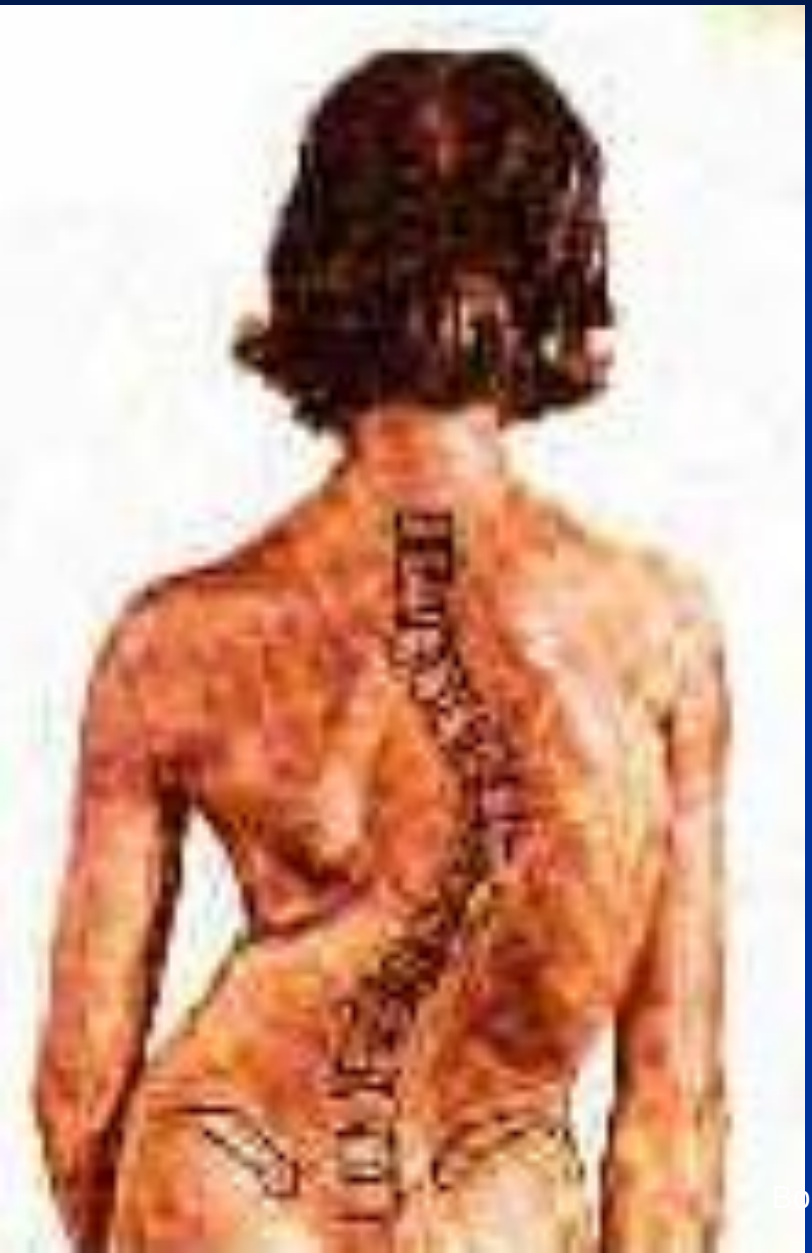
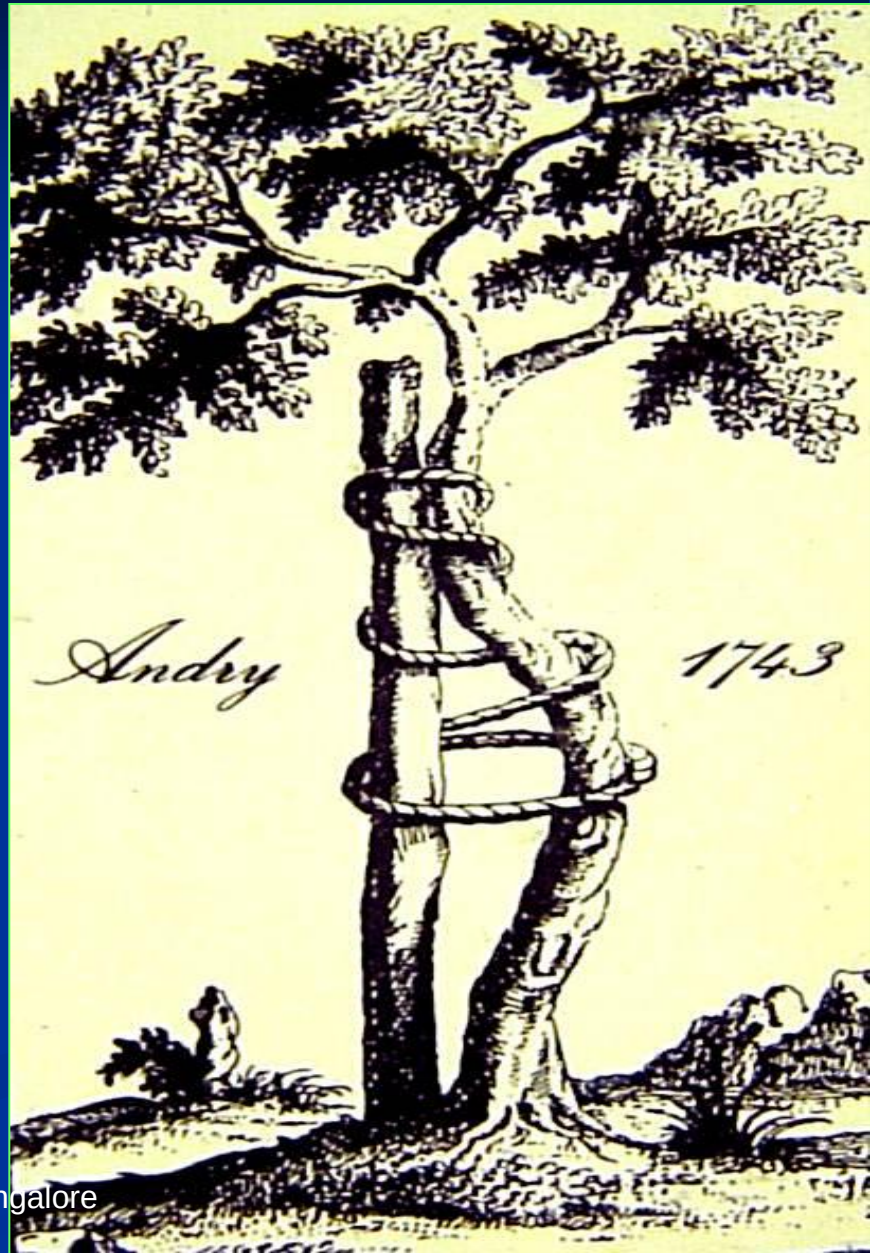
Introduction to scoliosis

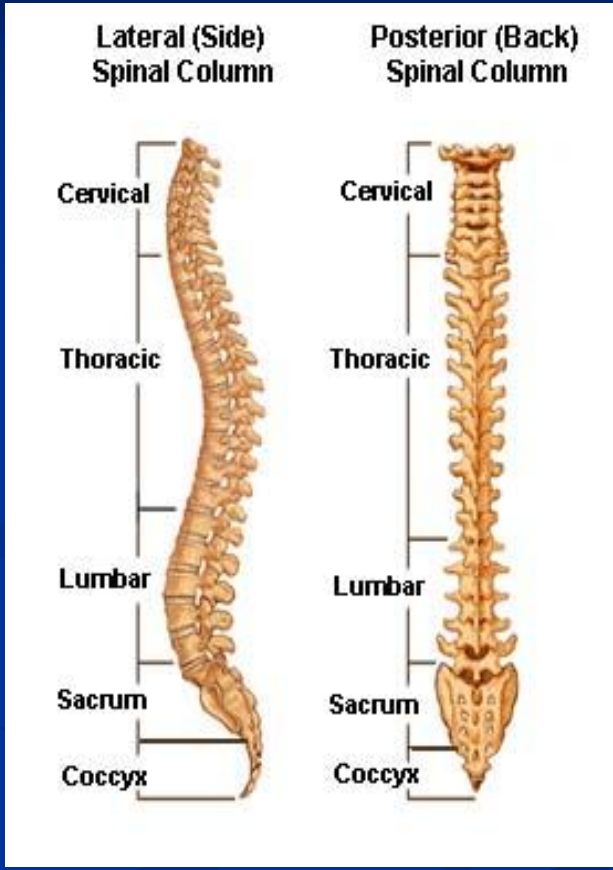




What is scoliosis?

Lateral curvature of the spine
> 10 degrees

- Structural scoliosis
- Non-structural scoliosis

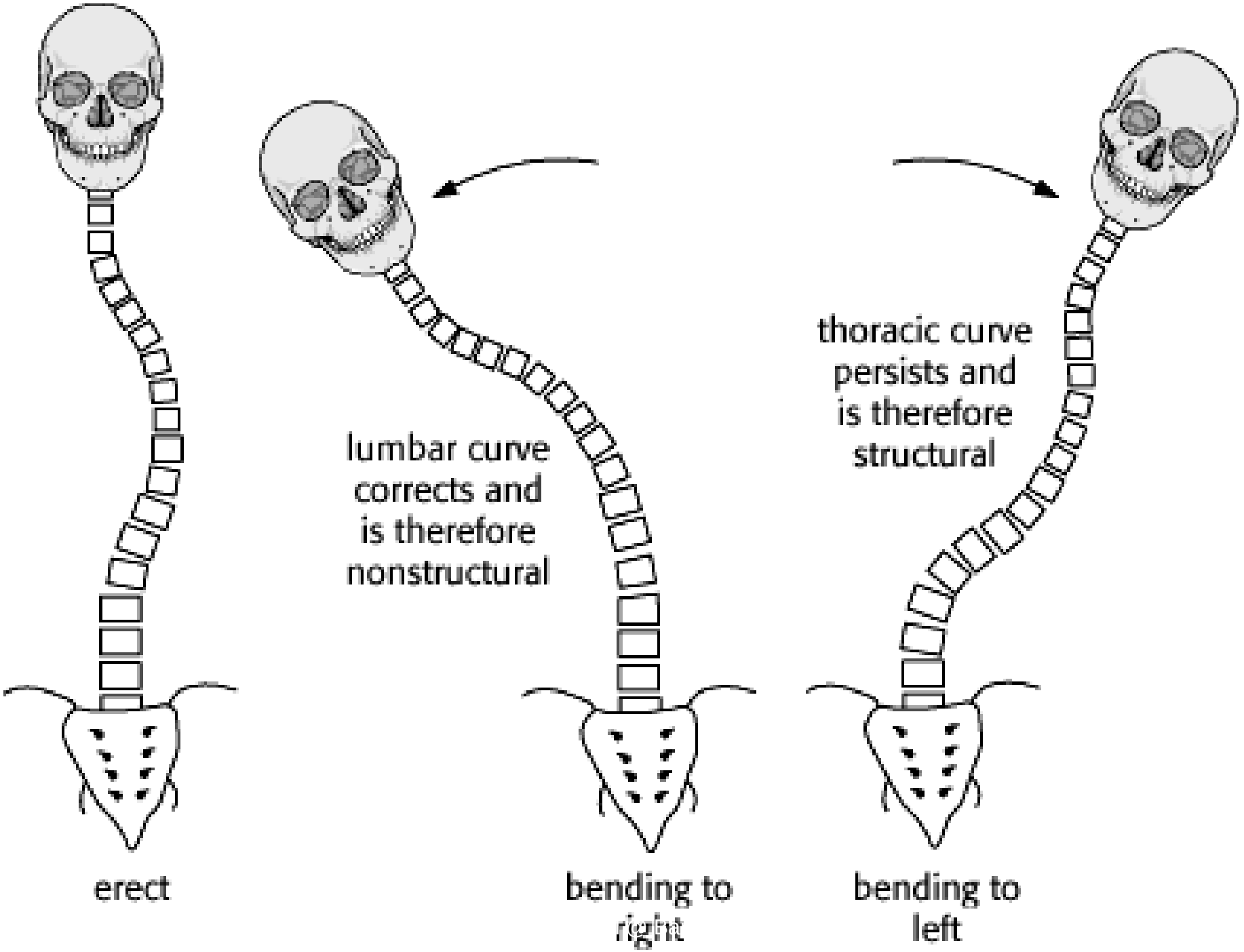


Structural Curve

- Cobb measurement fails to correct past zero on supine maximal voluntary lateral side bending x-ray

