Ortho postgraduate teaching programme

Radiological assessment of spinal deformity

Zoom meeting ID- 5076140228
Password- 1981
Time- 6pm – 7pm
Date- 18-5-2020

An initiative by Midwest orthoclub

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Consultant spine surgeon,
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Radiology in scoliosis

- X-ray
- Computed tomography (CT Scan)
- Magnetic resonance imaging (MRI)

Whole spine X-ray

- Standing AP view
- Standing Lat view
- Stress views- bending view (supine)
  - traction view
  - fulcrum bending view

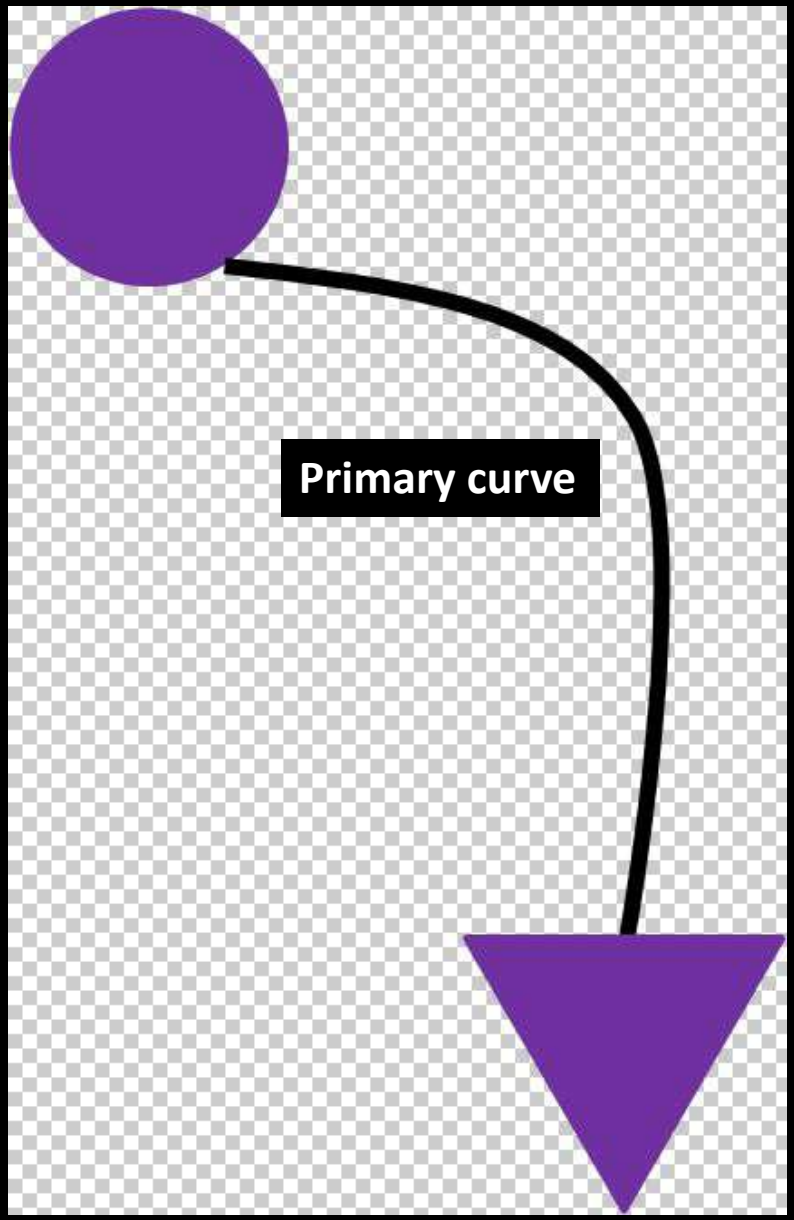
Standing AP view

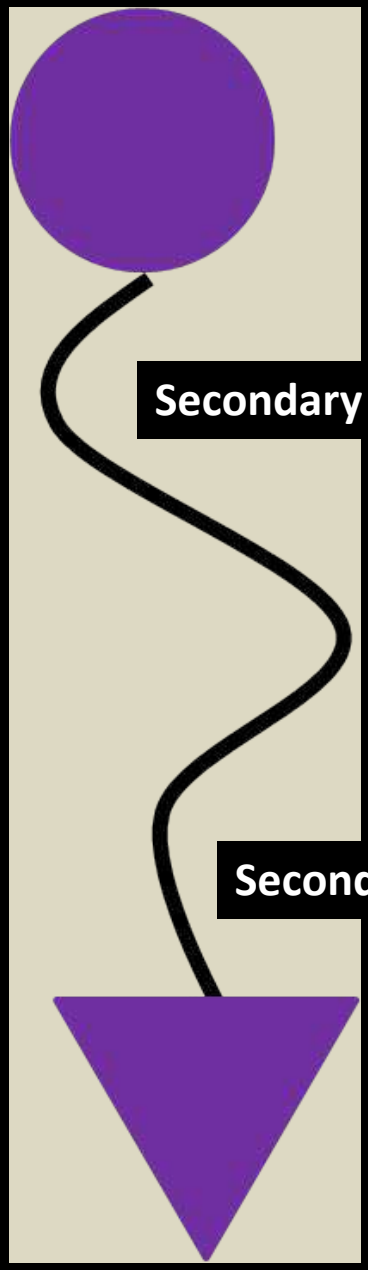
- Apex
- End vertebrae
- Neutral vertebrae
- Stable vertebrae
- Curve magnitude
- Coronal balance

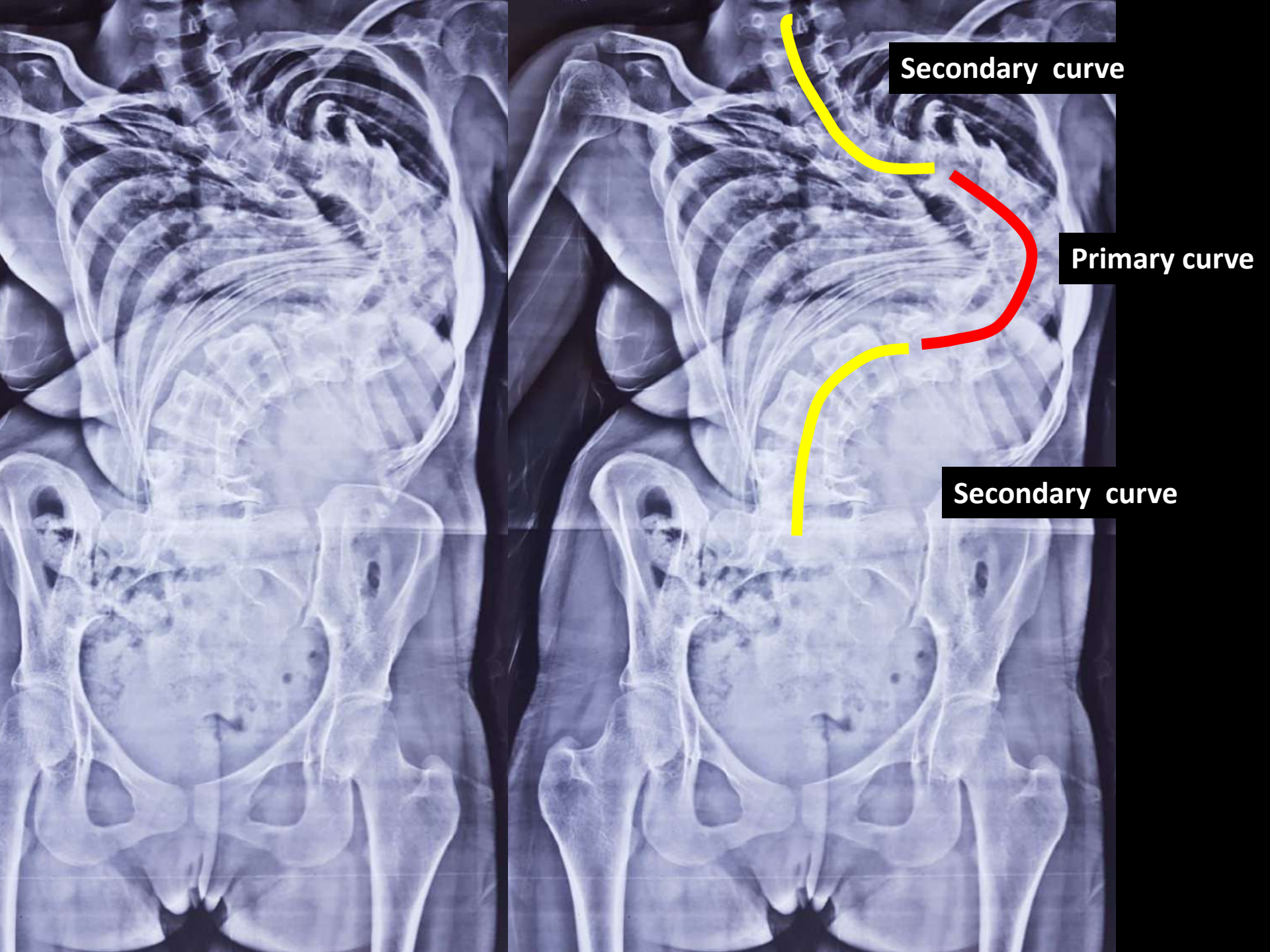
Whole spine xray

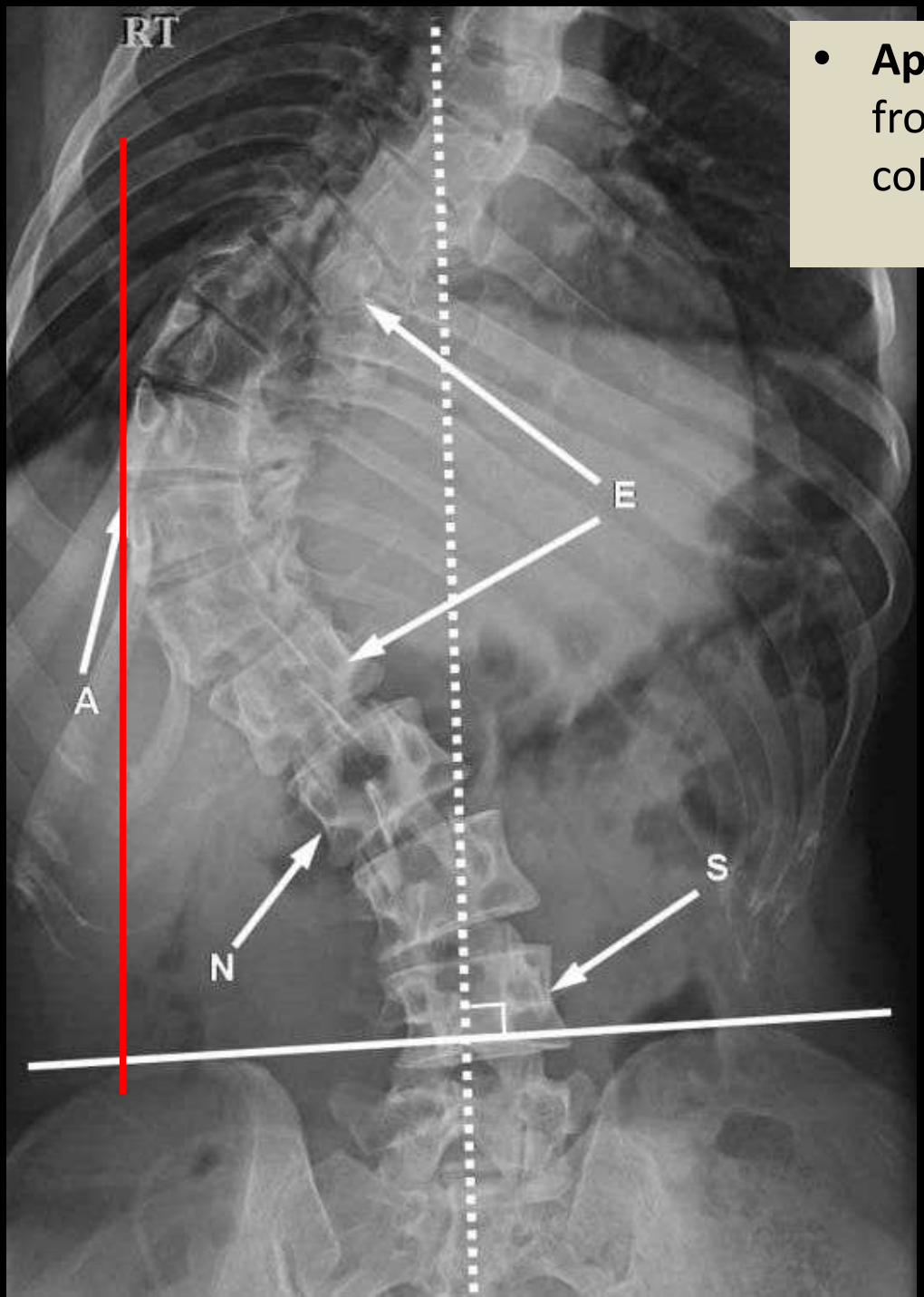
Why standing x ray

- Plane of deformity
- Side of deformity
- Severity of deformity
- Primary & secondary curve

