pushed by an adult or operate a powered chair) outdoors, at school and in the community.



GMFCS Level V

Physical impairment restricts voluntary control of movement and the ability to maintain antigravity head and trunk postures. All areas of motor function are limited. Children have no means of independent mobility and are transported by an adult.

Scoliosis Surgical Indications

- Neuromuscular - 15 yo M GMFCS Level 4 CP



Scoliosis Surgical Indications



Scoliosis Surgical Indications

- Neuromuscular – 13 yo M GMFCS Level 5 CP



Scoliosis Surgical Indications

- Neuromuscular – 13 yo M GMFCS Level 5



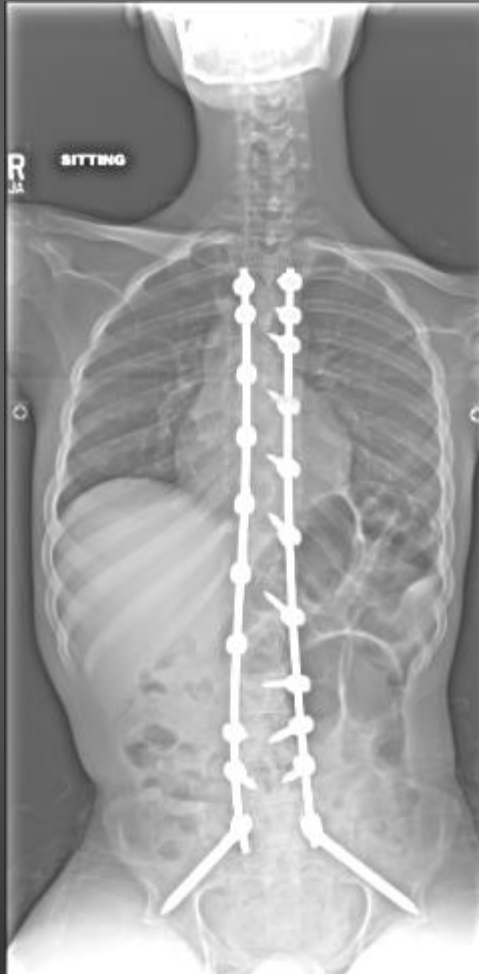
Scoliosis Surgical Indications

- Neuromuscular – 14 yo M w/ Duchenne MD



Scoliosis Surgical Indications

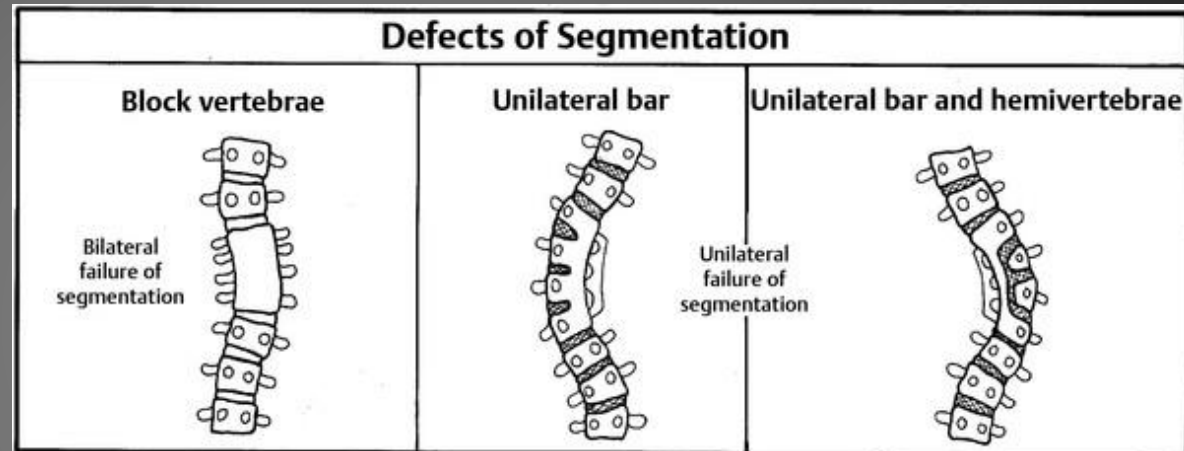
- Neuromuscular – 14 yo M w/ Duchenne MD