Non-structural

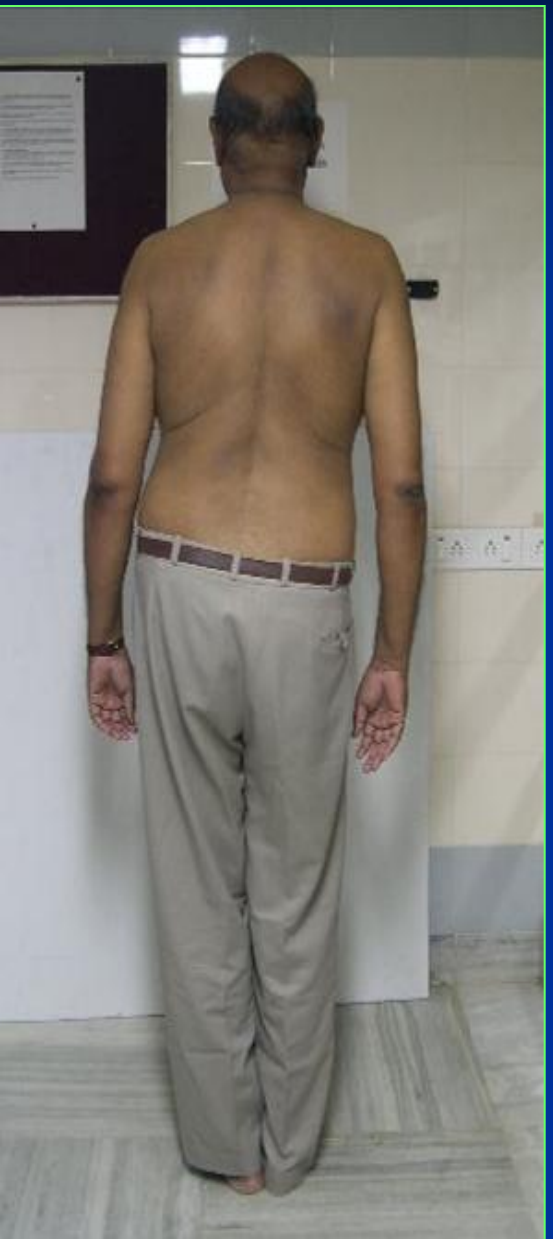
- Cobb measurement measurement corrects past zero on supine lateral side bending x-ray

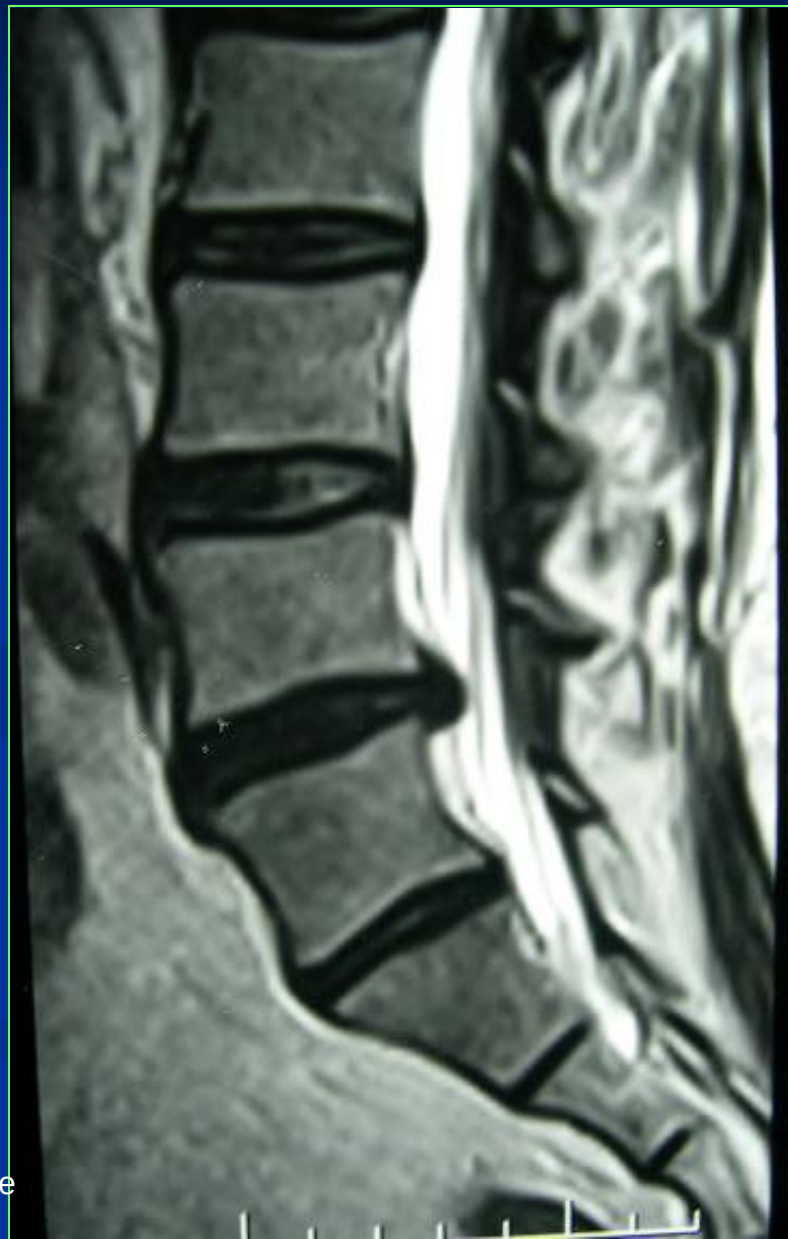

lumbar curve
corrects and
is therefore
nonstructural
thoracic curve
persists and
is therefore
structural
erect
bending to
right
bending to
left

Functional scoliosis – (usu. non-structural)

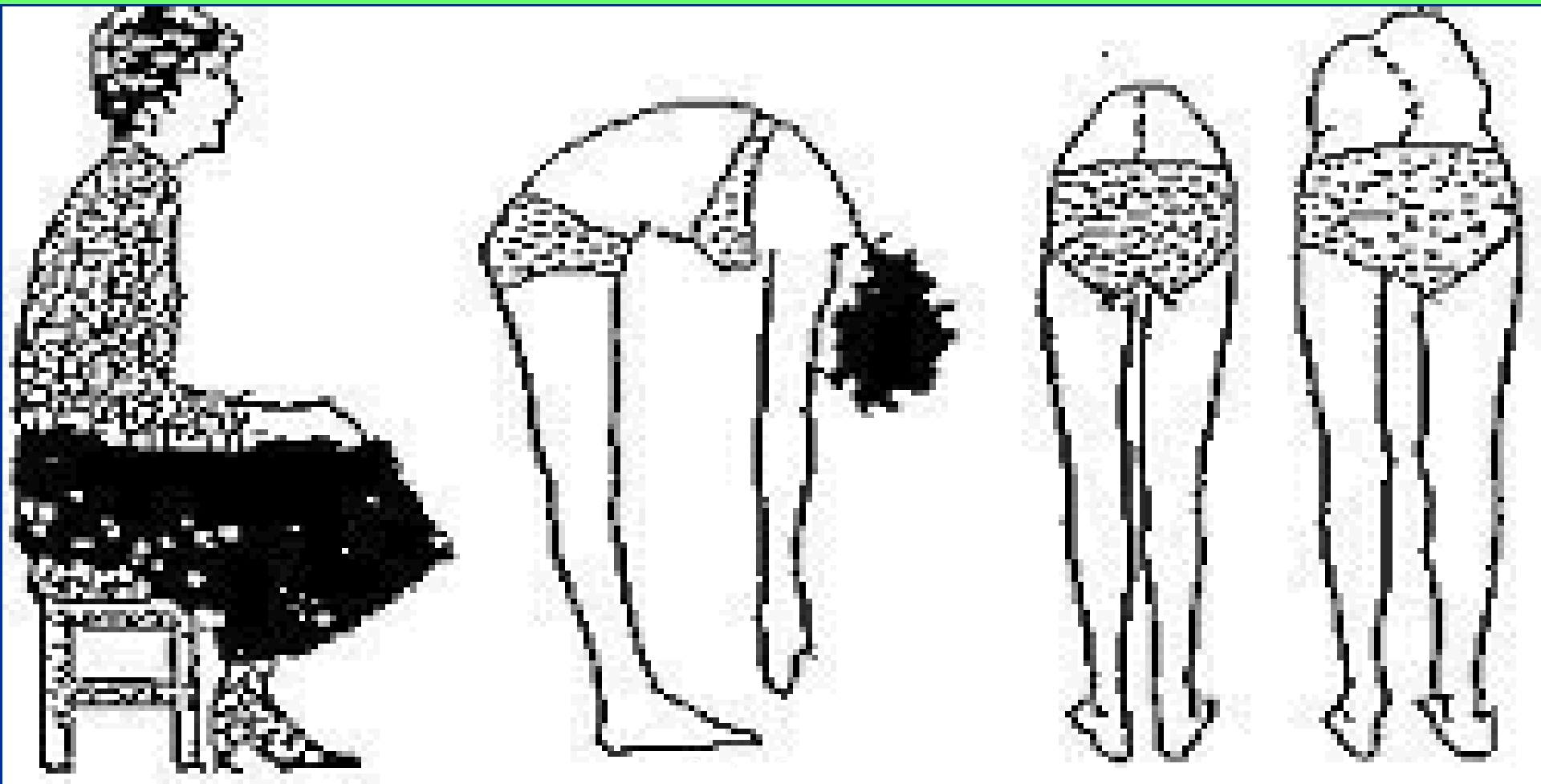
- Limb length discrepancy
- Sciatic scoliosis
- Hysterical scoliosis - manifestation of a conversion reaction
- Benign tumours – painful spasm – osteoid osteoma