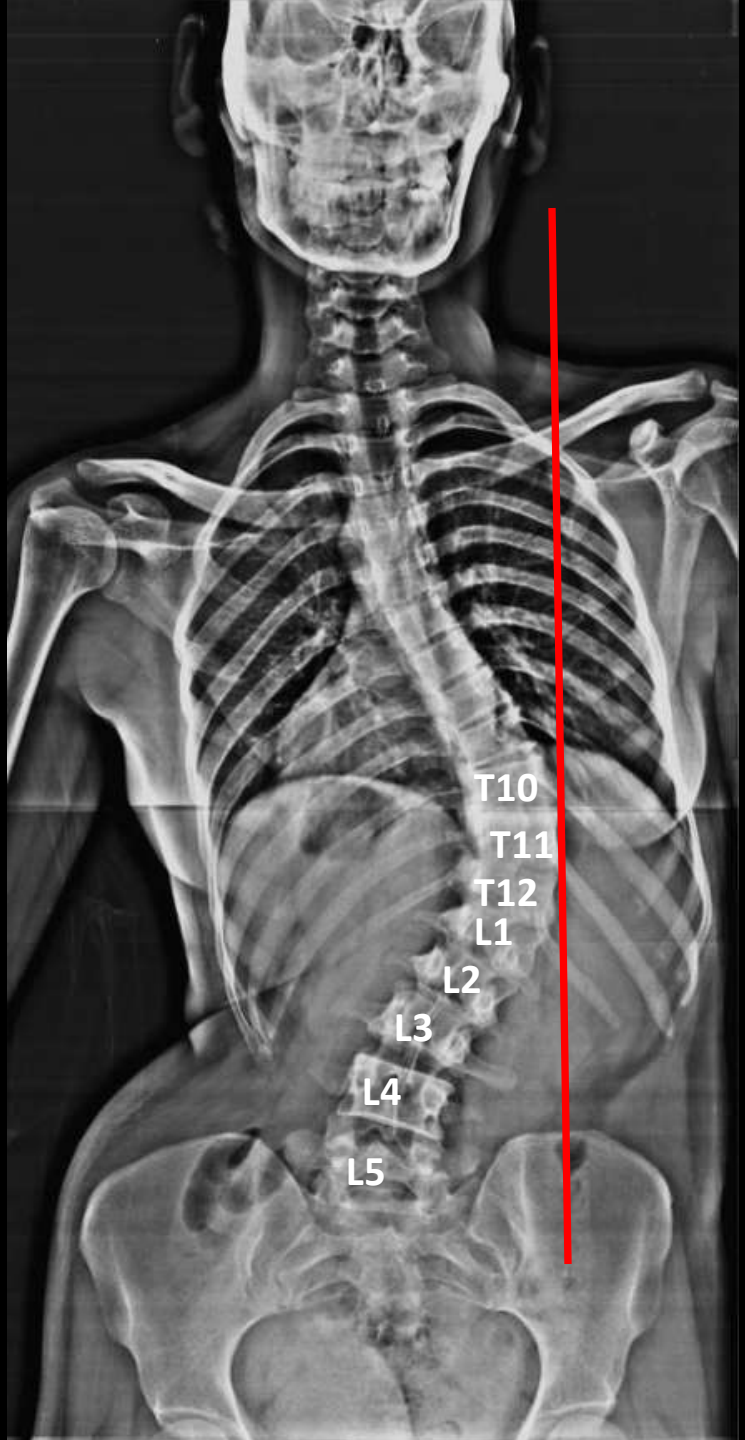

Primary curve

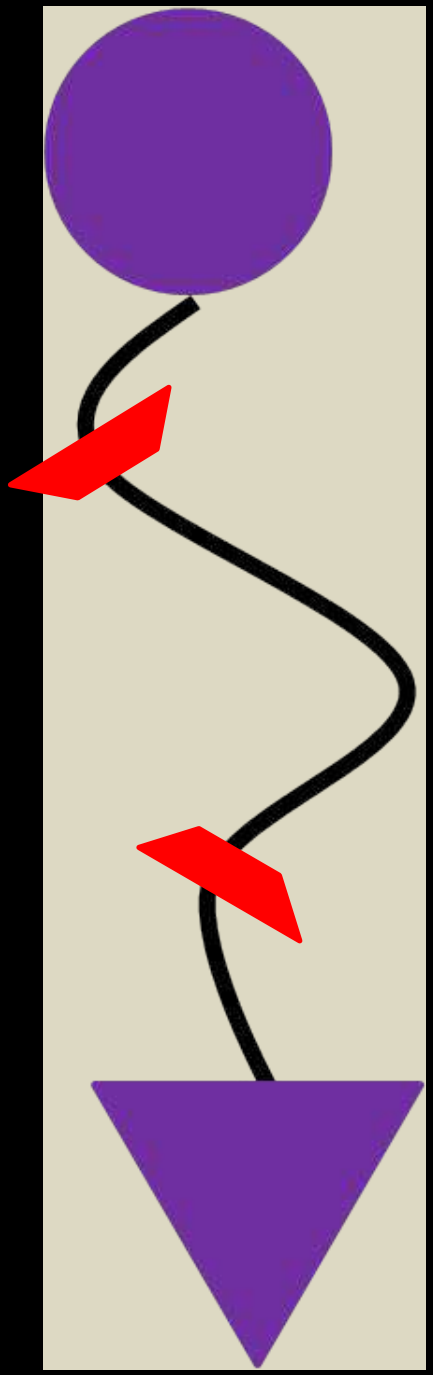

Secondary curve
Primary curve
Secondary curve


Secondary curve
Primary curve
Secondary curve

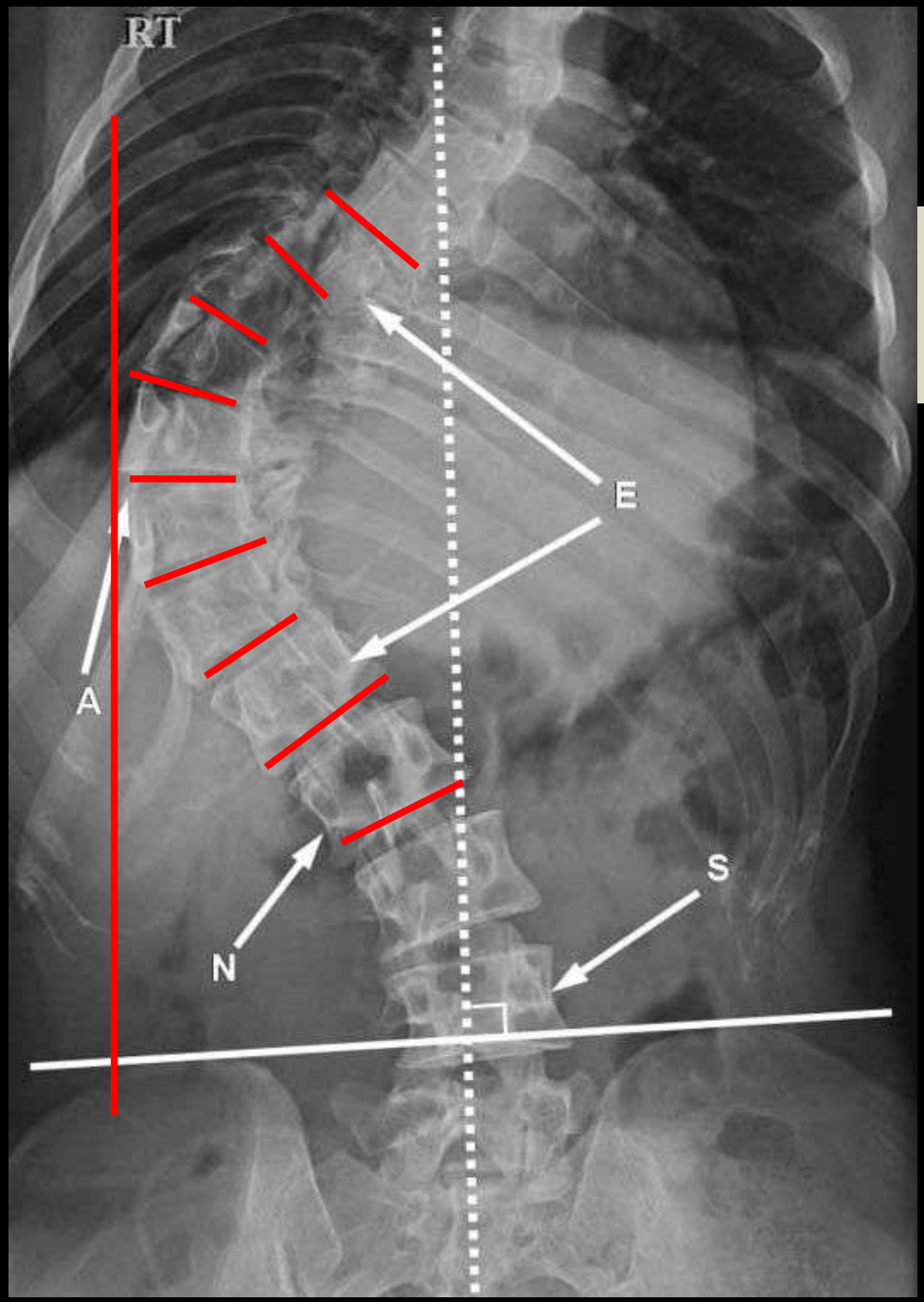


- **Apex vertebra(A)-** farthest deviation from the center of the vertebral column or **-(** greatest rotation)


T10
T11
T12
L1
L2
L3
L4
L5



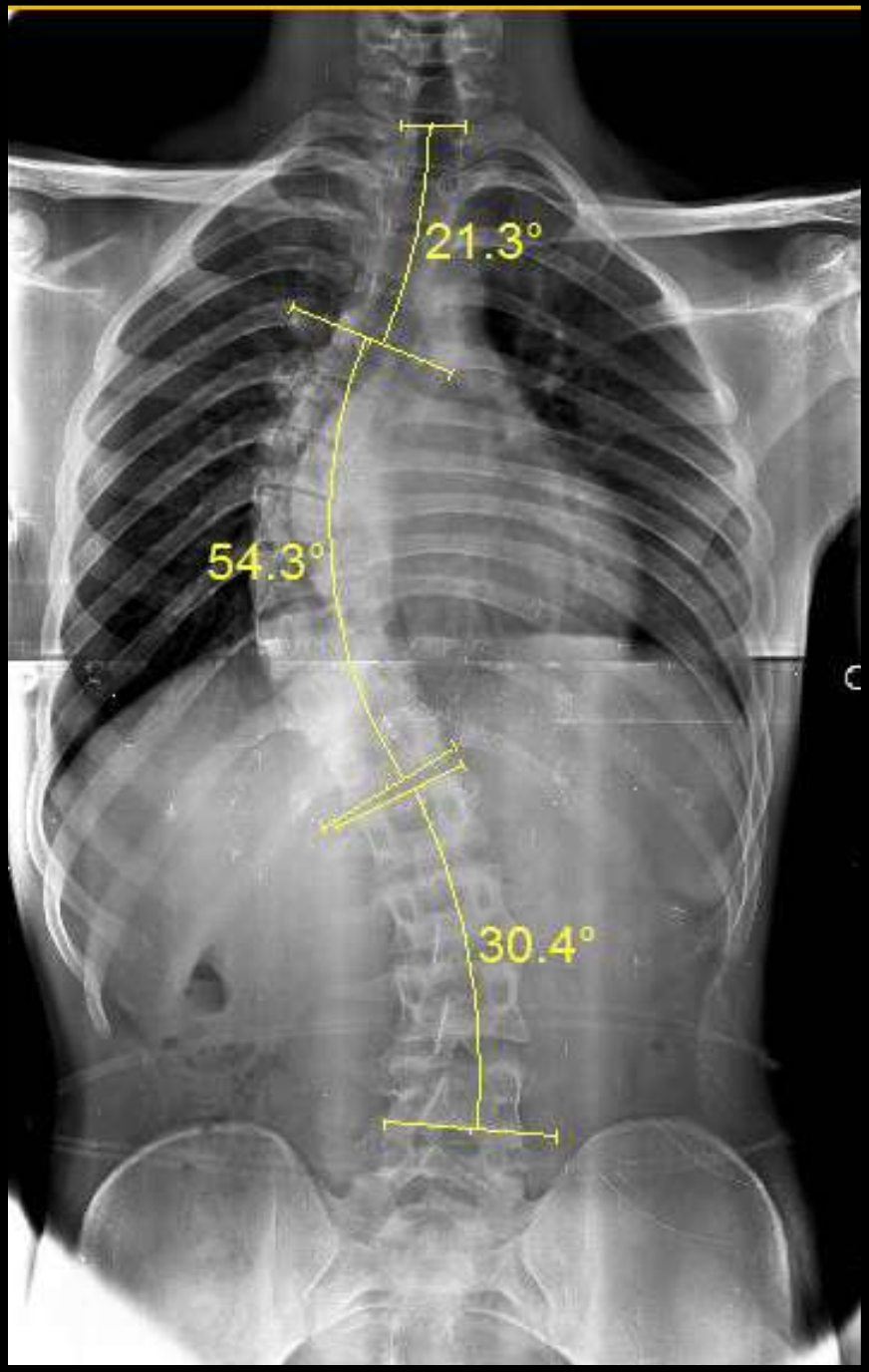
End vertebra

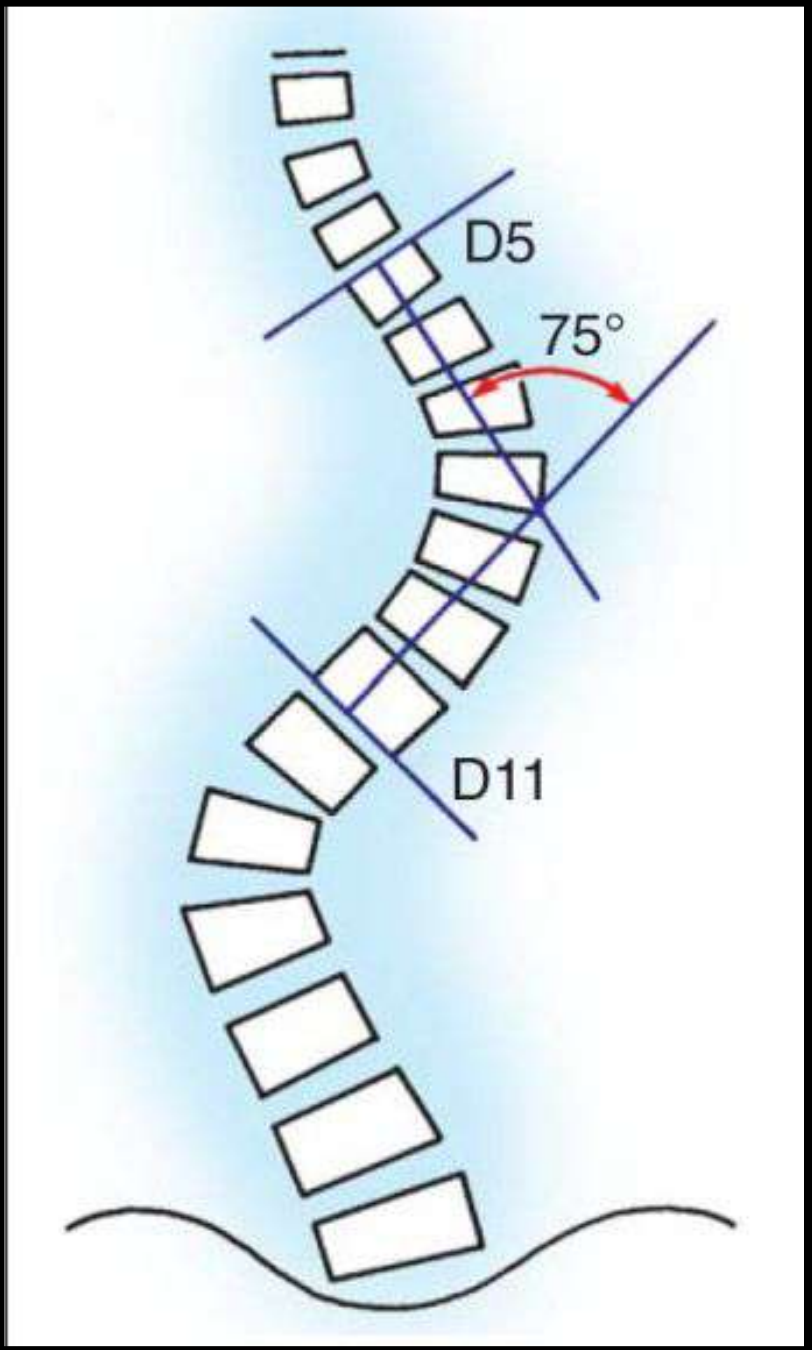


- **End vertebra(E)** - maximal tilt toward the apex of the curve

Cobbs angle

- Tangents along the **superior endplate of the superior end vertebra and the inferior endplate of the inferior end vertebra.**
- Endplates not visualized -the **borders of the pedicles used.**
- The Cobb angle - between the tangential lines or the angle between two lines drawn perpendicular to the tangents.