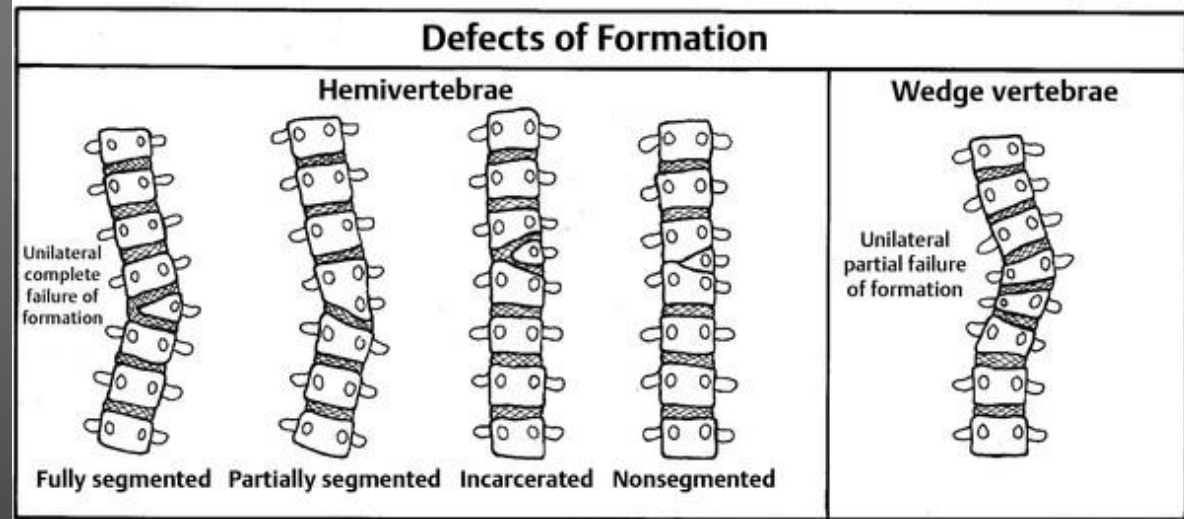
Scoliosis Surgical Intervention

- Congenital

- Failure of Segmentation



- Failure of Formation

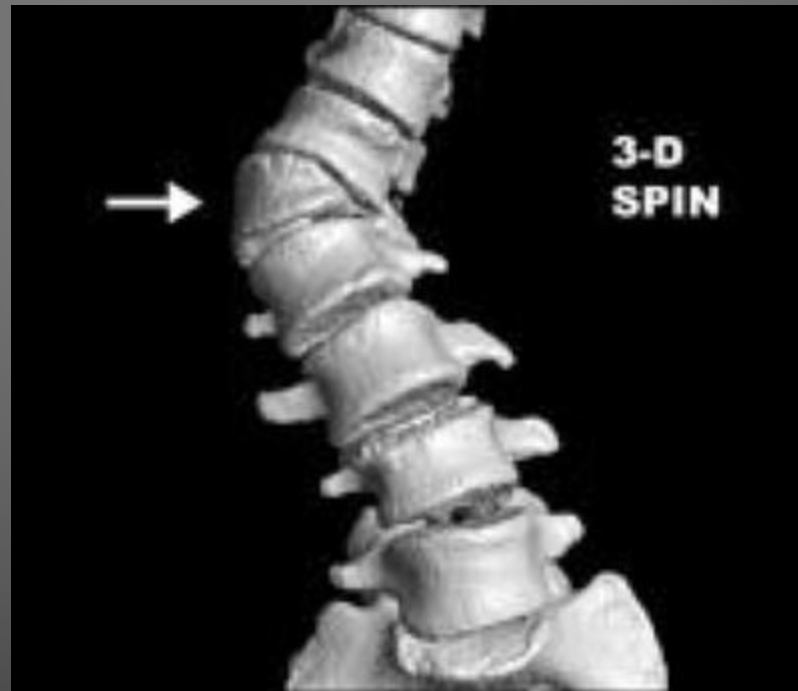


Scoliosis Surgical Indication

- Congenital
 - Hemivertebrae & Contralateral Bar Formation
 - Significant Progression
 - Segmental Hemivertebrae –usual progress
 - Age 3-8 yo
 - Posterior Approach
 - Localized Fusion
 - Unilateral Bar – usual progress
 - Localized fusion
 - Neurologic Deficit
 - Declining Respiratory Status