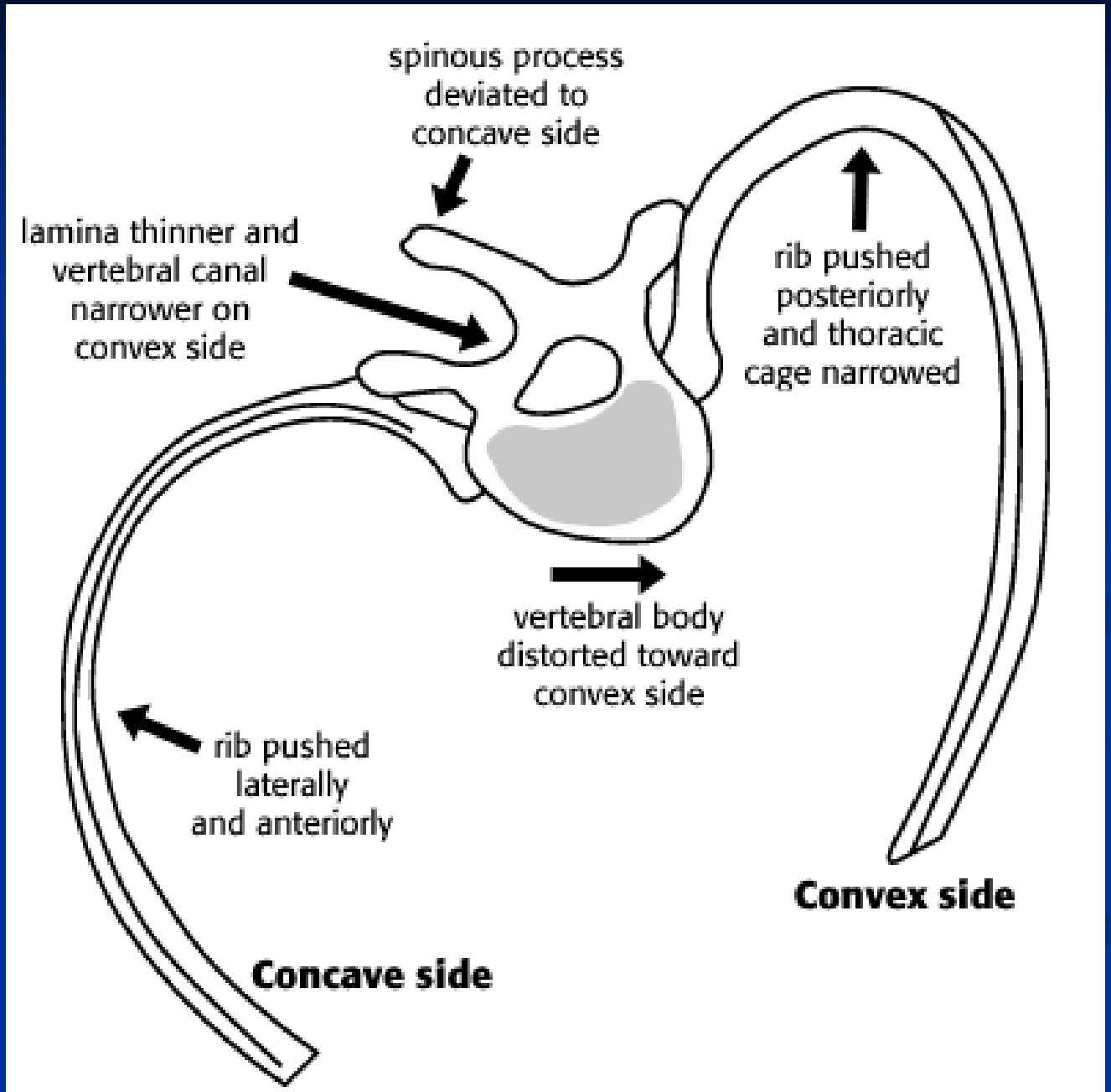
Sciatic scoliosis



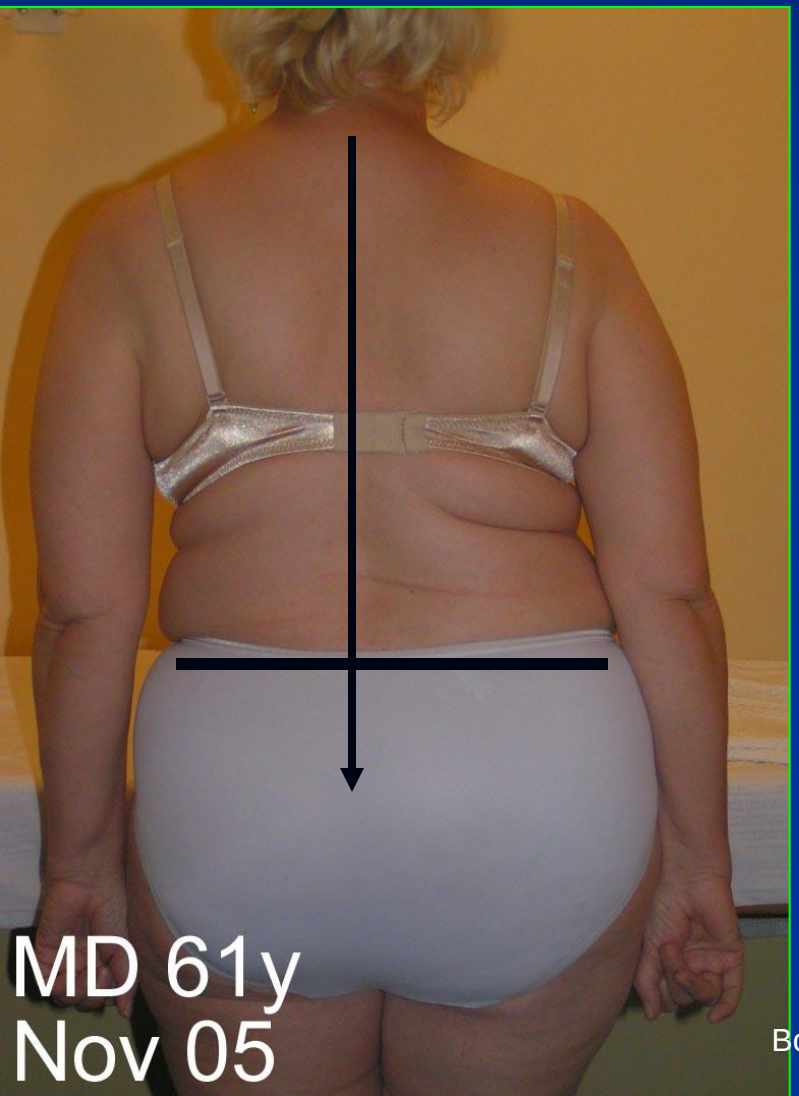


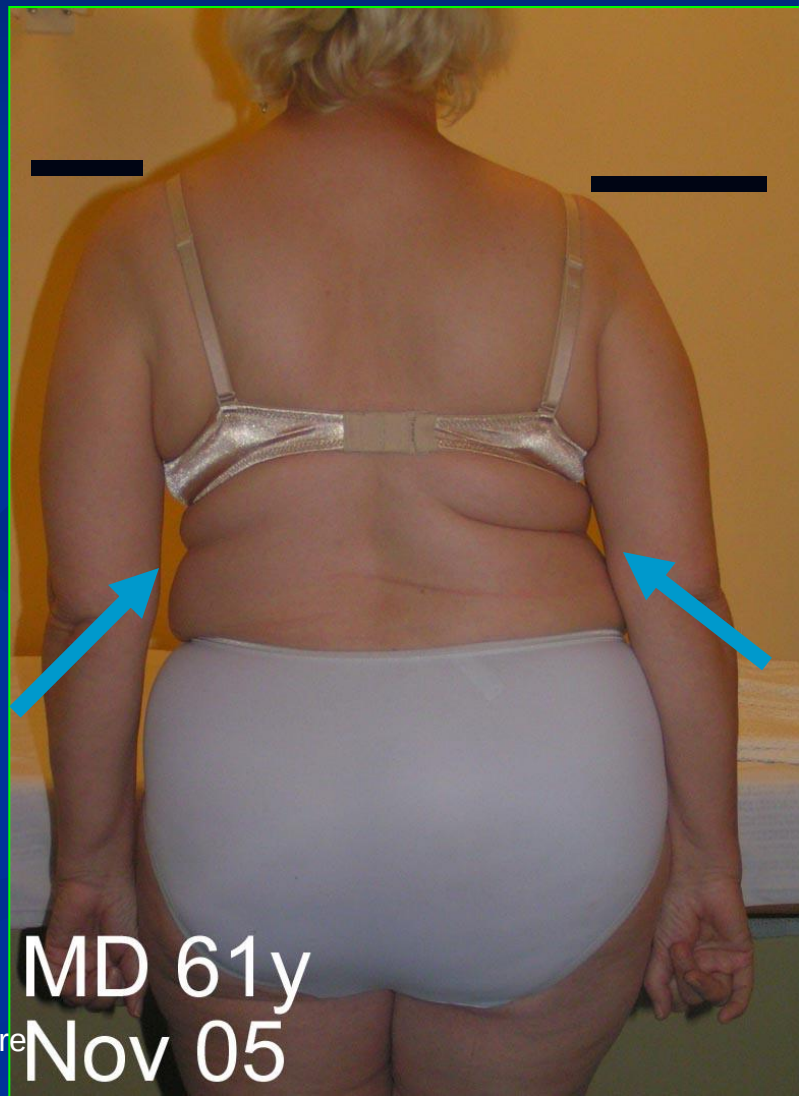
Screening for scoliosis – Adams test



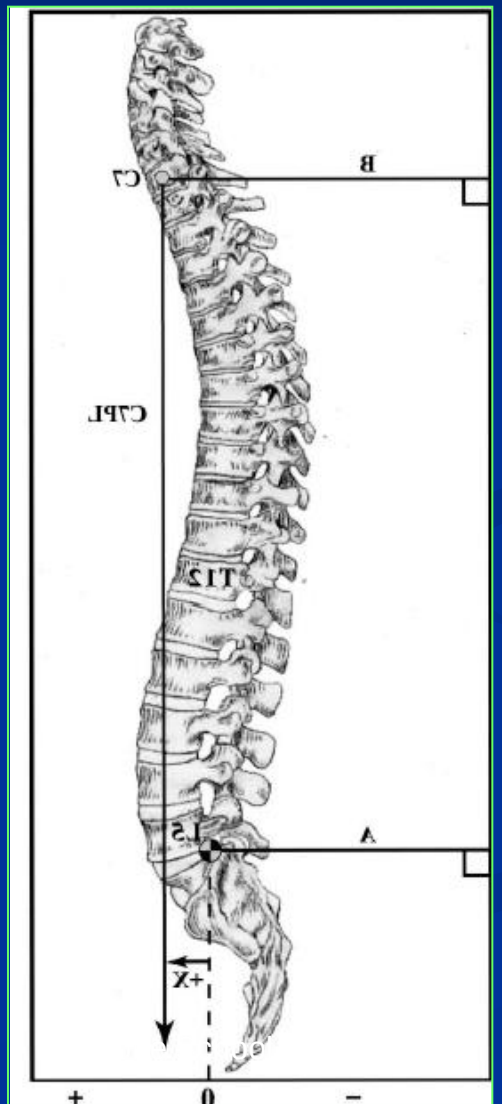

spinous process
deviated to
concave side
lamina thinner and
vertebral canal
narrower on
convex side
rib pushed
posteriorly
and thoracic
cage narrowed
vertebral body
distorted toward
convex side
rib pushed
laterally
and anteriorly
Convex side
Concave side