21.3°
54.3°
30.4°


D5
75°
D11

Cobbs angle

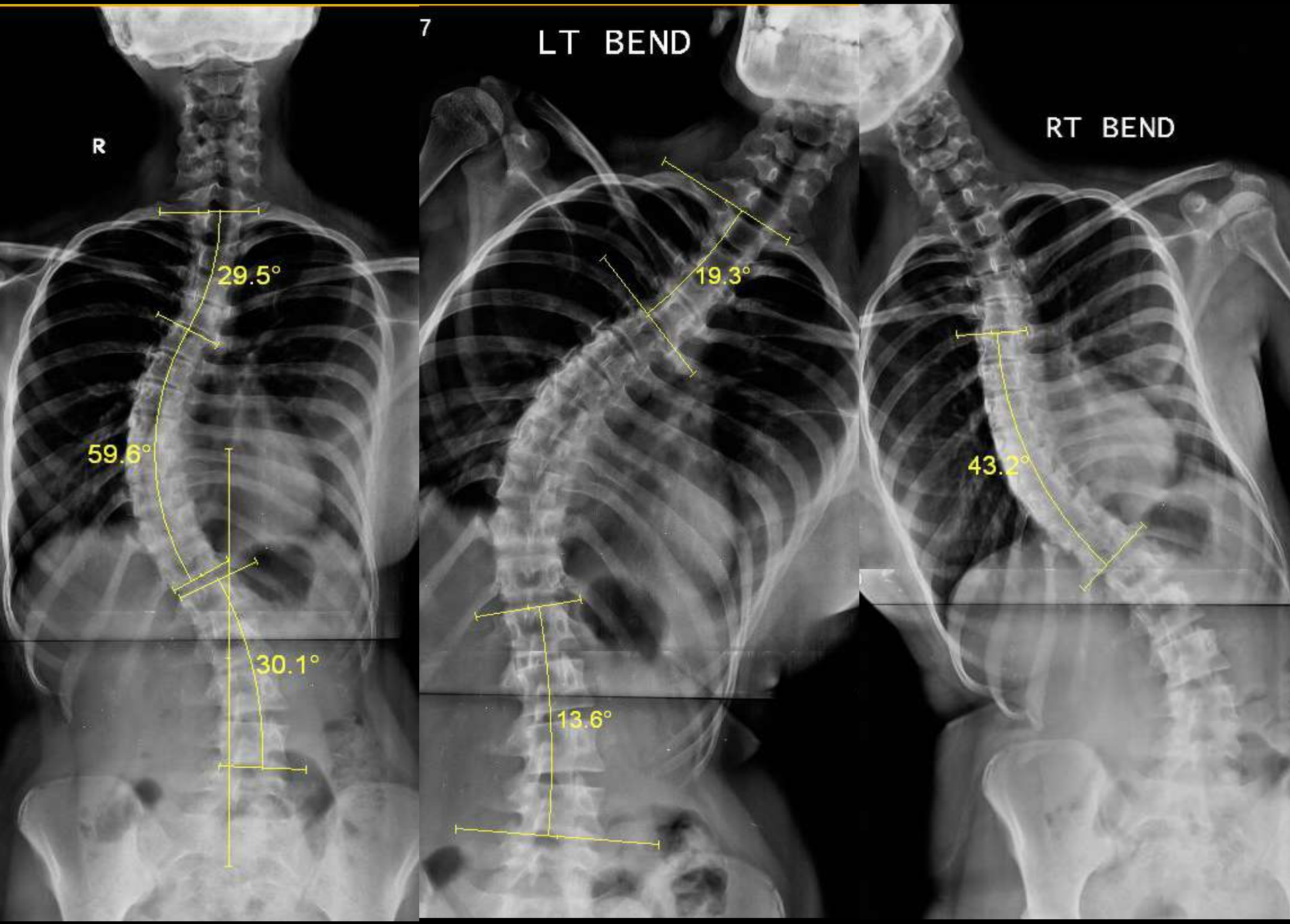
- The Scoliosis Research Society (SRS) definition of scoliosis - **lateral curvature of the spine greater than 10°**

- **Structural curve –**

  side bending cobbs ≥ 25 deg

- **Non structural curve –**

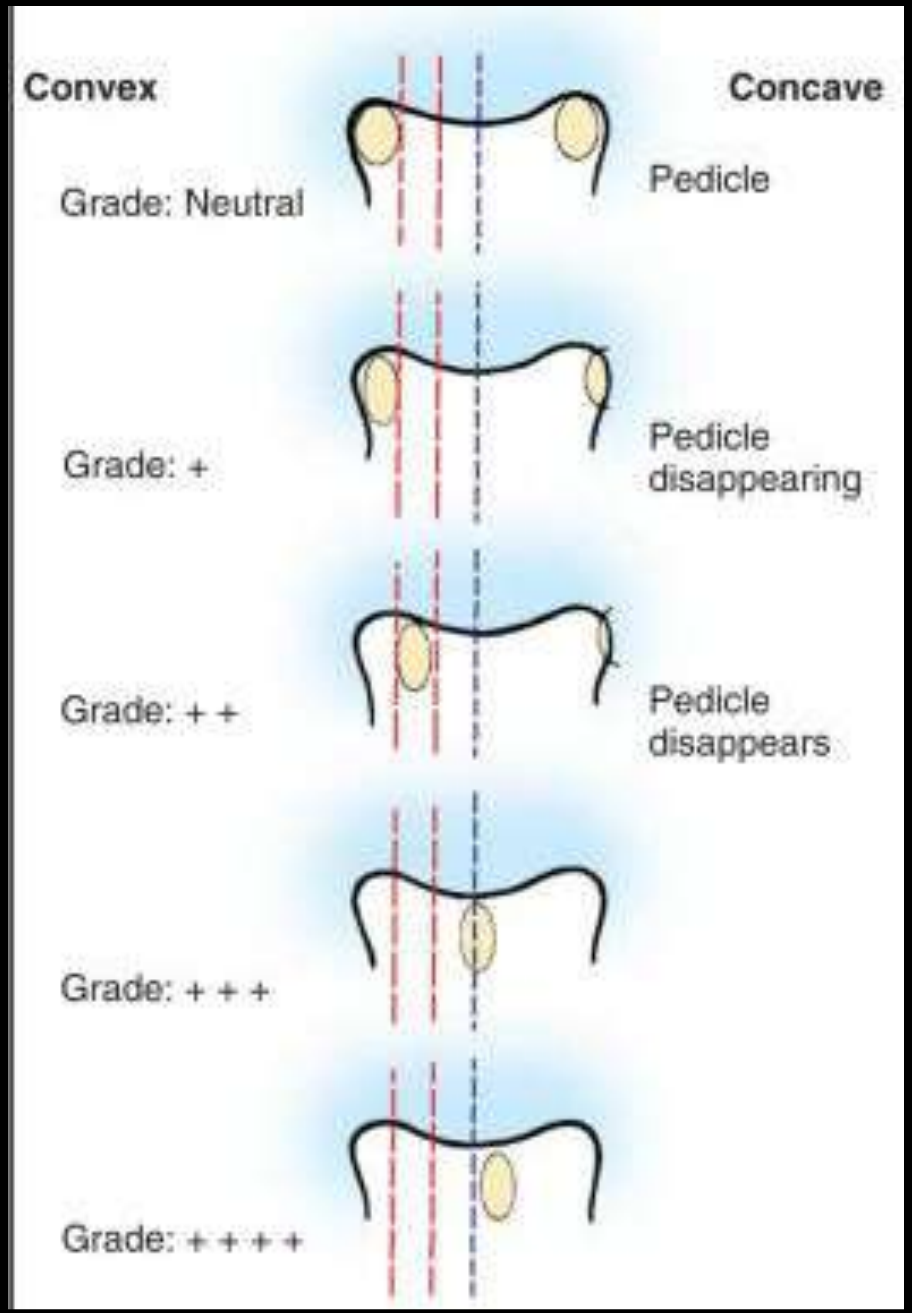
  side bending cobbs < 25 deg.

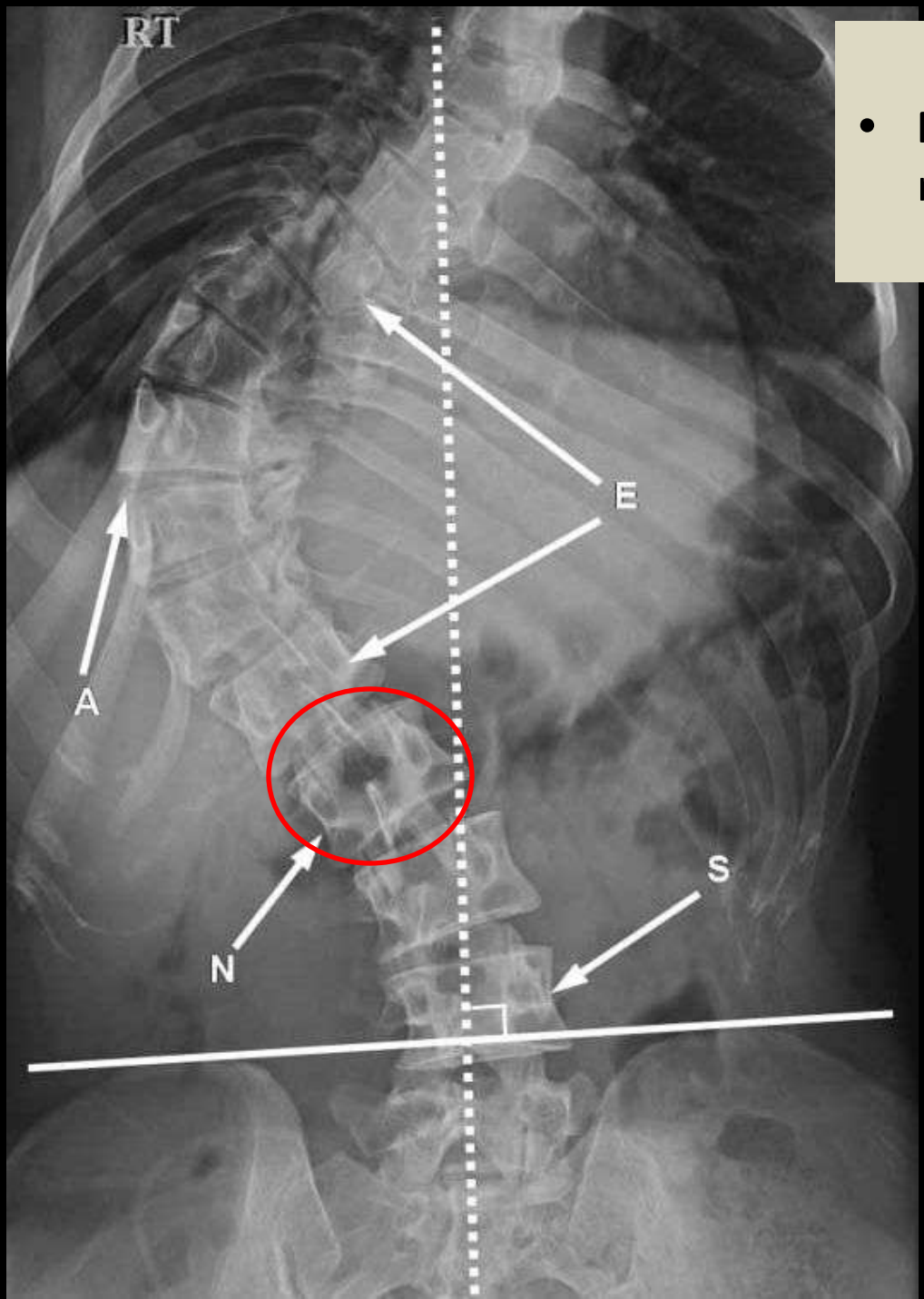

R
29.5°
59.6°
30.1°
7
LT BEND
19.3°
13.6°
RT BEND
43.2°


Angle : 103.6 deg
ENDING

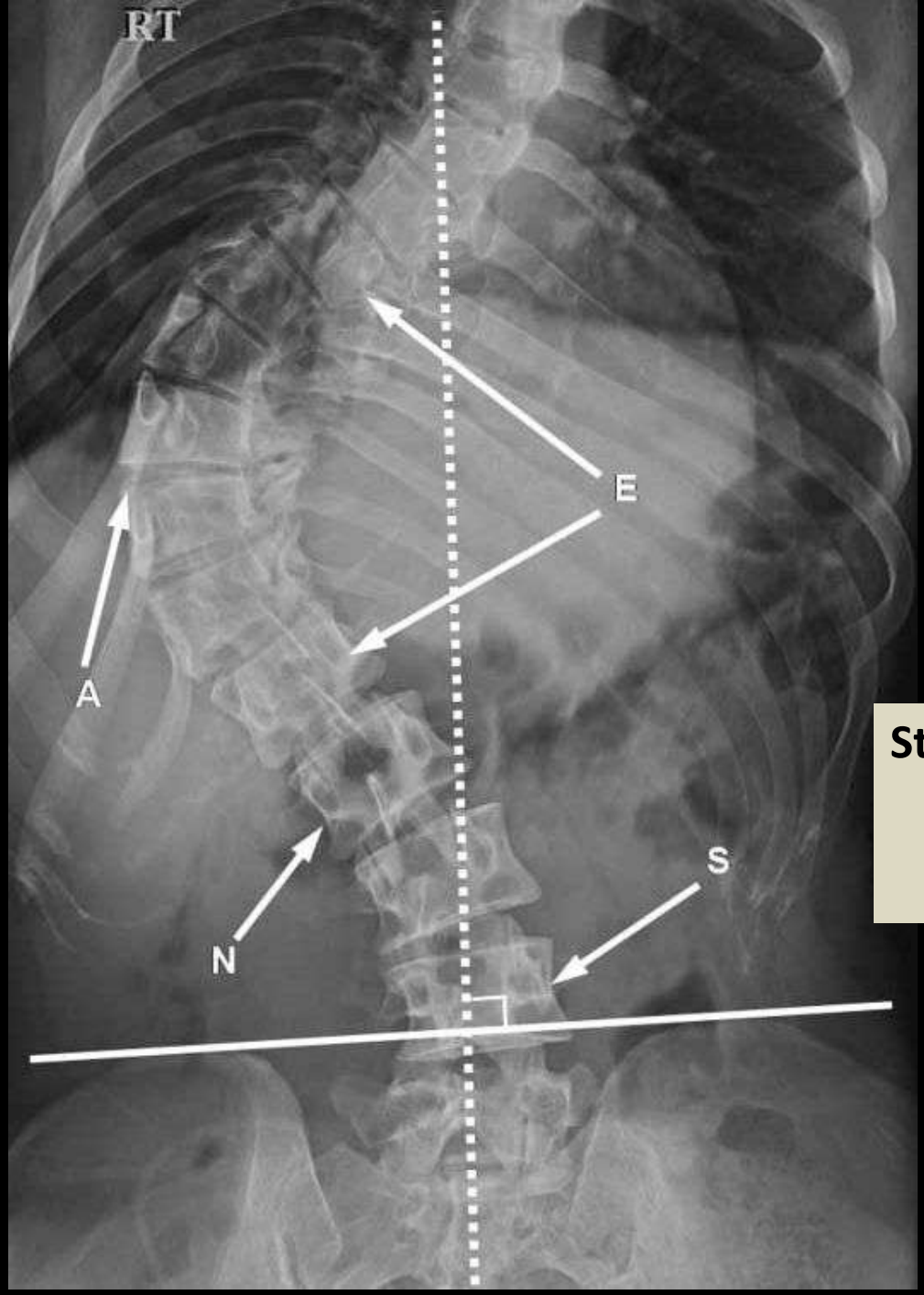

Angle : 10.4 deg
Angle : 14.2 deg




Convex
Concave
Grade: Neutral
Pedicle
Grade: +
Pedicle disappearing
Grade: + +
Pedicle disappears
Grade: + + +
Grade: + + + +