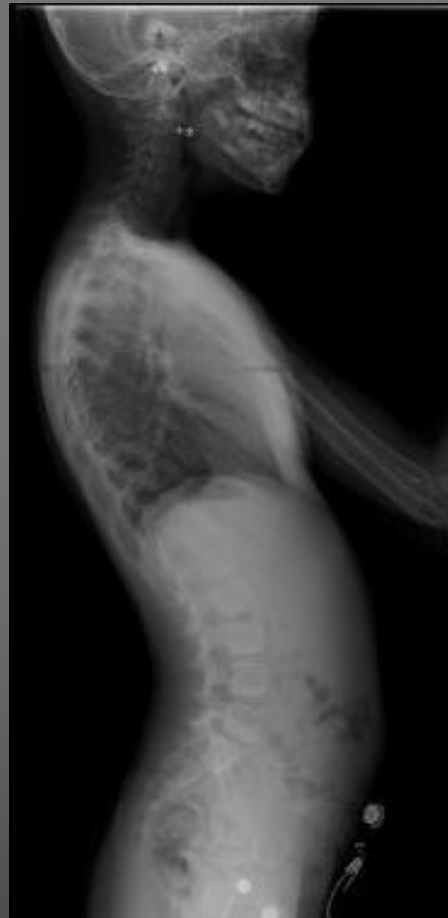
Scoliosis Surgical Indication

- Congenital
 - 3D CT Scan is helpful for surgical intervention
 - Especially with Vertebrocomy