Assessment of scoliosis- Coronal alignment





Assessment - Sagittal alignment

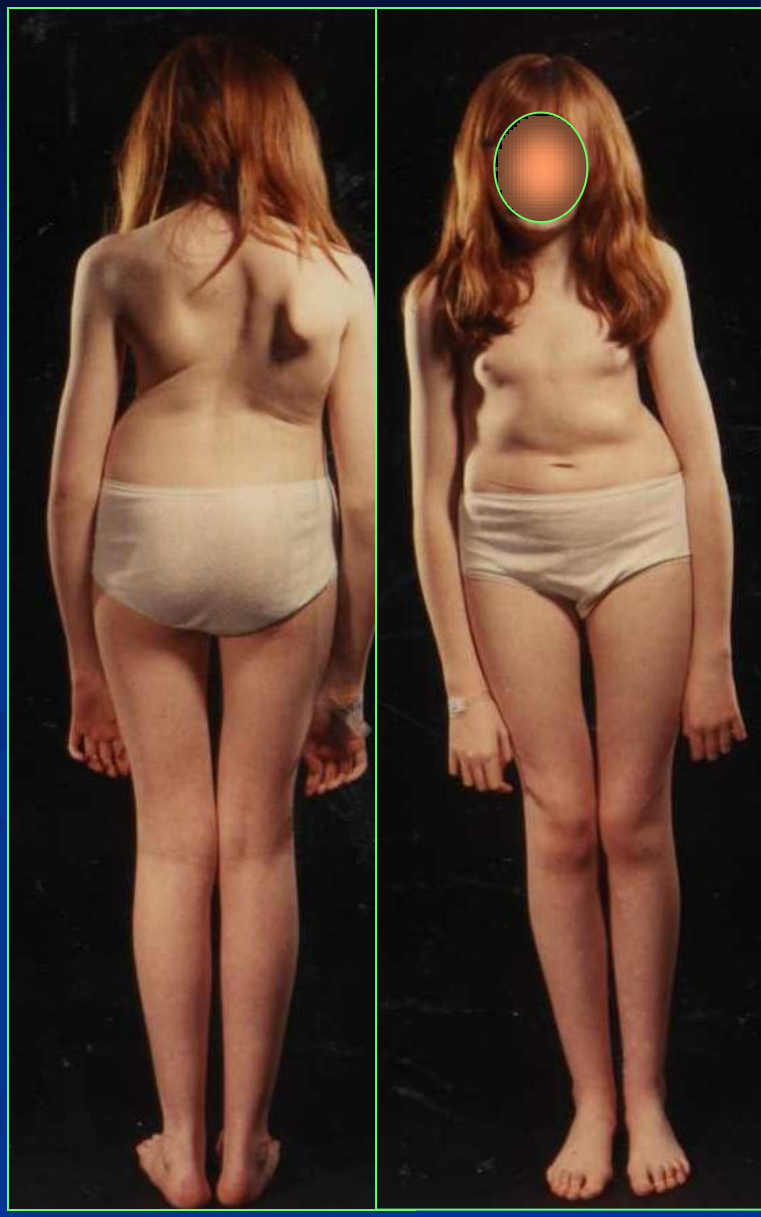


Classification of Scoliosis

- Idiopathic
- Congenital
- Neuromuscular
- Others

Idiopathic scoliosis

- Cobb (L) > /= 10º + rotation
- Unknown etiology



Types of idiopathic scoliosis

- Infantile scoliosis - presenting from birth – 2+11
- Juvenile scoliosis – 3yrs - 9+11
- Adolescent scoliosis – 10yrs - 17+11
- Adult scoliosis – 18 yrs and beyond

ABSENT SUPERFICIAL ABDOMINAL REFLEXES IN CHILDREN WITH SCOLIOSIS

AN EARLY INDICATOR OF SYRINGOMYELIA

HAMID G. ZADEH, SAMIR A. SAKKA, MICHAEL P. POWELL, MIN H. MEHTA

From the Royal National Orthopaedic Hospital Trust, Stanmore, England

We describe 12 children with idiopathic scoliosis who had a persistent absent superficial abdominal reflex (SAR) on routine neurological examination. MRI showed syringomyelia to be present in ten. The average age at detection of the scoliosis was 4.3 years and at diagnosis of syringomyelia 6.6 years.

In all ten children the SAR was consistently absent on the same side as the convexity of the curve. In two it was the only abnormal neurological sign. An absent SAR in patients with scoliosis is an indication for investigation for underlying syringomyelia.

Burwell et al 1992; Williams 1992). Arai et al (1993), in a comprehensive study, reported that 4.0% of patients with scoliosis with curves larger than 20° had syringomyelia. New imaging techniques and improved clinical awareness have identified more patients with idiopathic scoliosis who have syringomyelia (Nohria and Oakes 1990). It is progressive and early diagnosis and treatment are therefore paramount (Williams 1992).

Our aim was to indicate the clinical features of importance in the early detection of syringomyelia with special reference to the superficial abdominal reflex (SAR) and to

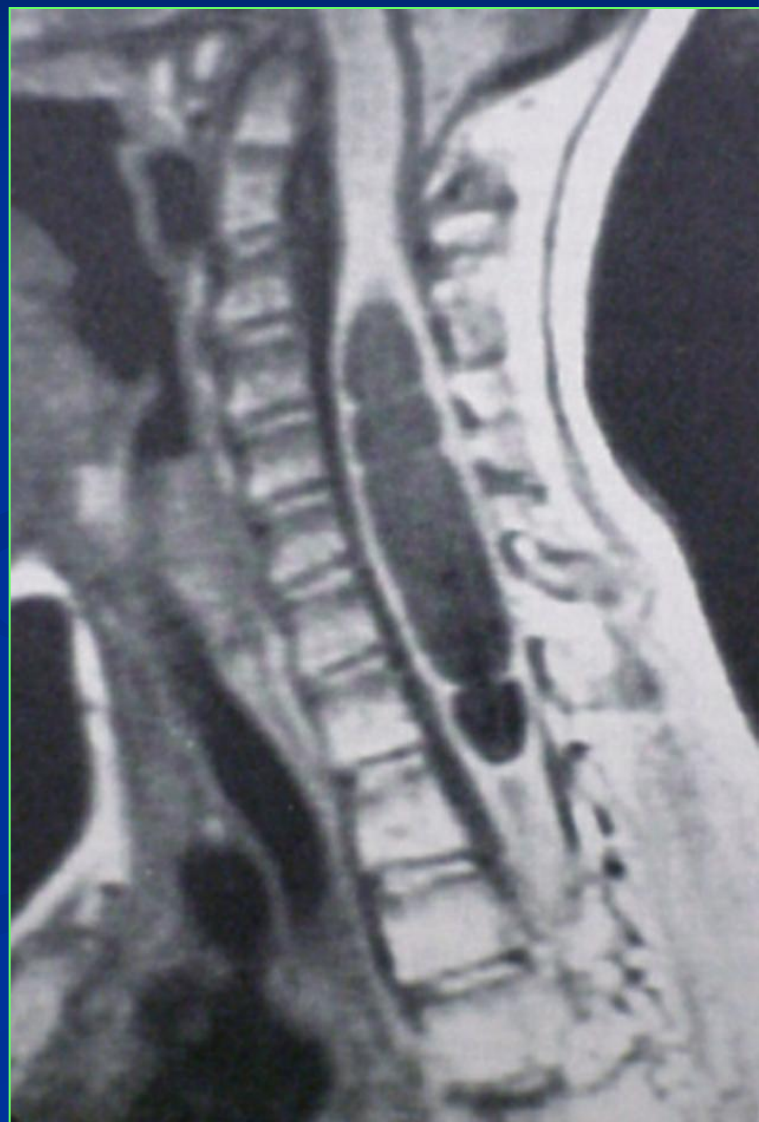
J Bone Joint Surg [Br] 1995;77-B:762-7.

Absent abdominal reflex

Left thoracic scoliosis

+

Absent abdominal reflex

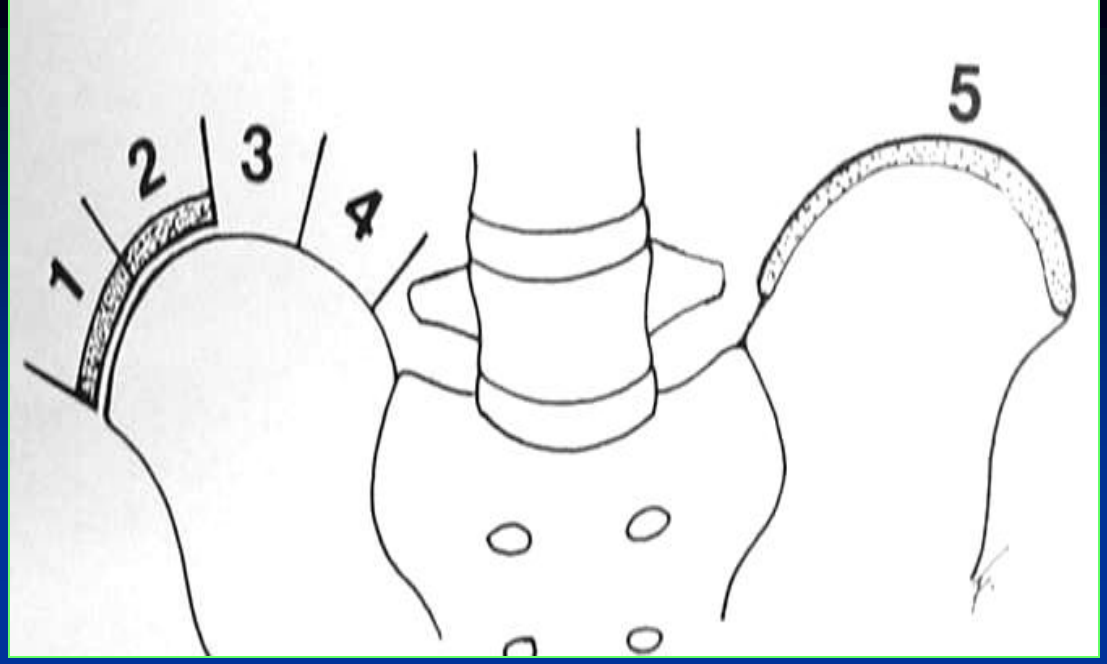


Terminology

- Cervical scoliosis - apex betwn C1 and C6-C7 disc
- Thoracic - apex betwn T2 body - T11-T12 disc
- T-L scoliosis - apex at T12, T12-L1 disc or L1
- Lumbar - apex L1-L2 disc - L4-L5 disc
- L-S scoliosis - apex - L5 or below