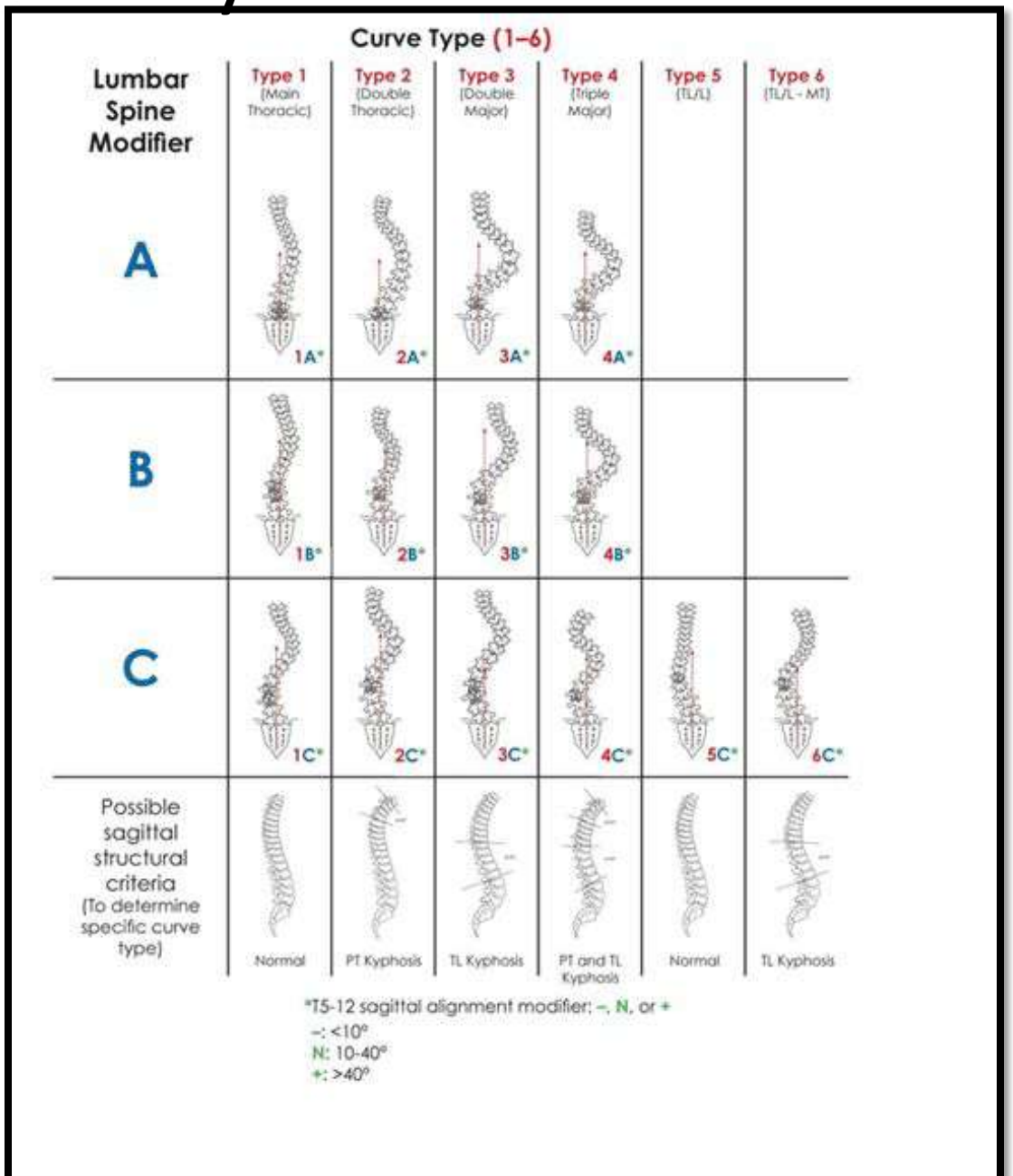


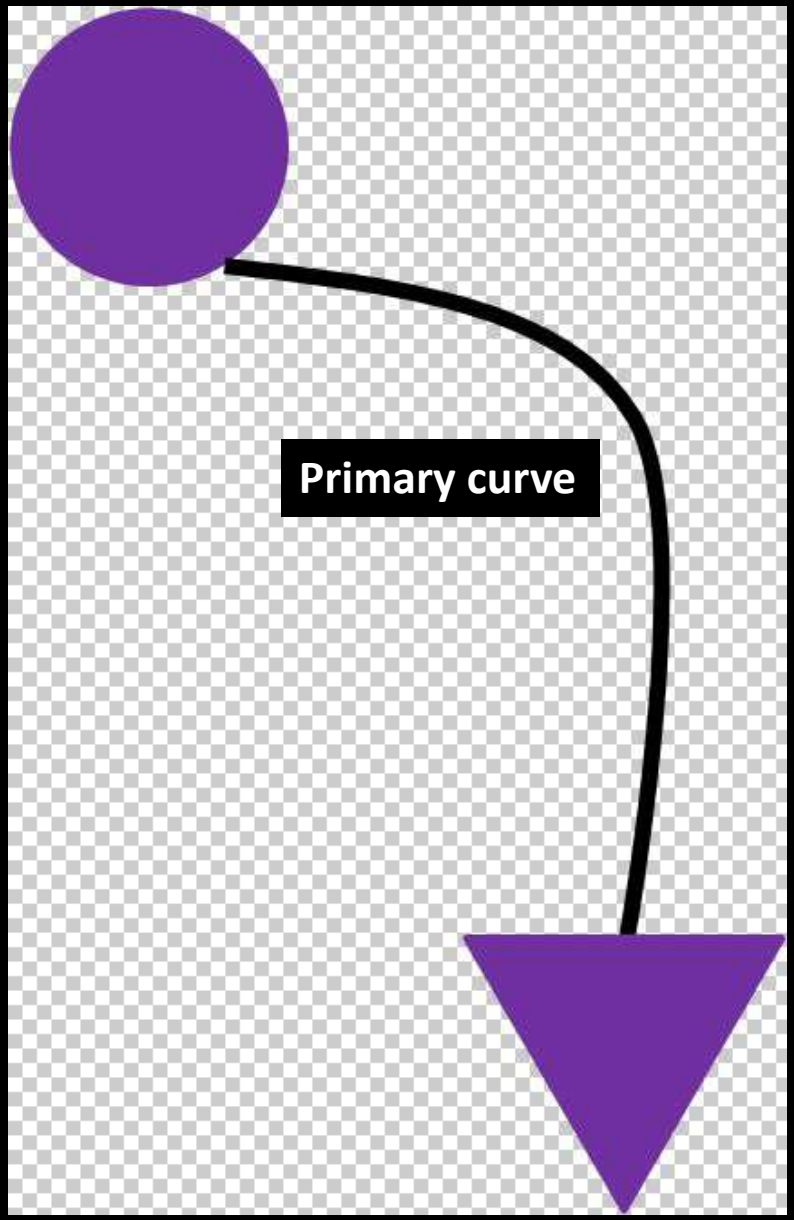
- **Neutral vertebra (N) -**is one that is not rotated.

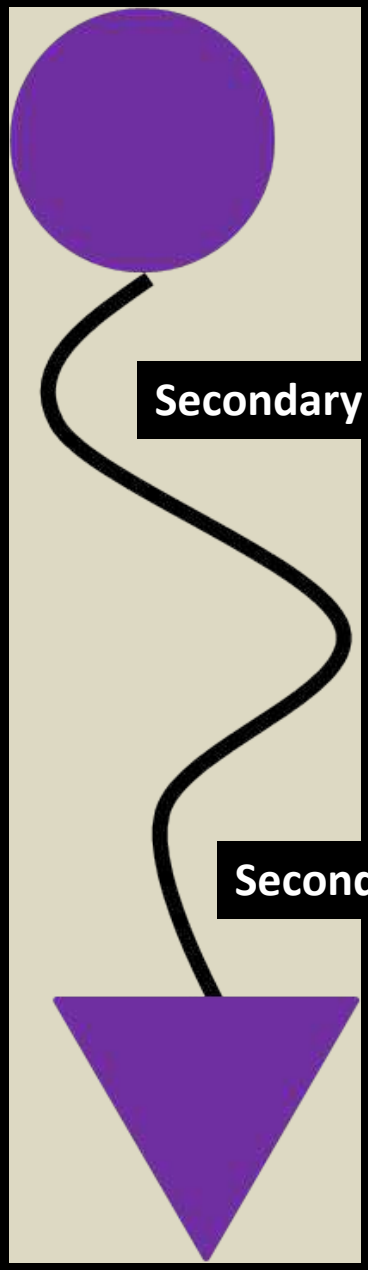


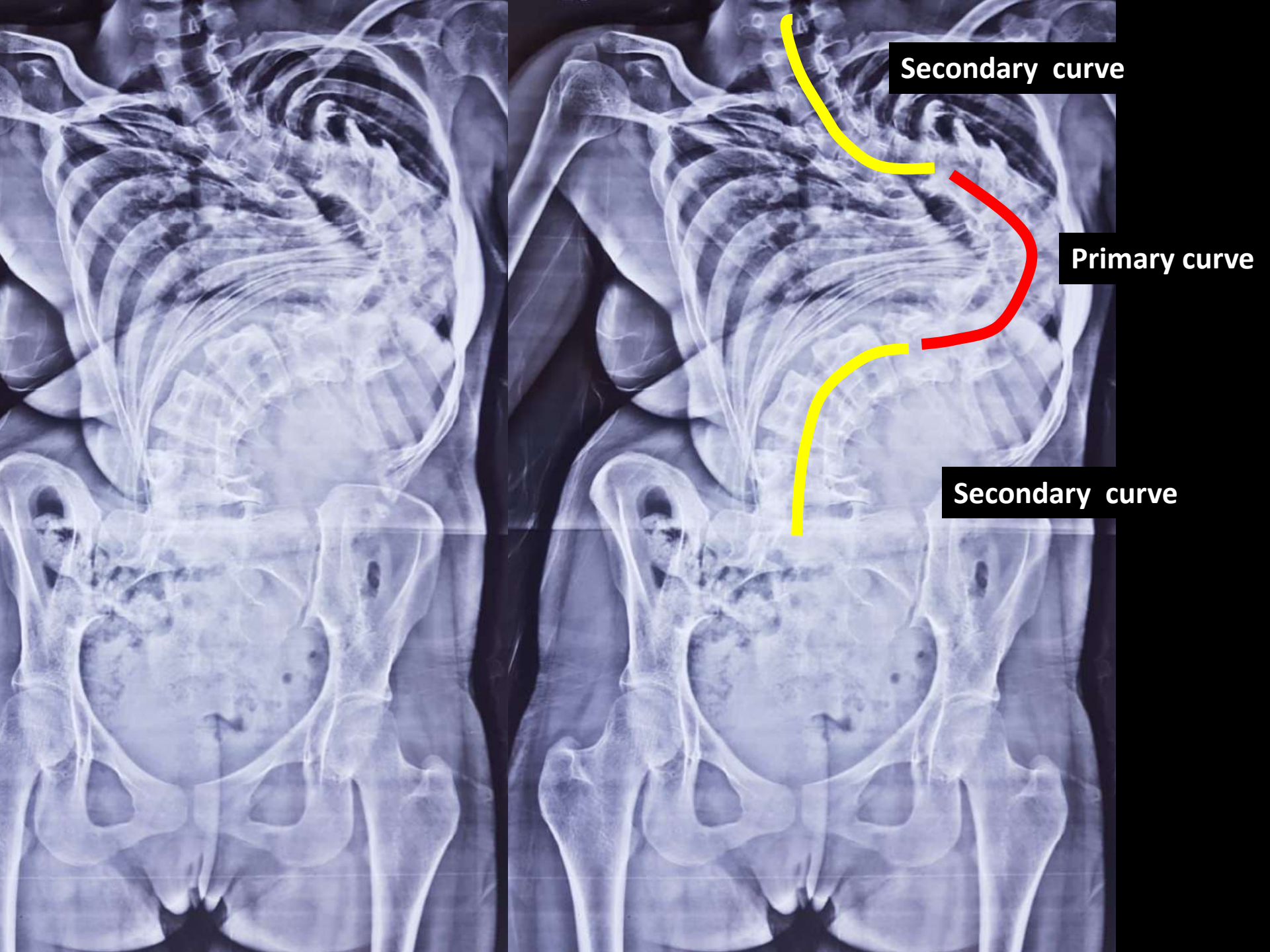
Stable vertebra (S) - is one that is bisected or nearly bisected by the CSVL (dotted line).