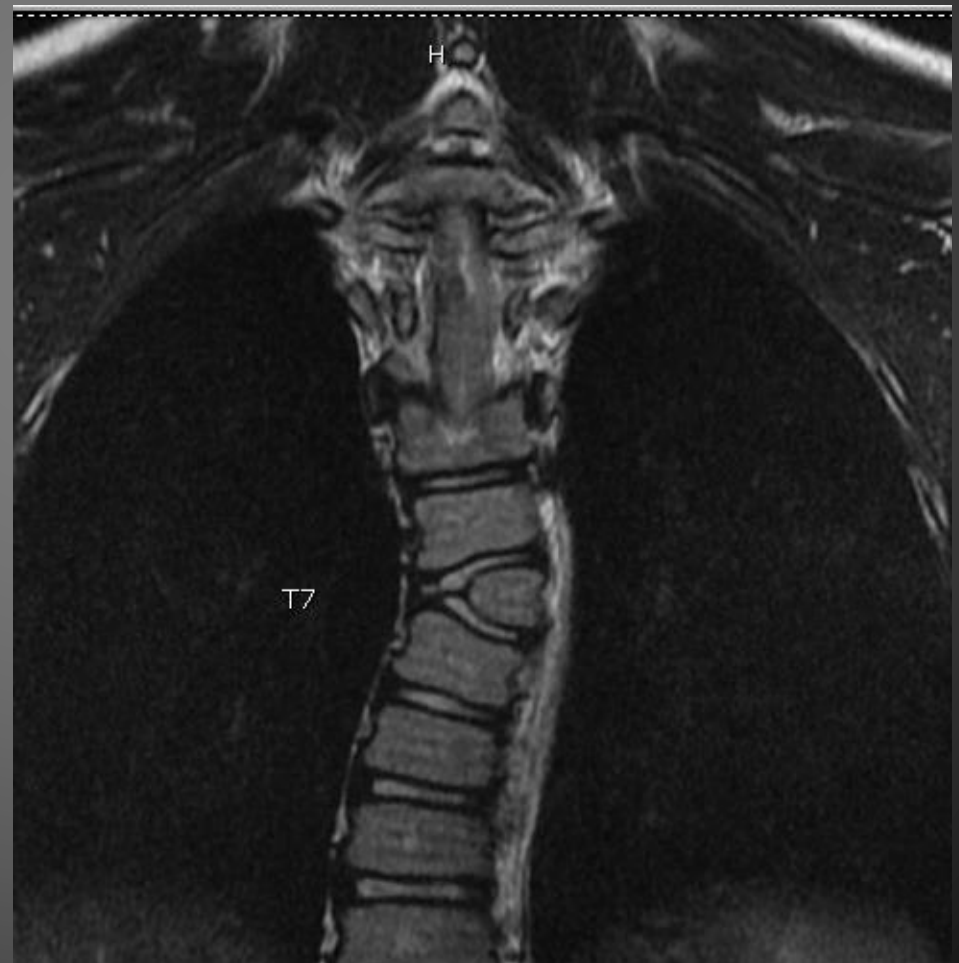
Scoliosis Surgical Indication

- Congenital – 6 yo female with hemivertebrae



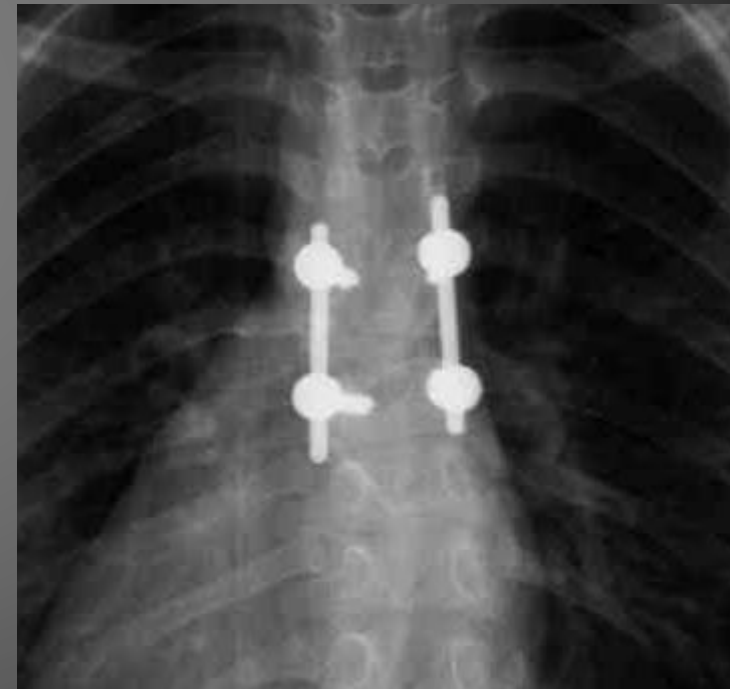
Scoliosis Surgical Indication

- Congenital – 6 yo female with hemivertebrae



Scoliosis Surgical Indication

- Congenital – 6 yo F w/ Hemivertebrae Excision



Scoliosis Surgical Indication

- Congenital – 11.5 yo M w/ Congenital Bar



11.5 yo



14 yo



14.5 yo



Scoliosis Surgical Indication

- Congenital



Scoliosis Surgical Intervention

- Syndromic

- Prader Willi
- MarFan
- Neurofibromatosis
- Angelman
- Down Syndrome
- Prune Belly
- Ehlers Danlos
- OI
- Muscular Dystrophy
- Noonan
- VATER/VACTRL
- Rett
- Osteochondrodystrophy
 - Dwarfism

Scoliosis Surgical Indication

- Variable Progression
- No set indication different than other scoliosis except DMD
 - Multiple approaches depending on deformity & progression
- DMD
 - 20-30° in nonambulatory patients
 - Wait until 40° if responding well to corticosteroids
 - Operate before pulmonary function decline

Scoliosis Surgical Indication

- 12.5 yo M w/ Down Syndrome & h/o Cong. Heart Defect s/p repair as infant



Scoliosis Surgical Indication

- Down Syndrome



Scoliosis Surgical Indication

- 5.5 yo F w/ h/o clubfoot & torticollis



Neurofibromatosis Type 1

Scoliosis Surgical Indication

- Syndromic – NF1
 - 6.5 yo F



Scoliosis Surgical Indication

- NF1
 - 7yo F



Scoliosis Surgical Indication

- NF1
 - 9.5 yo F



When do you operate on a child with Scoliosis?

- Depends on ...
 - Type of Scoliosis
 - Progression
 - Pt. Age
 - Pt. Maturity
 - Curve Size
 - Neurologic Status
 - Functional Impairment



Thank You

- Questions