Rapid Curve progression in

- Curve size > 40°
- Curve rotation Moe grade 2 or more
- Age ~ <10, pre-menarche
- Skeletal maturity -Riser grade 0-2
  -Open acetabular cartilage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2
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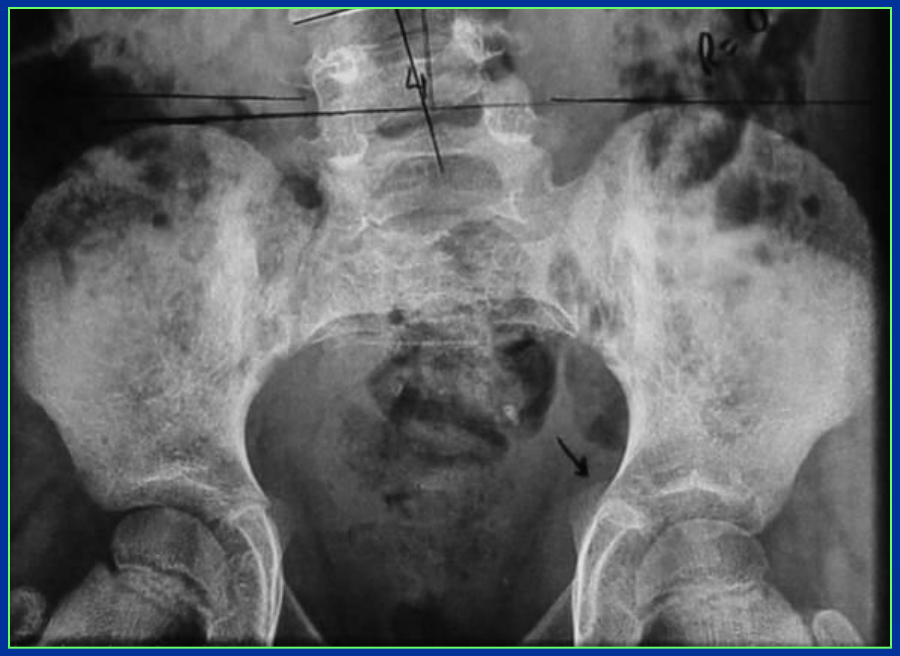
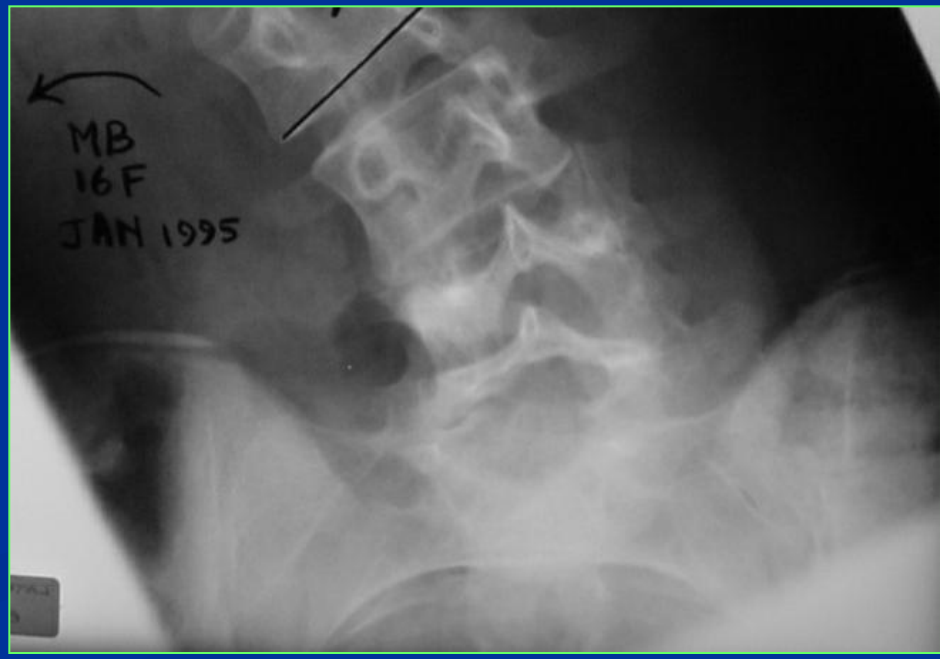



MB
16 F
JAN 1995

Curve progression in *immature* patients…

- < 20° 22 % chance of progression
- 20-30° 68 % chance of progression
- 30-60° 90 % chance of progression
- >60° 100 % chance of progression

Nachemson, Lonstein et al SRS 1982

Treatment Options

Observation (but not neglect)