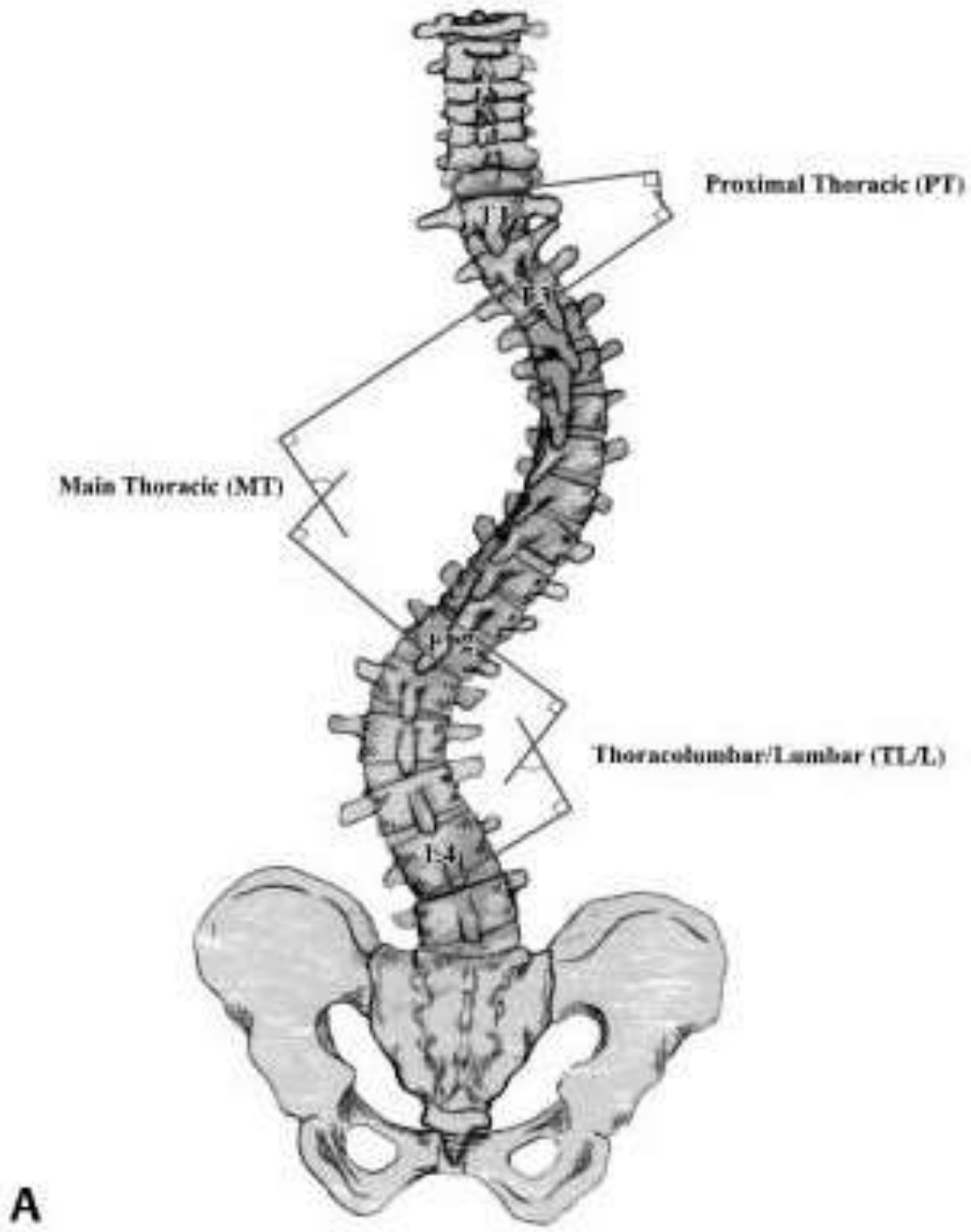
Lenkes system of classification



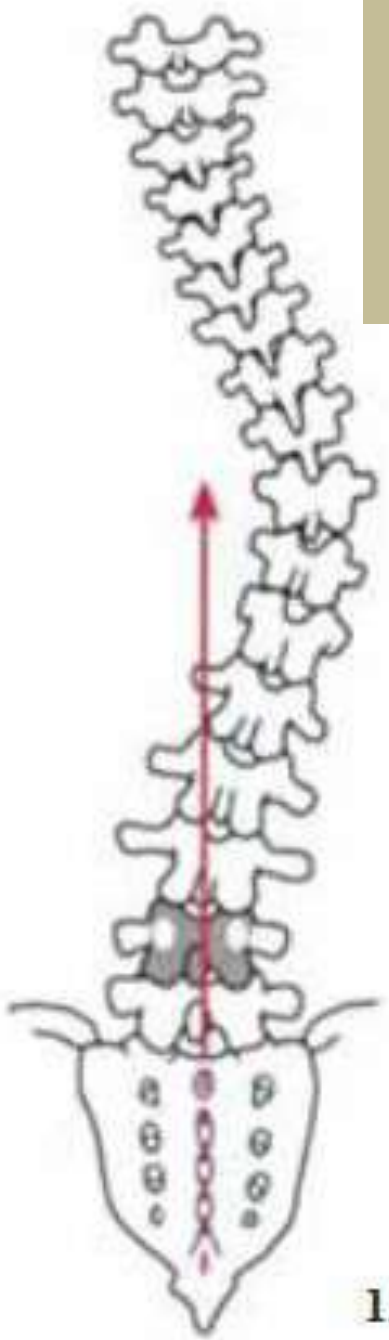

Primary curve


Secondary curve
Primary curve
Secondary curve

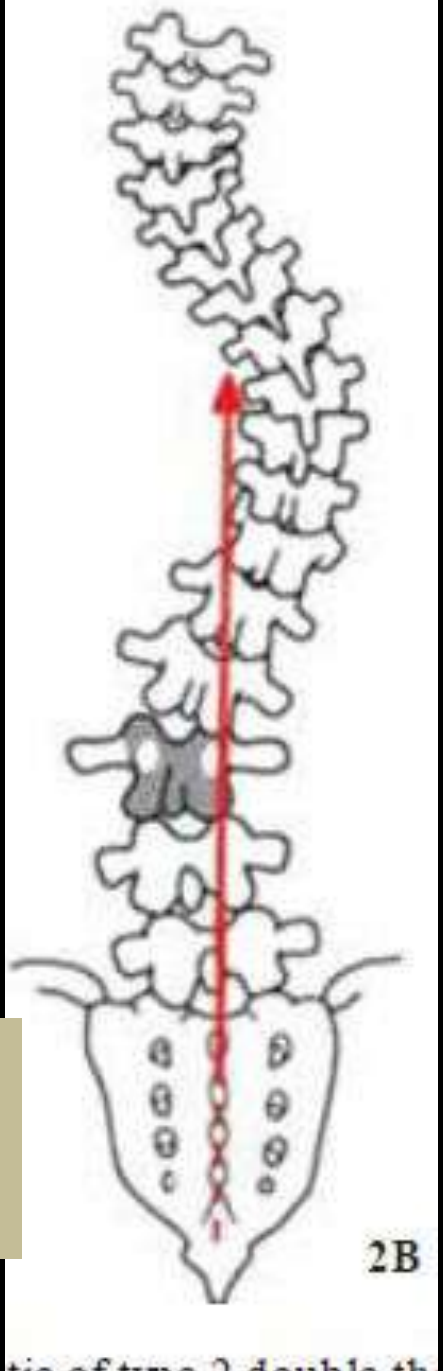

Secondary curve
Primary curve
Secondary curve

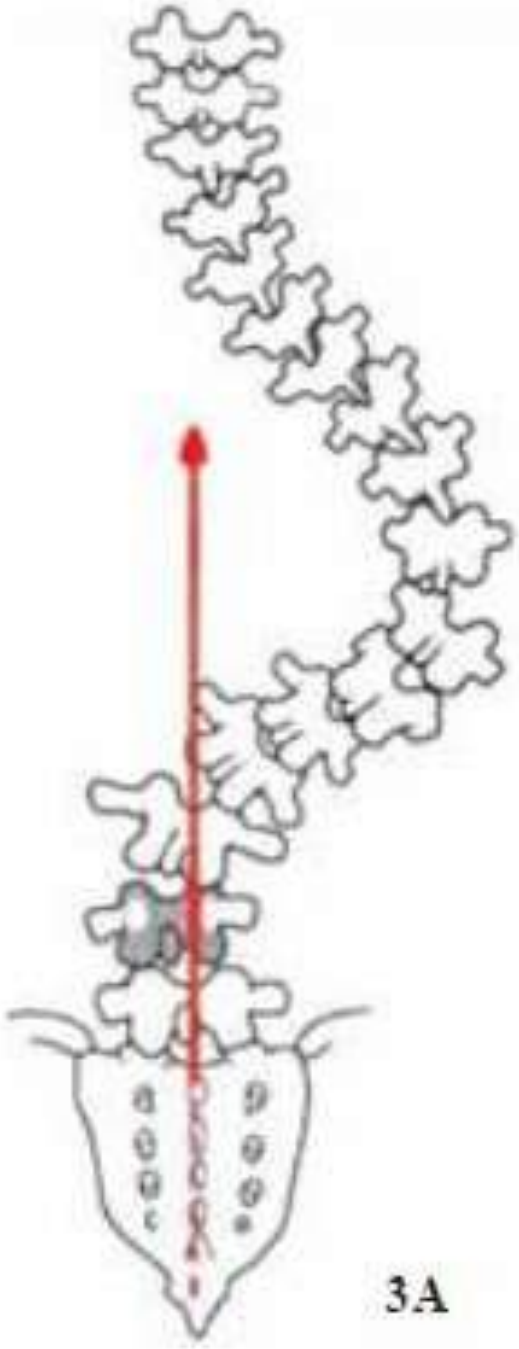

Proximal Thoracic (PT)
Main Thoracic (MT)
Thoracolumbar/Lumbar (TL/L)
A

Type 1
Main thoracic curve



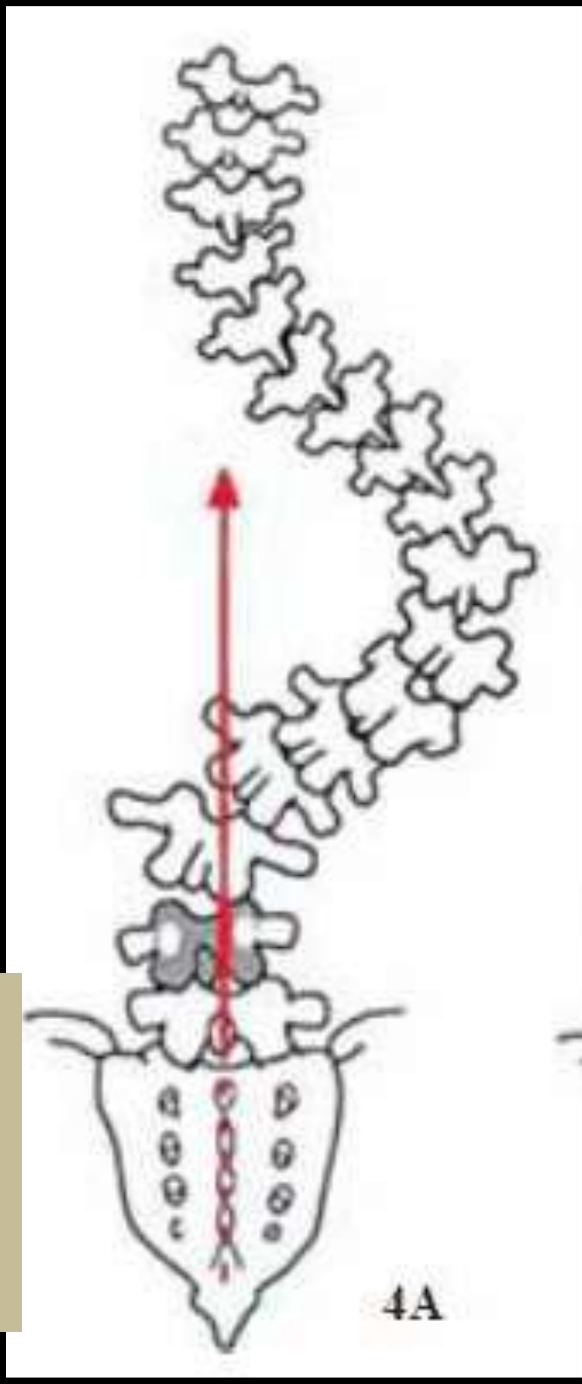
Lenke type-2
Double thoracic curve



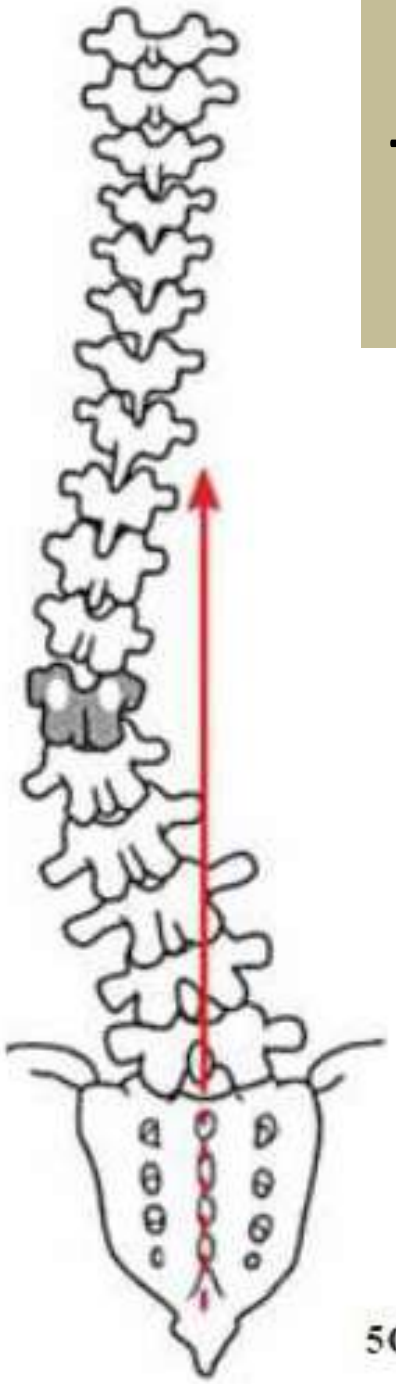


Type 3
Double major

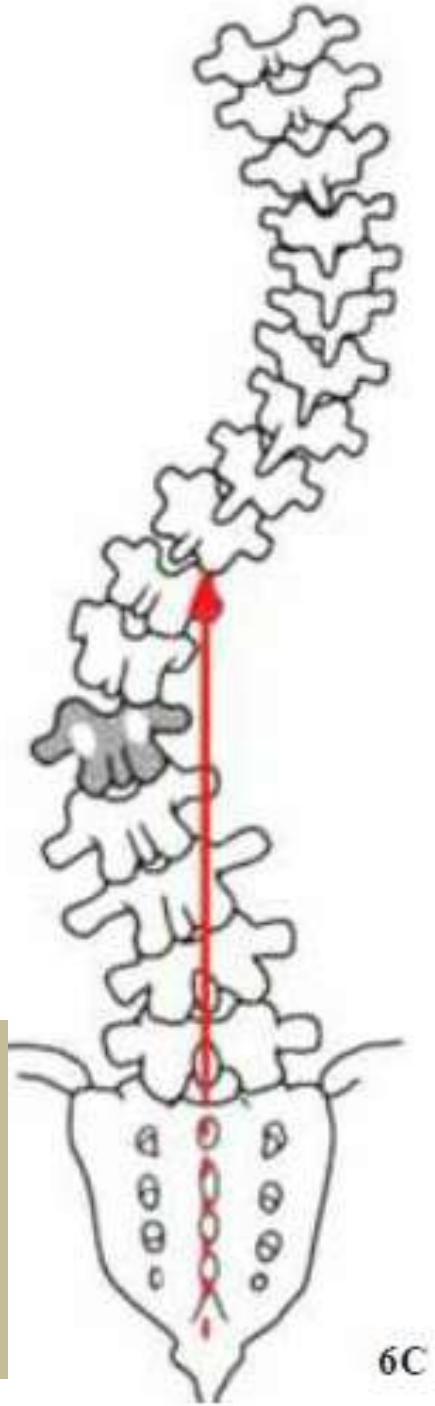
Type 4
Triple major



Type 5
Thoracolumbar/
Lumbar curve



Type 6
Thoracolumbar/
Lumbar curve with
Main thoracic curve



Assessment of Vertebral Alignment and Balance

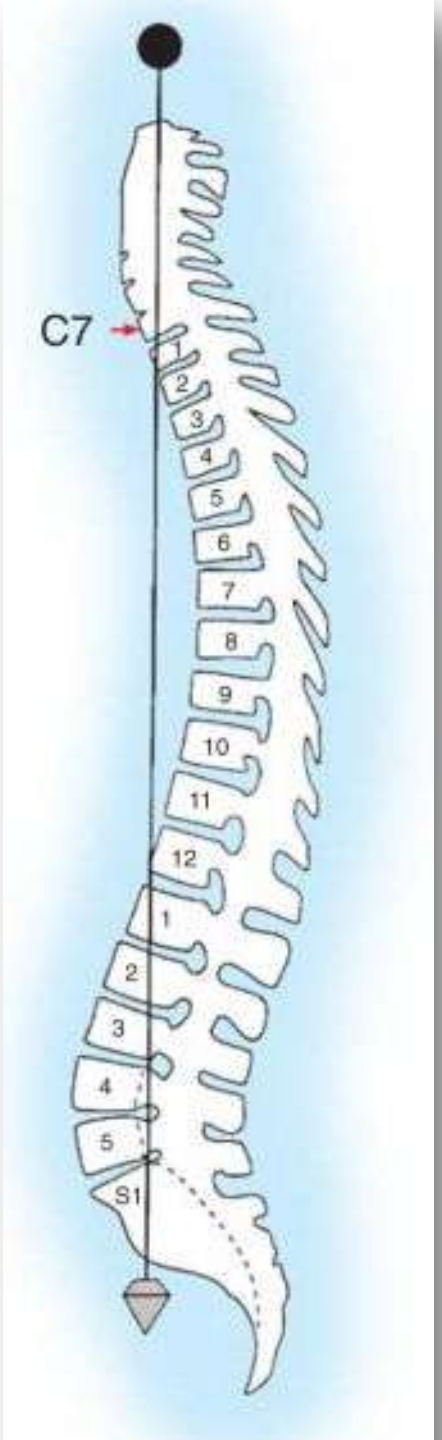
- **The plumb line** is a vertical line drawn downward from the center of the C7 vertebral body
- **Coronal balance** - distance between the CSVL and the plumb line
- Balance is considered abnormal if the distance is greater than 2 cm

C7 plumb line

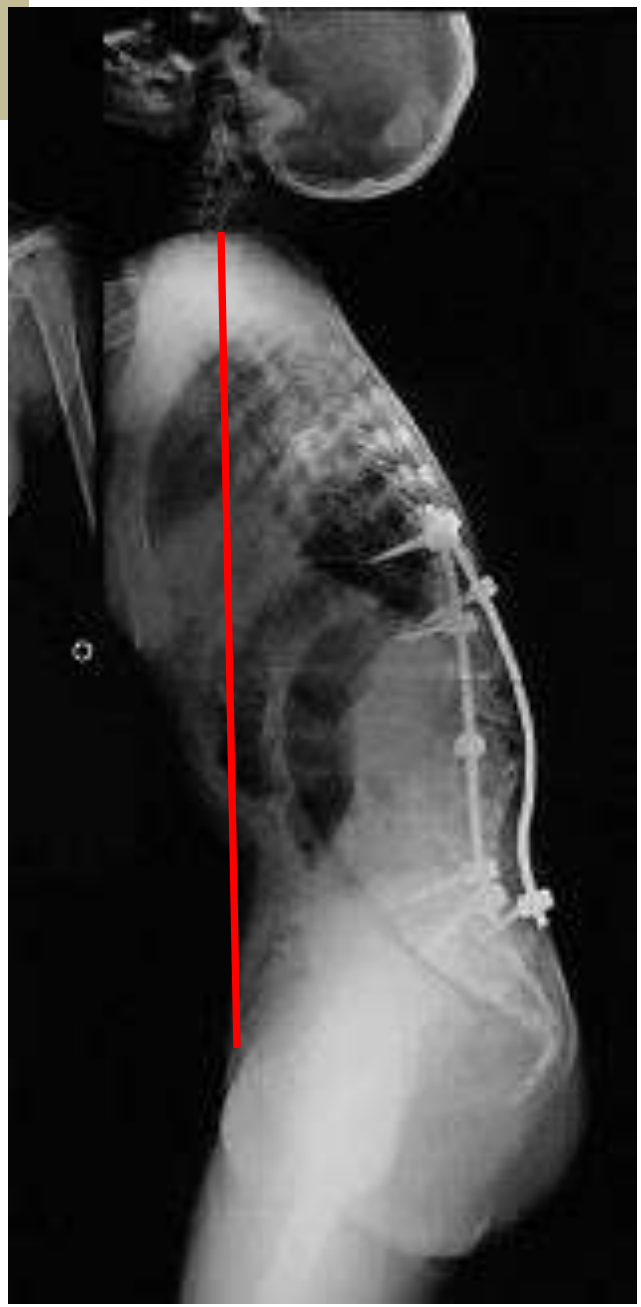
Central sacral vertical line

- **Sagittal balance** - distance between the posterosuperior aspect of the S1 vertebral body and the plumb line.