Orthosis – Brace

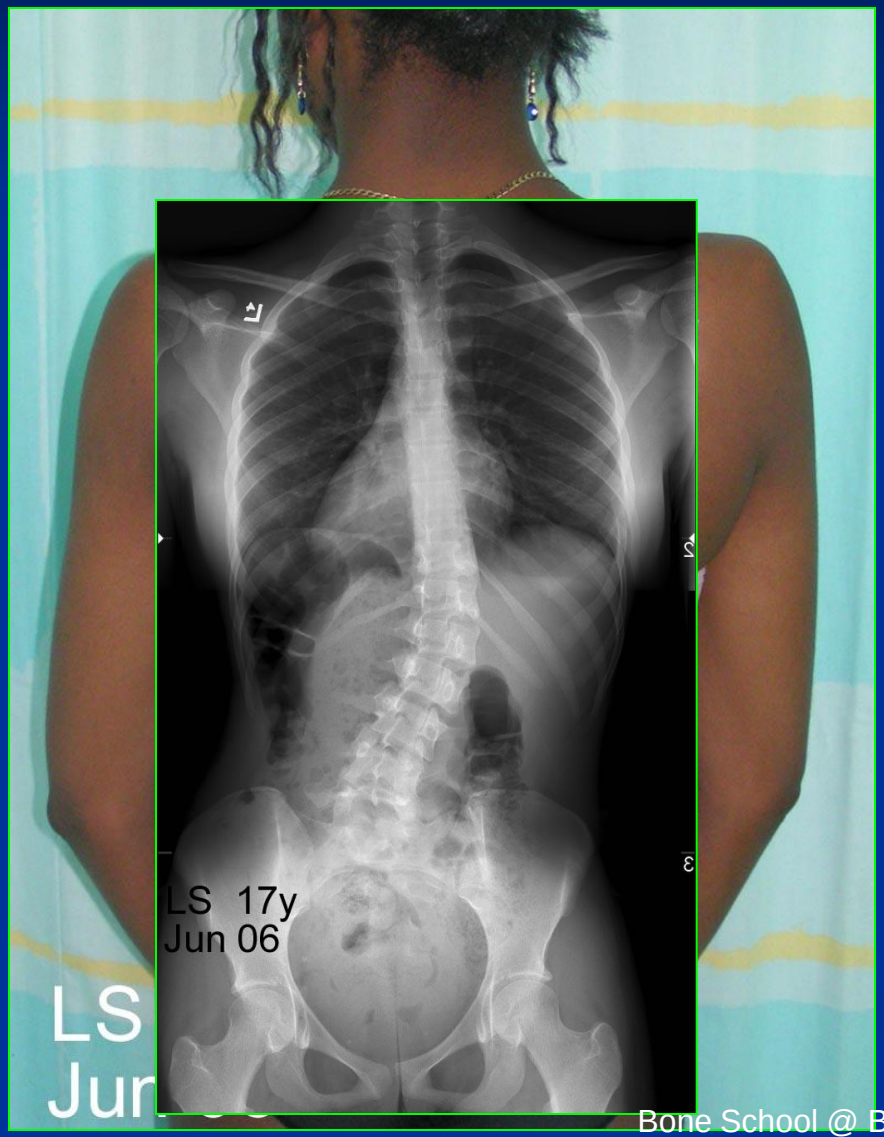
Operative

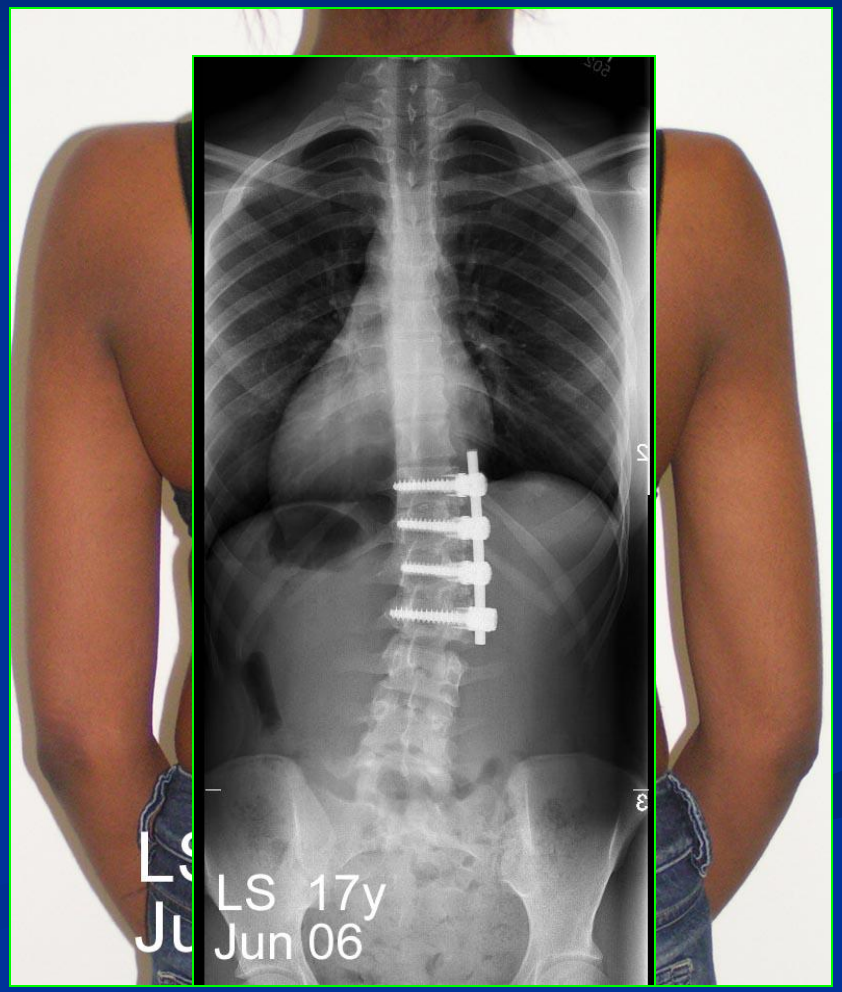
Orthosis - Brace

Guidelines – Not accurate

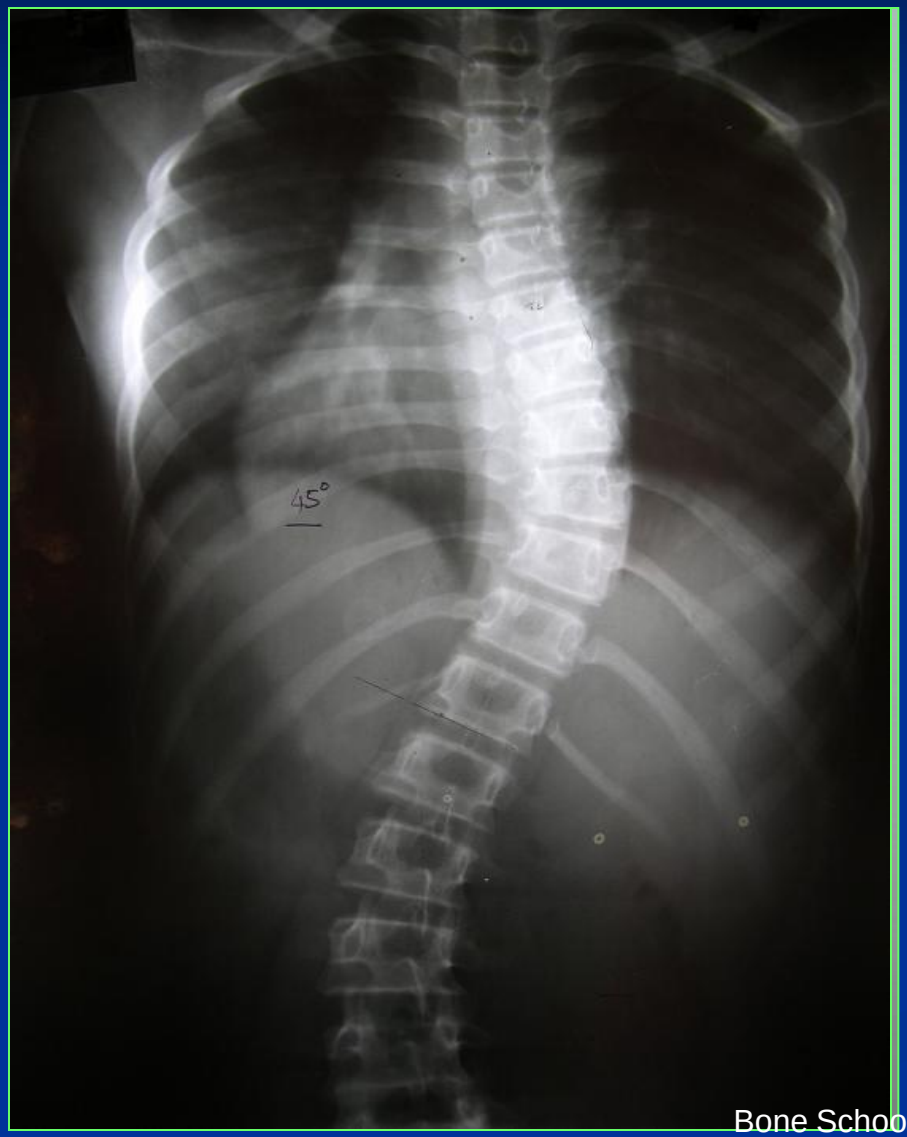
- 10-25 degrees – Observe / Brace
- 25-45 degrees – Brace (growing children)
- > 50 degrees - Surgery