- Imbalance if > 2 cm



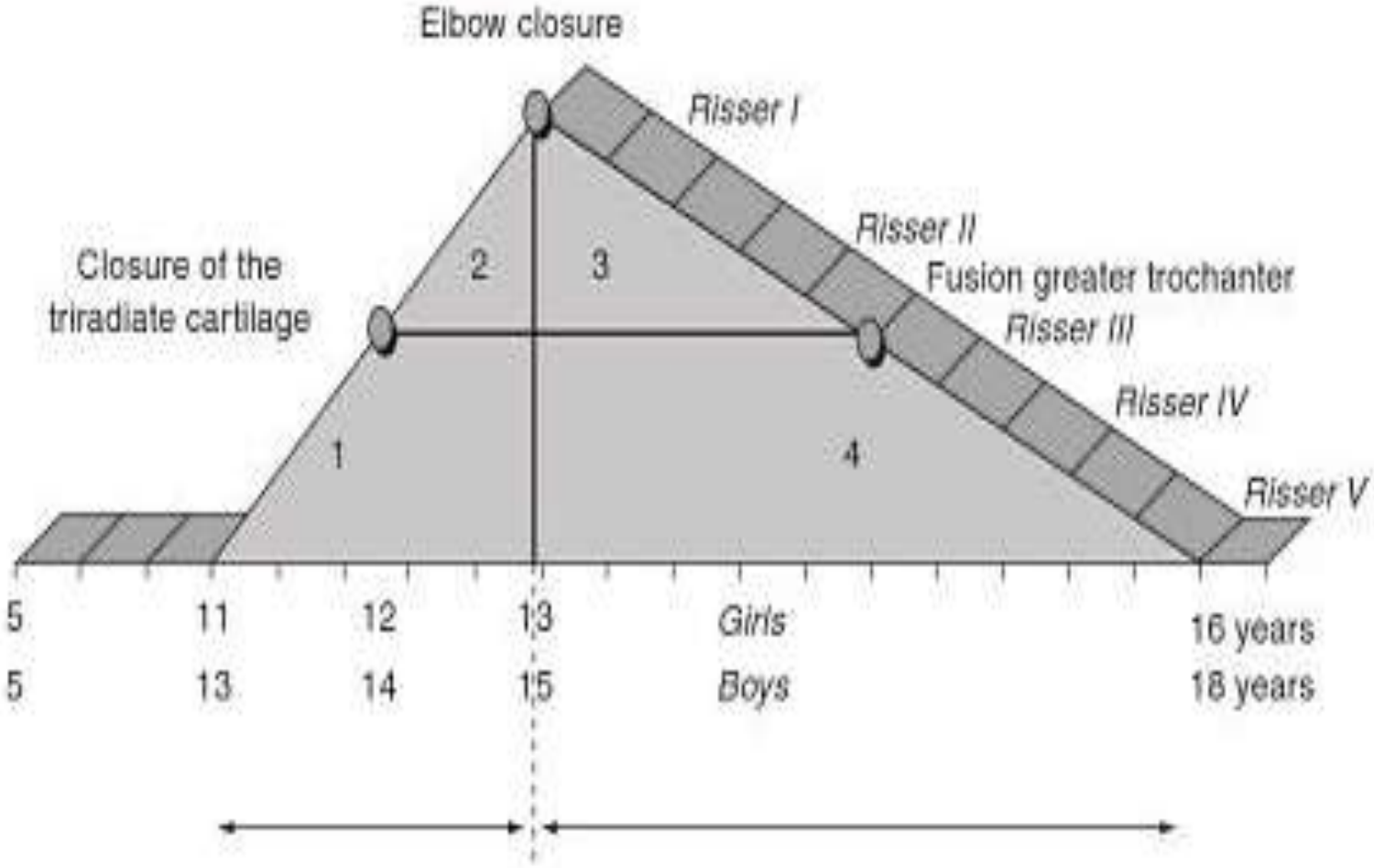
Sagittal balance



Positive sagittal imbalance

Stagnara view

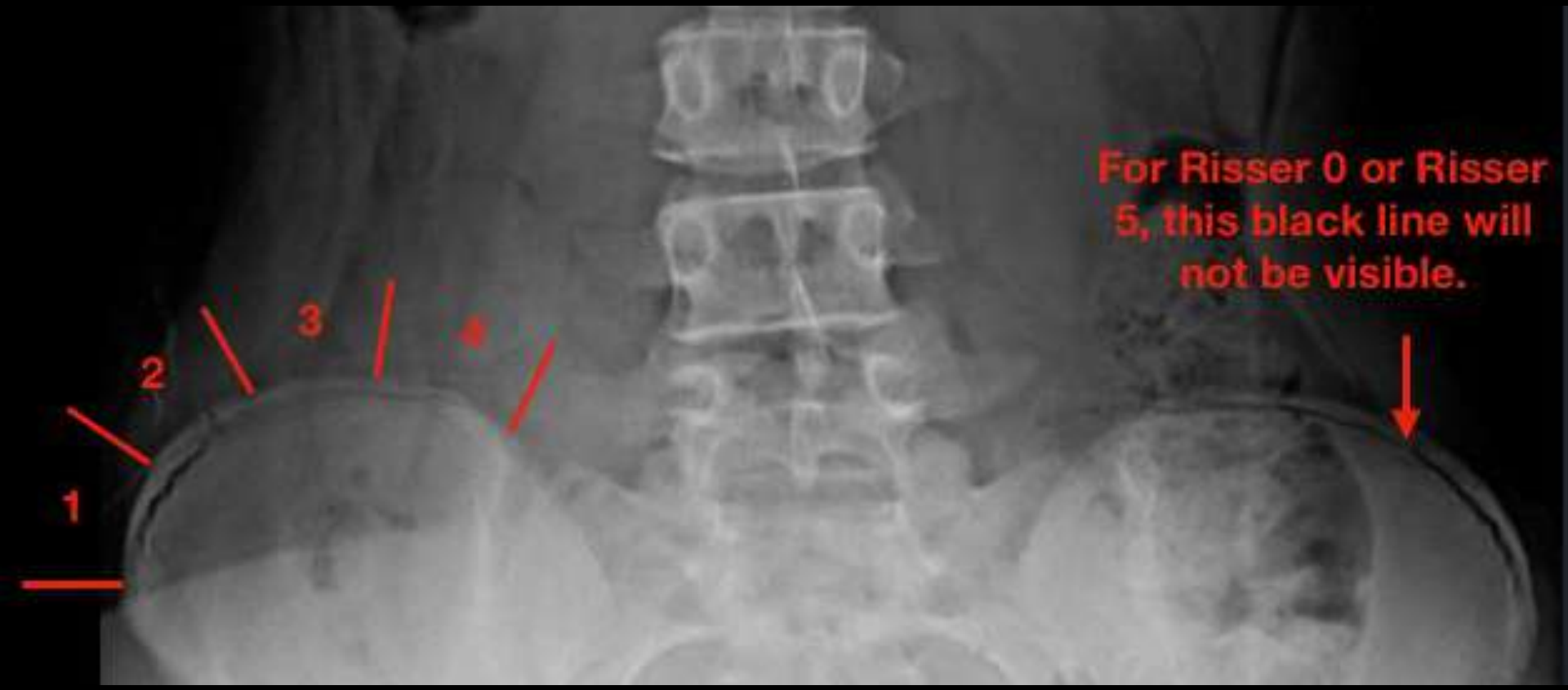
Assessment of progression

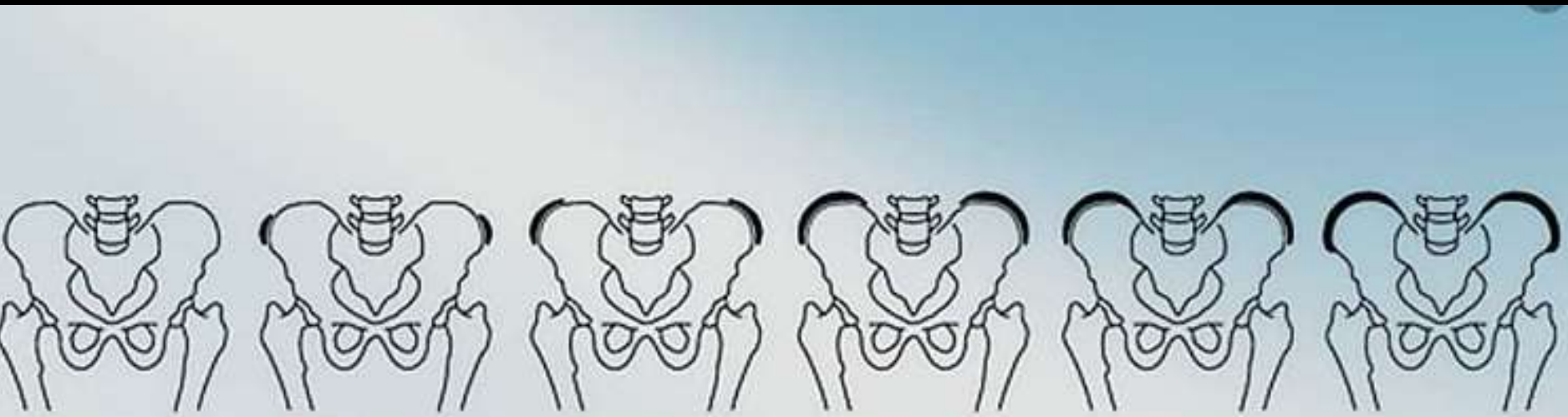


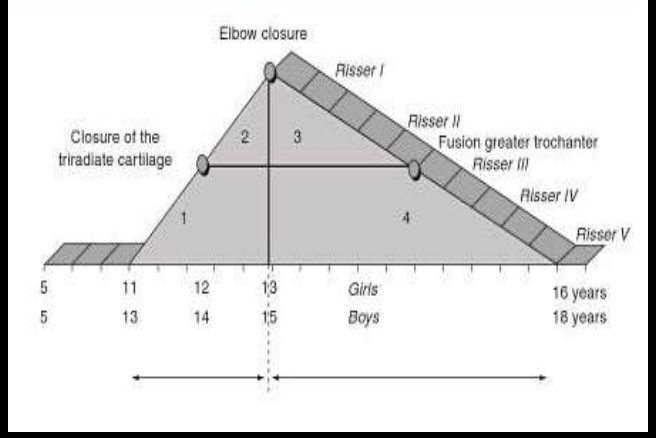
Assessment of progression

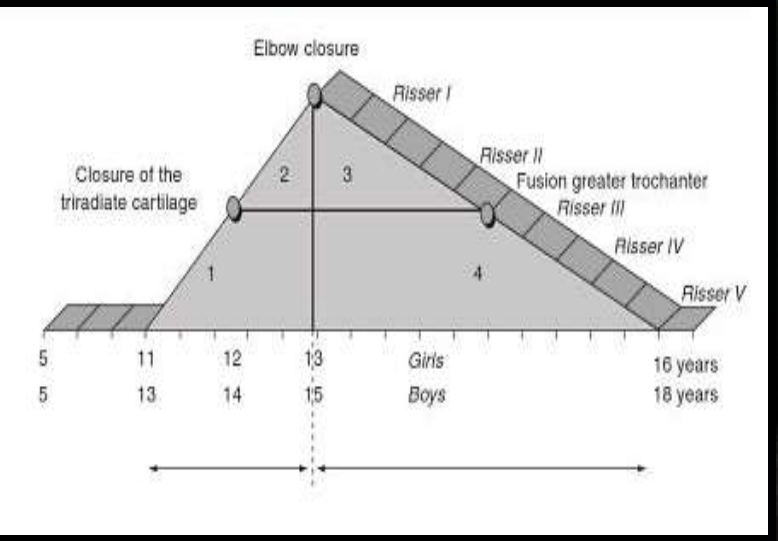
1. Rissers grading

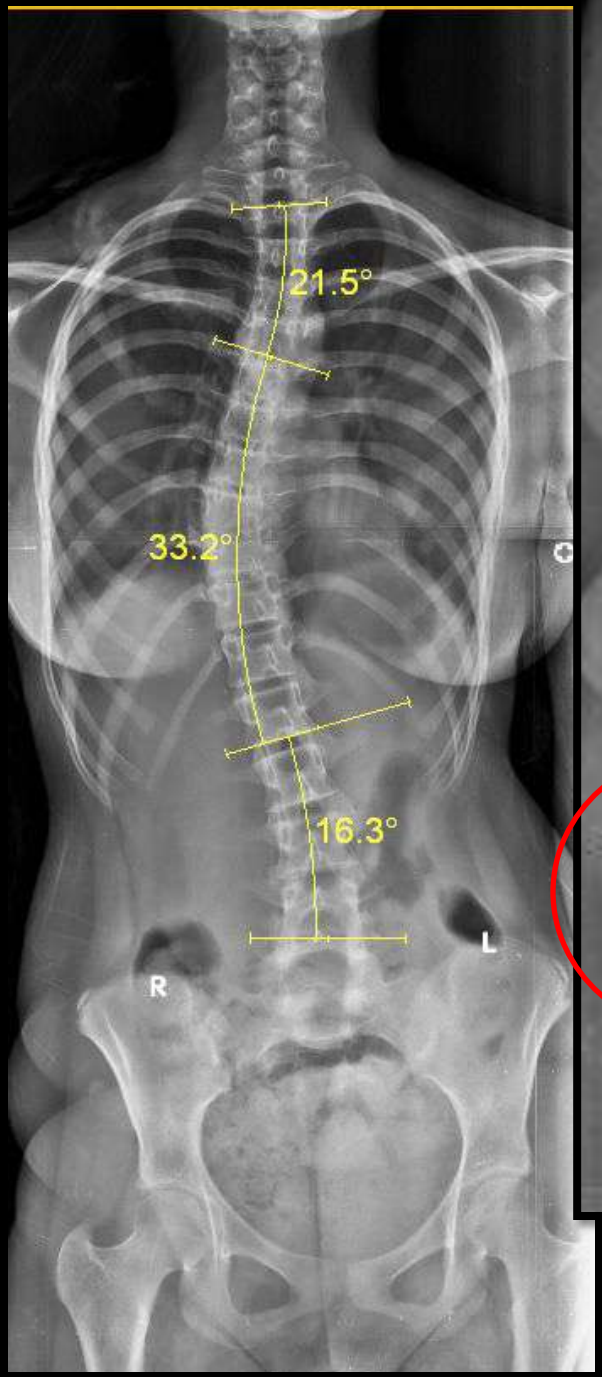
2. Fusion of triradiate cartilage & greater trochanter

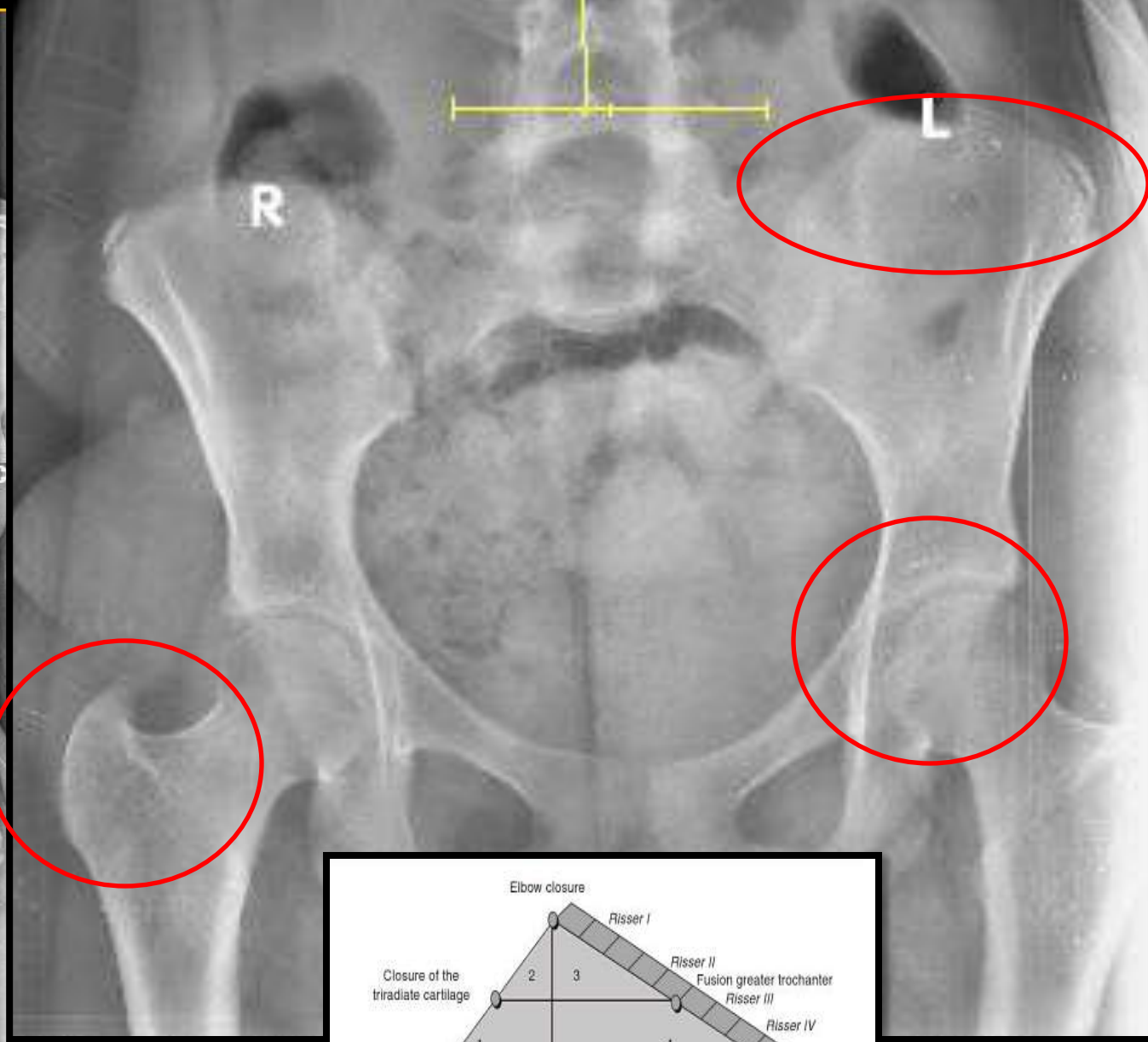

For Risser 0 or Risser 5, this black line will not be visible.
1
2
3

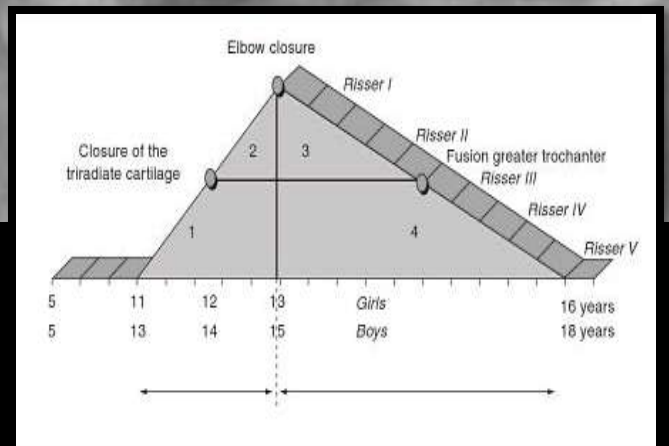

Risser 0
Risser 1
Risser 2
Risser 3
Risser 4
Risser 5

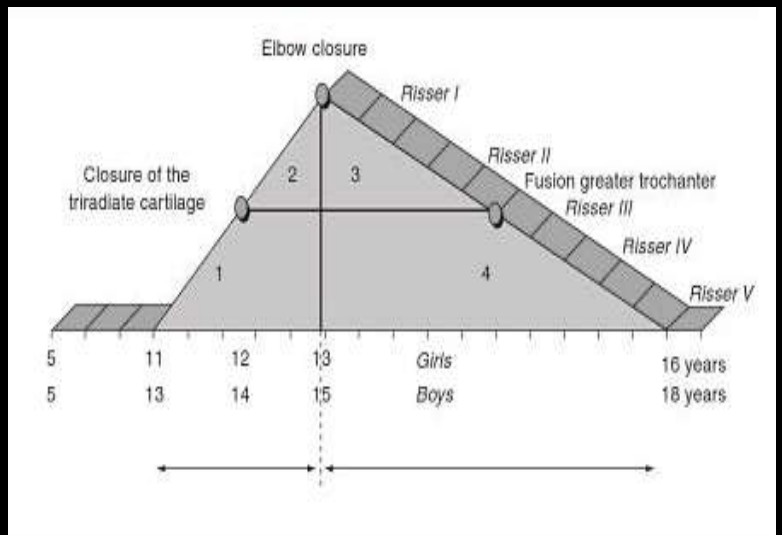

Elbow closure
Risser I
Risser II
Fusion greater trochanter
Risser III
Risser IV
Risser V
Closure of the triradiate cartilage
1
2
3
4
5
11
12
13
Girls
16 years
5
13
14
15
Boys
18 years


Elbow closure
Risser I
Risser II
Fusion greater trochanter
Risser III
Risser IV
Risser V
Closure of the triradiate cartilage
1
2
3
4
5
11
12
13
Girls
16 years
5
13
14
15
Boys
18 years


21.5°
33.2°
16.3°
R
L

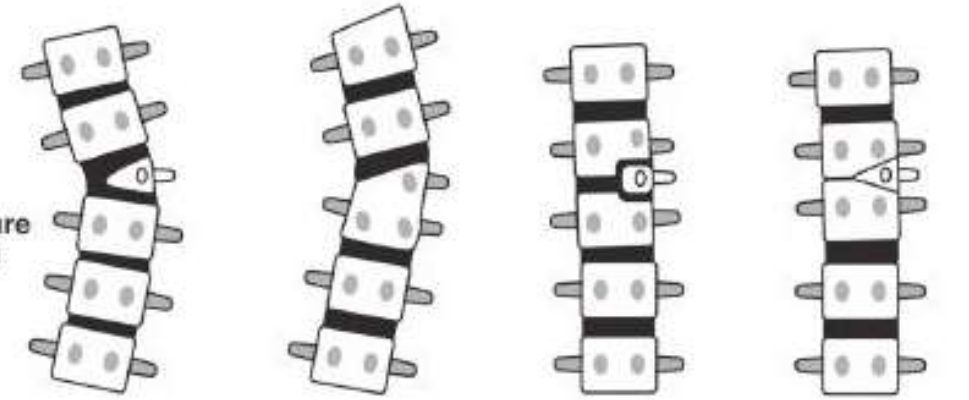

R
L


Elbow closure
Risser I
Risser II
Fusion greater trochanter
Risser III
Risser IV
Risser V
Closure of the triradiate cartilage
1
2
3
4
5 11 12 13 Girls 16 years
5 13 14 15 Boys 18 years

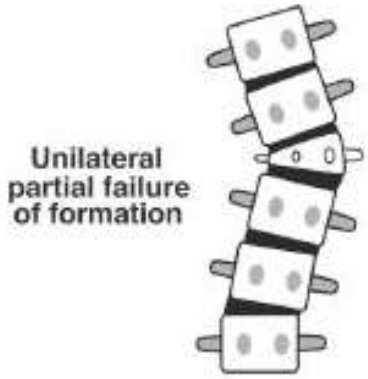

Elbow closure
Risser I
Risser II
Fusion greater trochanter
Risser III
Risser IV
Risser V
Closure of the triradiate cartilage
1
2
3
4
5
11
12
13
Girls
16 years
5
13
14
15
Boys
18 years