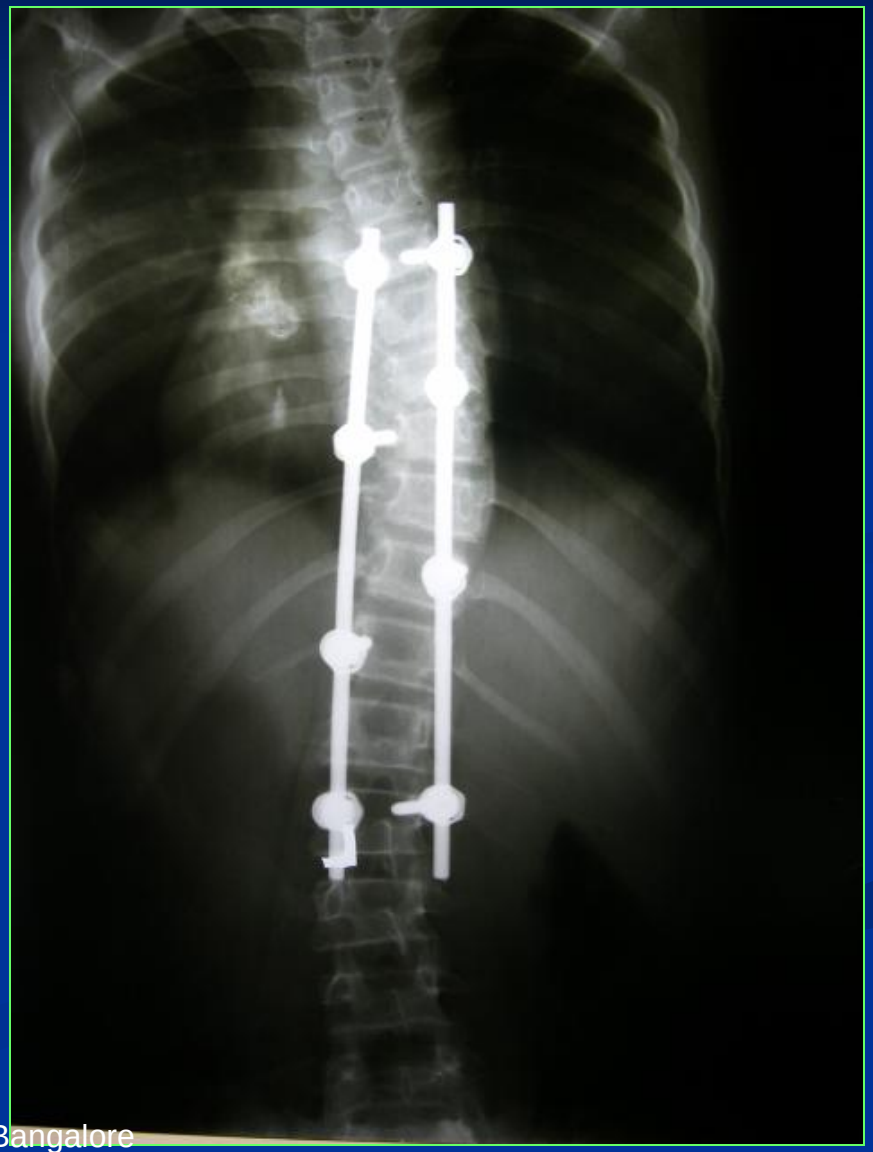
Operative Treatment – Anterior





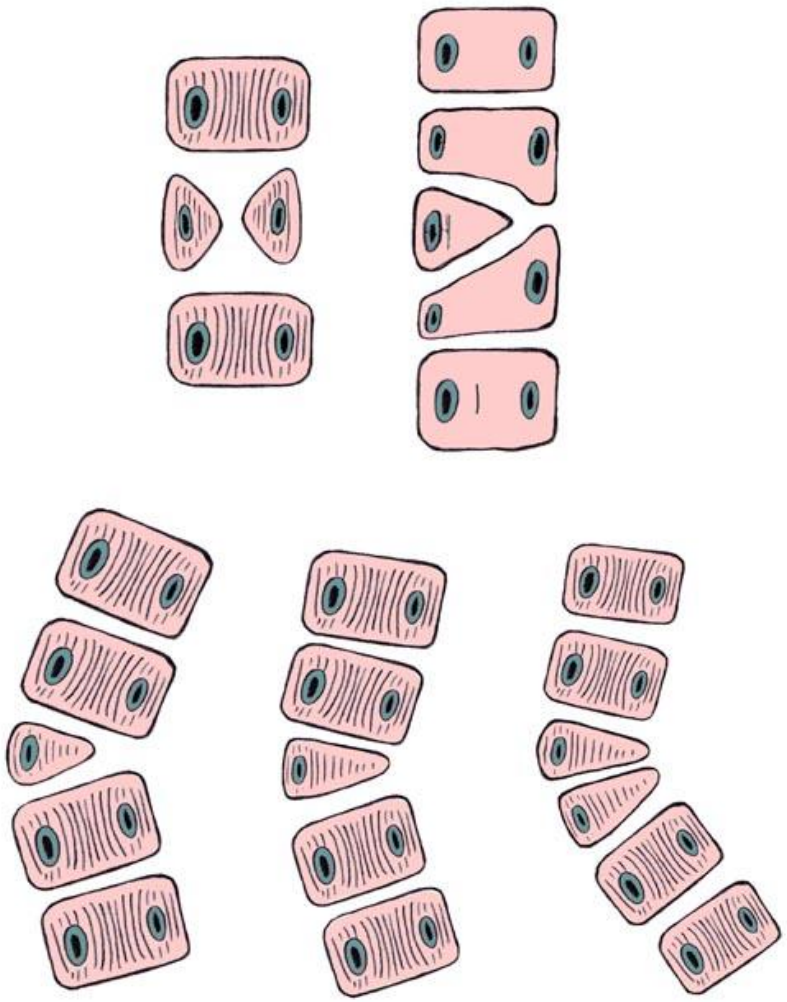
Operative Treatment – Posterior





Congenital Scoliosis

Classification

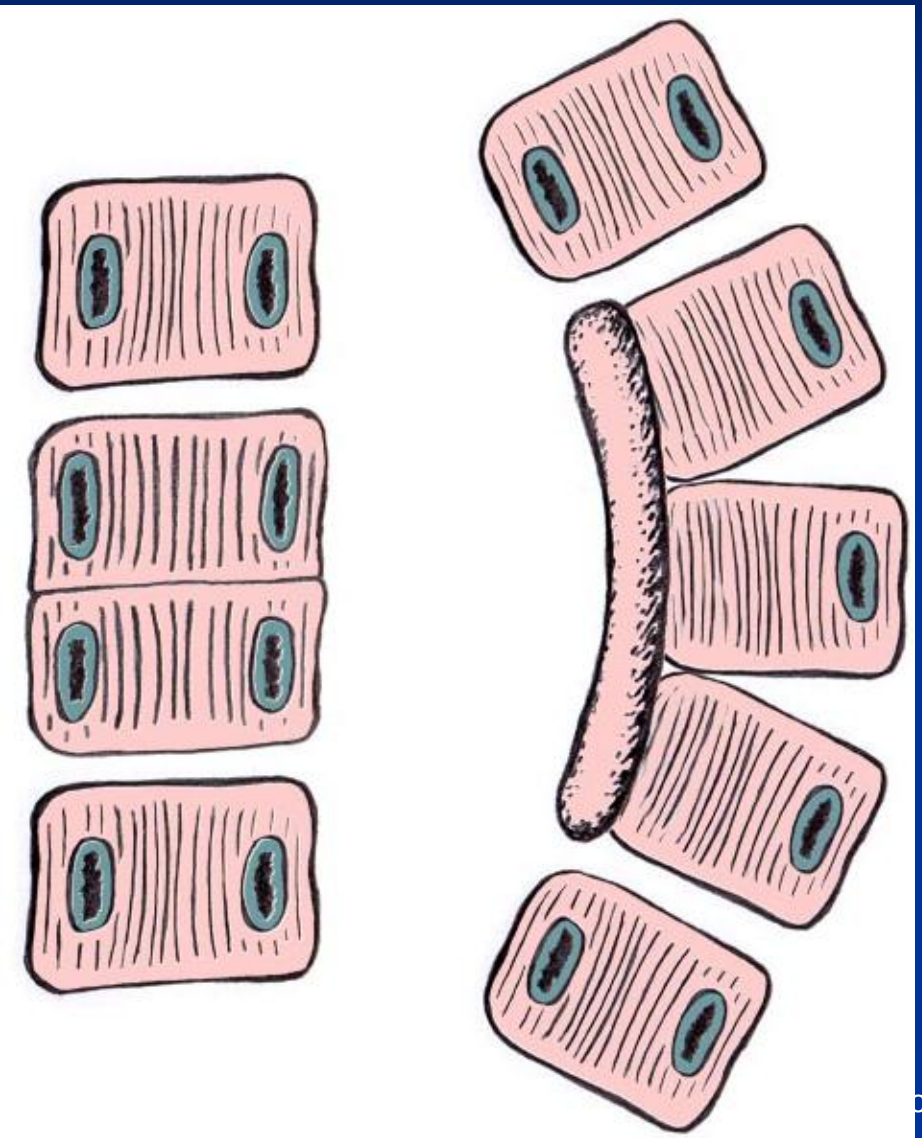


Type I- Failure of formation

a) Hemivertebra

b) Wedged vertebra

Classification

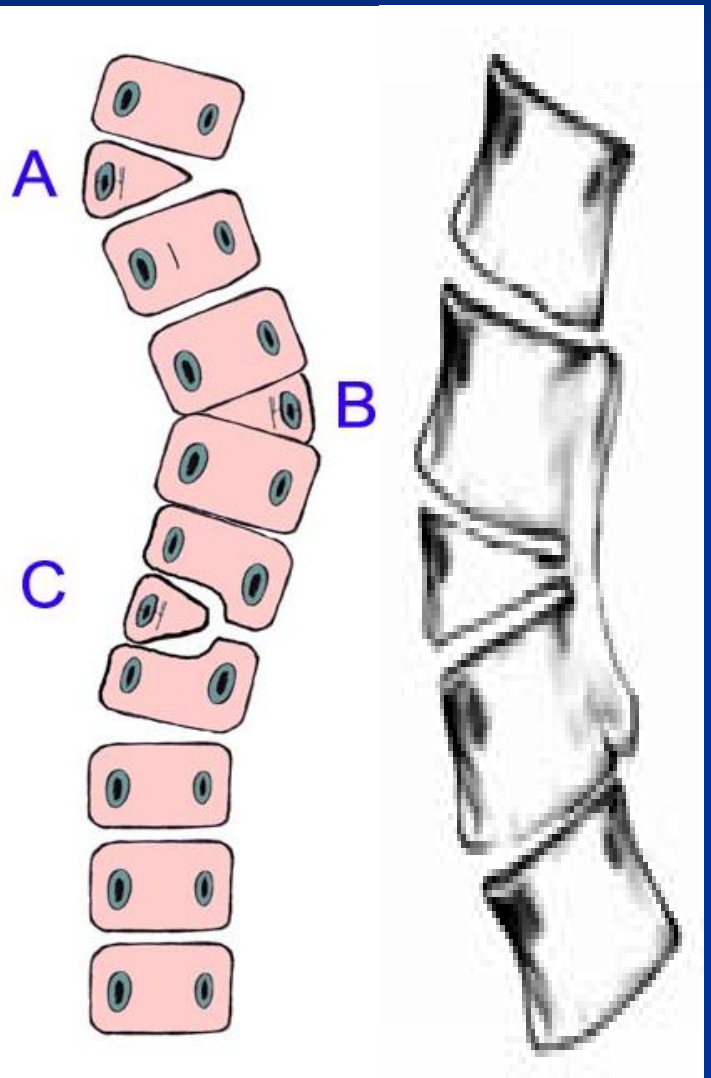


Type II- Failure of segmentation

a) Block vertebrae

b) Unilateral unsegmented bar

Classification



Type III- Mixed anomalies

Associated anomalies

33% -Genito-urinary tract anomalies

25% -Klippel –Fiel syndrome

15% -Intraspinal anomalies

10% -Cardiovascular anomalies

Table 2. Anomalies Associated With Congenital Scoliosis

Cardiac[9]	Renal[9]	Neurologic[9]
Ventricular septal defects	Renal hypoplasia	Tethered cord
Atrial septal defects	Horseshoe kidney	Syrinx
Patent ductus arteriosus	Single kidney	Thickened and fatty filum
Tetralogy of fallot	Congenital megaureter	Low conus
Transposition of great arteries	Ectopic kidney (pelvic)	Diastematomyelia
Pulmonary stenosis	Hypospadias	Intradural mass/ Lipoma
Sick sinus syndrome	Pelviureteric junction obstruction	Extradural mass
	Posterior urethral valve	Chiari malformation
	Cloacal anomaly	Arachnoid cyst
	Epispadia	Dandy-Walker malformation
	Exstrophy of the bladder	
	Hydronephrosis	
	Undescended testis	

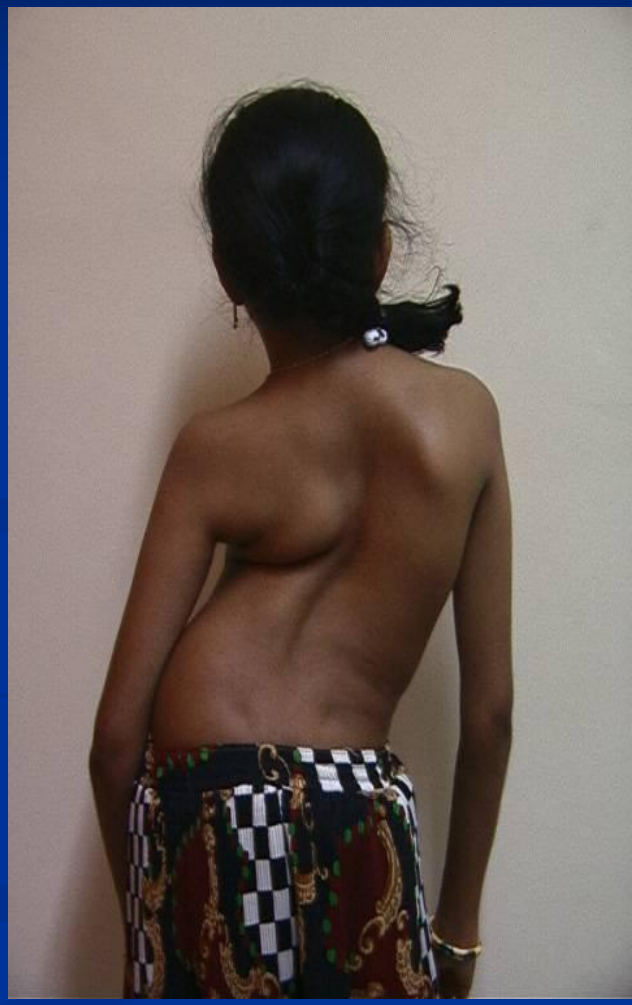
Pattern of progression

50% -severe progression

25% - slow progression

25% - non progressive

Winter et al JBJS 1996



Inheritance

Isolated hemivertebra - sporadic anomaly – no risk for siblings.

Multiple anomalies - 5-10% risk for future siblings.

Wynne-Davis J Med Gen 1975

1% of 1200 patients with congenital scoliosis has a known relative with the problem

Winter RB Congenital deformities of the spine 1983

Inheritance

Patients with multiple levels of bilateral failures of segmentation, with multiple fused ribs and missing segments have a positive family history.

- Spondylothoracic dysplasia
- Spondylocostal dysplasia
- Spondylovertebral dysplasia
- Jarcho-Levin Syndrome

Lonstein JE Principles and Techniques of Spine Surgery 1998

Natural history of progression

Site of curvature	Type of congenital anomaly					
	Block vertebra	Wedged vertebra	Hemivertebra: Single	Hemivertebra: Double	Unilateral unsegmented bar	Unilateral un-segmented bar and contralateral hemivertebrae
Upper thoracic	< 1°–1°	* – 2°	1°– 2°	2°– 2.5°	2°– 4°	5°– 6°
Lower thoracic	< 1°–1°	2°– 2°	2°– 2.5°	2°– 3°	5°– 6.5°	6°– 7°
Thoracolumbar	< 1°–1°	1.5°– 2°	2°– 3.5°	5°– *	6°– 9°	> 10°– *
Lumbar	< 1°– *	< 1°– *	< 1°–1°	*	> 5°– *	*
Lumbosacral	*	*	< 1°–1.5°	*	*	*

No treatment required May require spinal fusion Require spinal fusion

McMaster and Ohtsuka JBJS (A)1982

Natural history of congenital scoliosis

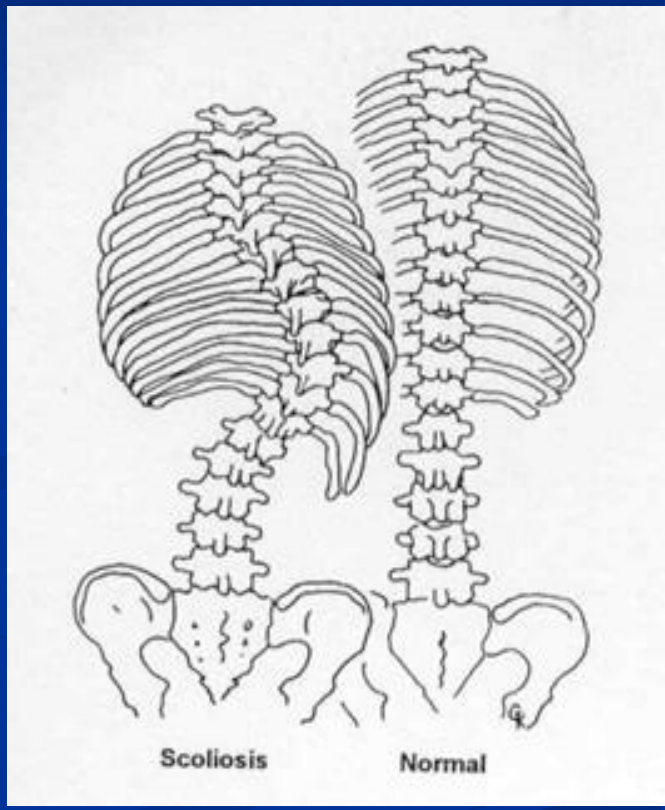
Site of curvature	Type of congenital anomaly					
	Block vertebra	Wedged vertebra	Hemivertebra: Single	Hemivertebra: Double	Unilateral unsegmented bar	Unilateral unsegmented bar and contralateral hemivertebrae
Upper thoracic	< 1°–1°	* – 2°	1°– 2°	2°– 2.5°	2°– 4°	5°– 6°
Lower thoracic	< 1°–1°	2°– 2°	2°– 2.5°	2°– 3°	5°– 6.5°	6°– 7°
Thoracolumbar	< 1°–1°	1.5°– 2°	2°– 3.5°	5°– *	6°– 9°	> 10°– *
Lumbar	< 1°– *	< 1°– *	< 1°–1°	*	> 5°– *	*
Lumbosacral	*	*	< 1°–1.5°	*	*	*

No treatment required — May require spinal fusion — Require spinal fusion

Fig. 4. McMaster prognosis. (Data from McMaster and Ohtsuka (1982).)

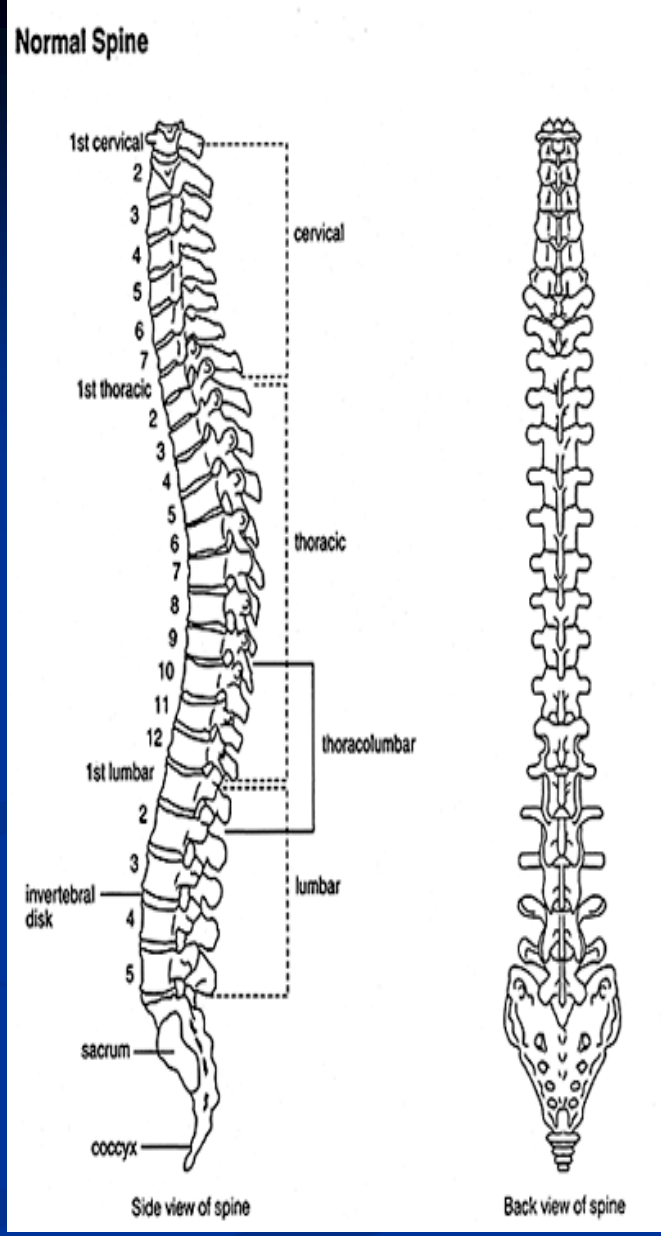
Philosophy of surgical treatment

- Minimal concave growth potential.
- Child may be taller if fusion is done earlier.
- Better to be short and straight than shorter and crooked.
- Limited role for bracing



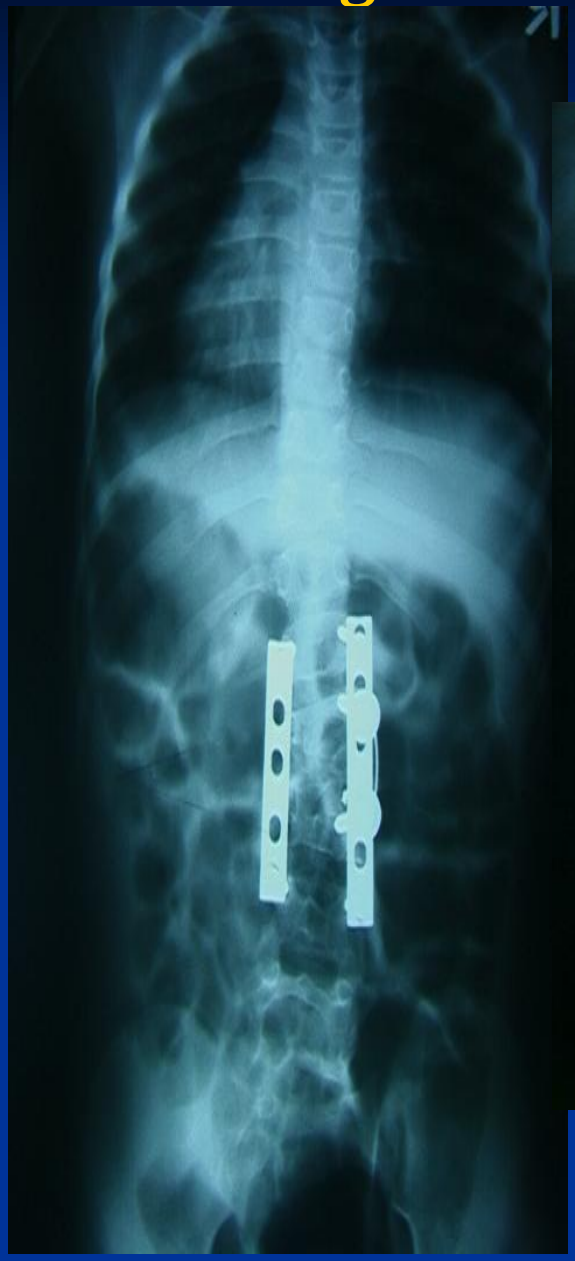
Surgical options

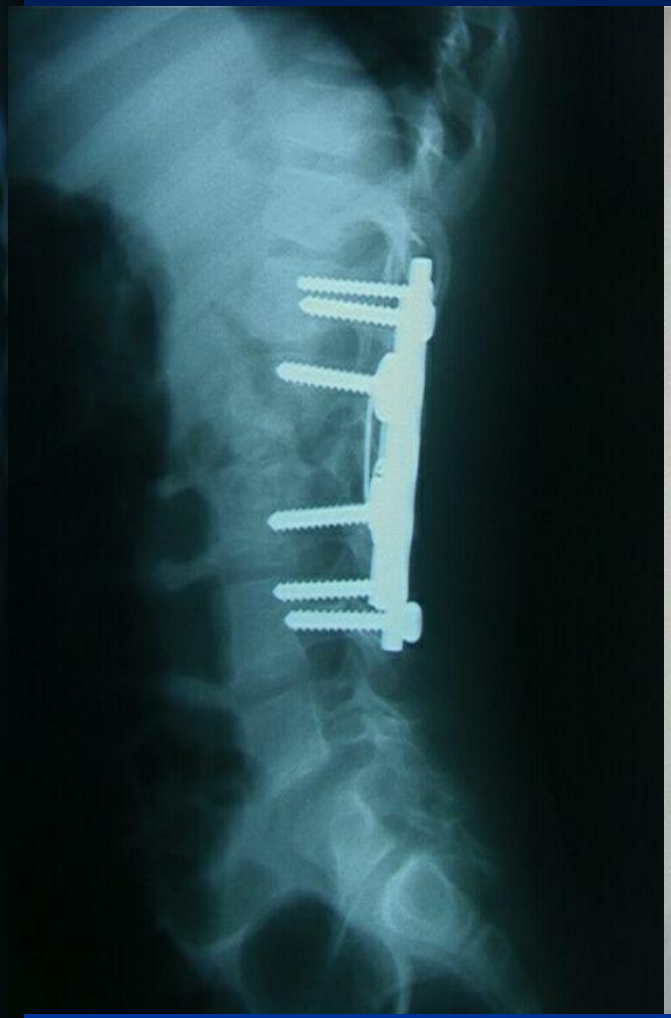
- Posterior fusion
- Anterior and posterior fusion
- Convex hemiepiphysiodesis
- Hemivertebra excision
- Growth rods / Shilla technique
- Anterior stapling
- VEPTR
  (vertical expandable prosthetic titanium rib)

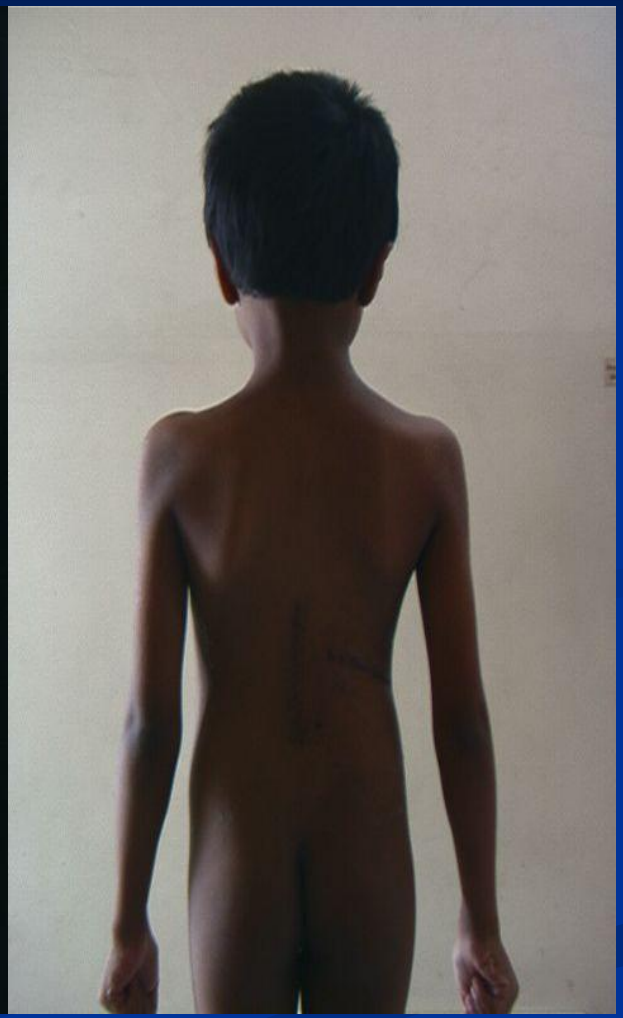


Cobbs angle = 20 ^{0}

No coronal decompensation







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