DEFECTS OF FORMATION

Hemivertebra



Wedge vertebra

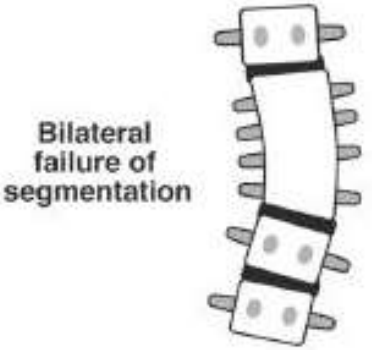


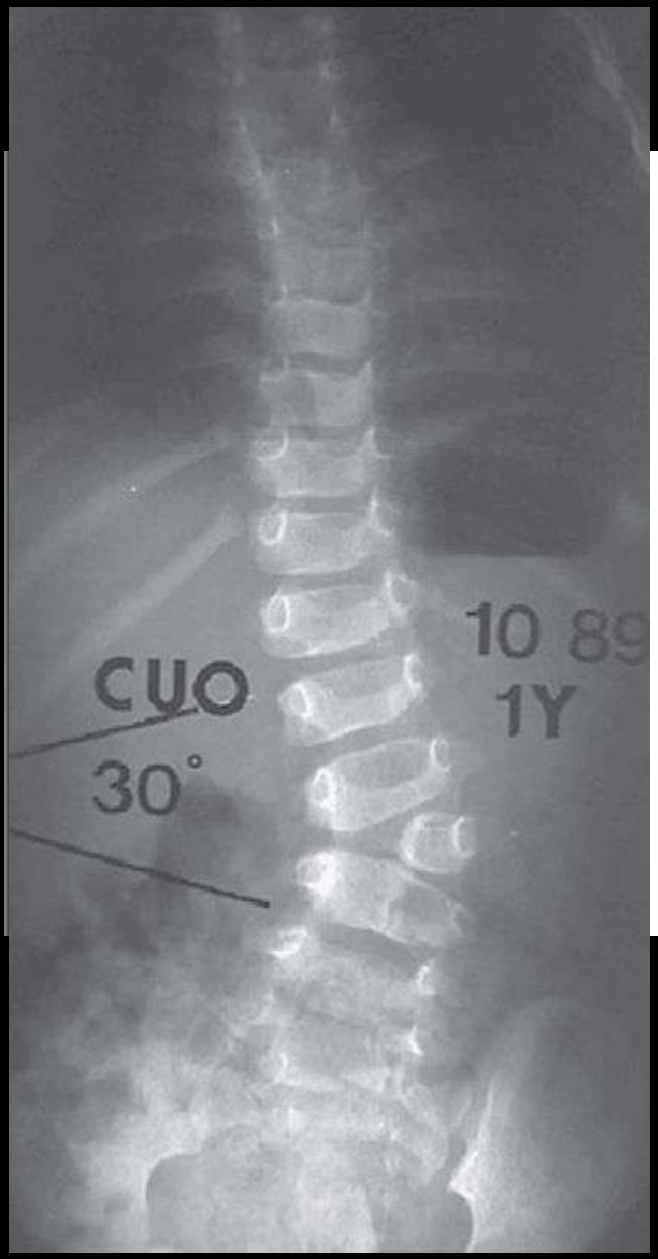
DEFECTS OF SEGMENTATION

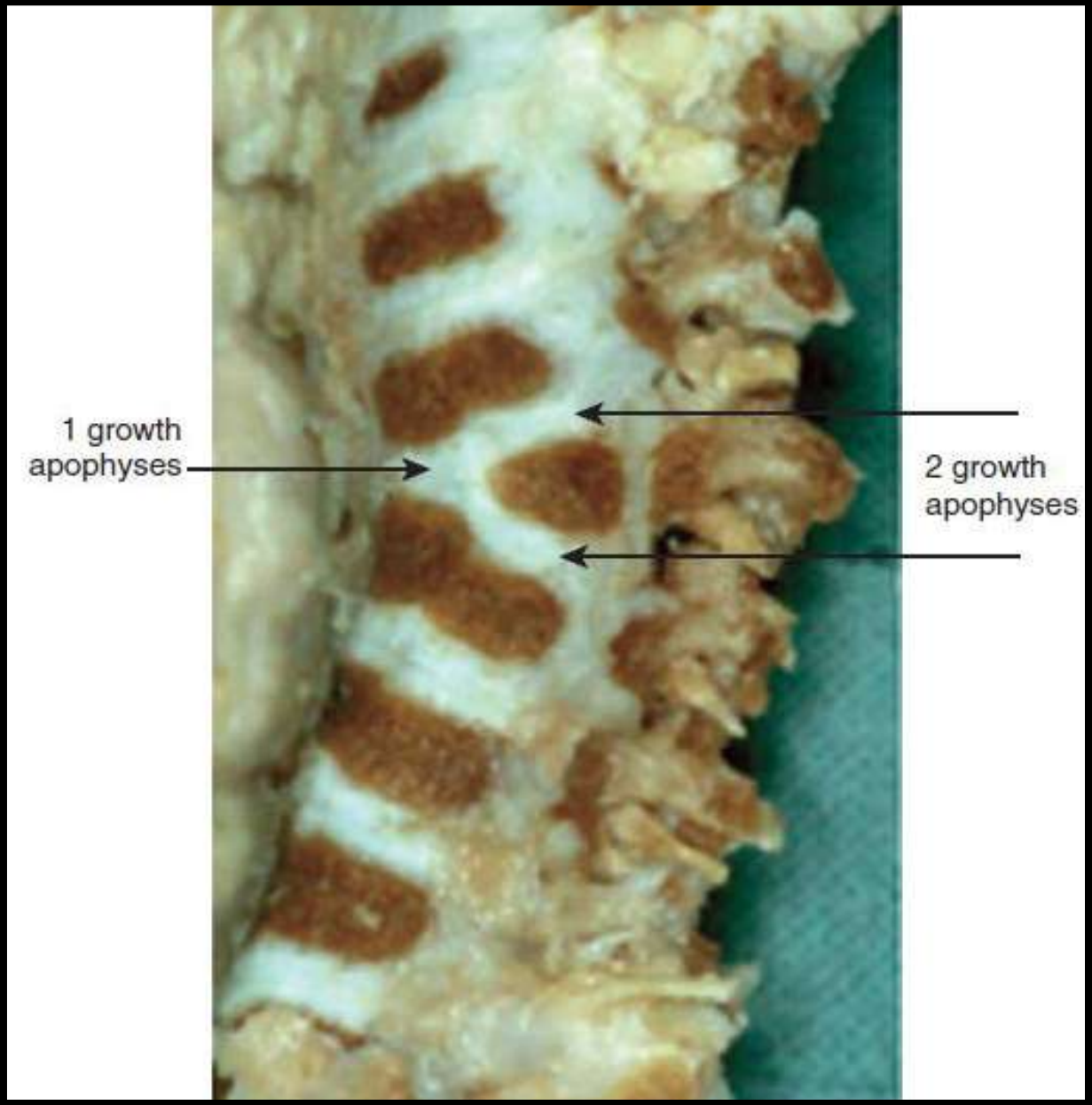
Unilateral Unsegmented Bar

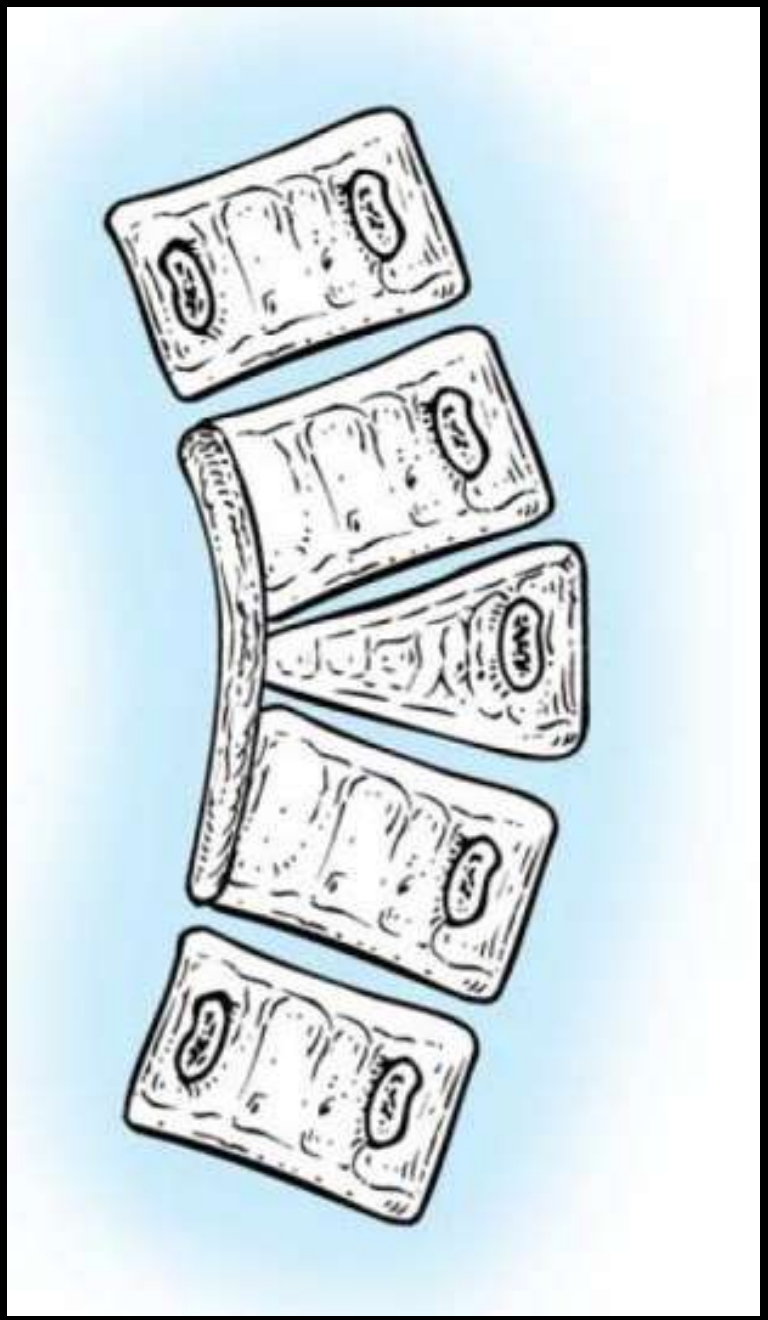
Unilateral Bar and Hemivertebrae

Block vertebra

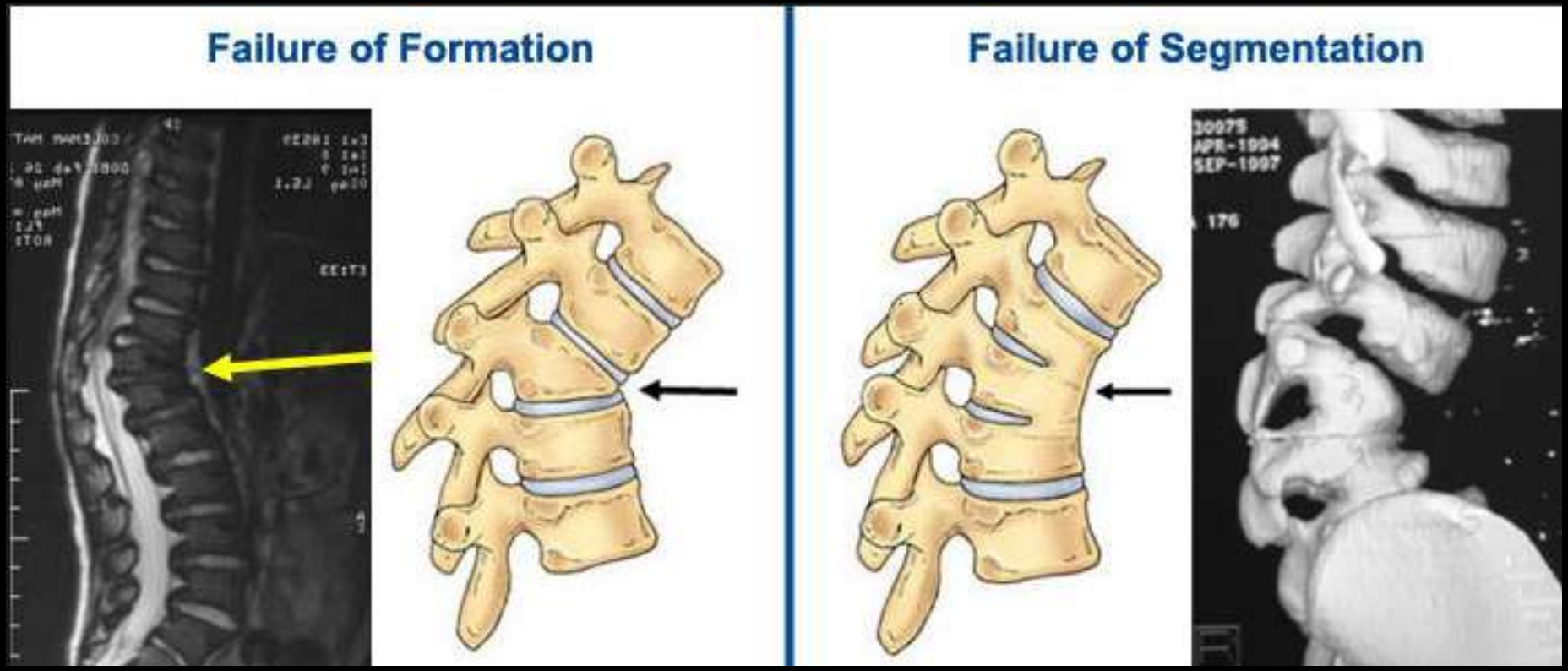



10 89
1Y
CUO
30°

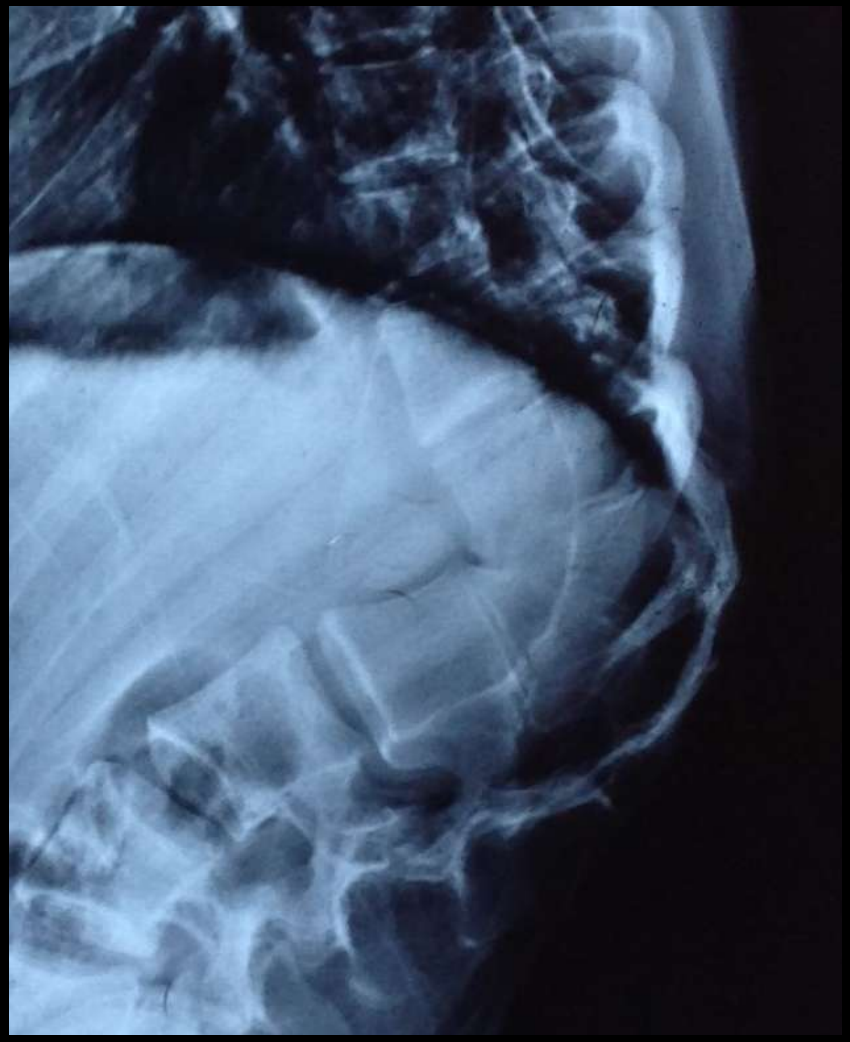

1 growth apophyses
2 growth apophyses



Congenital kyphosis



Failure of segmentation




Settings Orientation Type Imag

Scheurmanns kyphosis


Translatera

Cross-sectional Imaging Modalities

- **When to Use CT and MR Imaging**

Table 3
Main Indications for Further Imaging in Patients with Radiographic Findings of Scoliosis

Congenital osseous abnormality (fusion and segmentation anomaly)
Congenital neuropathic abnormality (Arnold-Chiari malformation, tethered cord, dysraphism-related abnormality)
Dysplasia (neurofibromatosis, osteogenesis imperfecta, Marfan syndrome)
Pain suggestive of bone tumor, infection, or intervertebral disk herniation
Neurologic deterioration with abnormality at electroneurography or evoked electromyography
Preoperative evaluation of osseous abnormality
Presumed postoperative complication
Idiopathic curvature of spine with specific clinical or radiographic features listed in Table 4

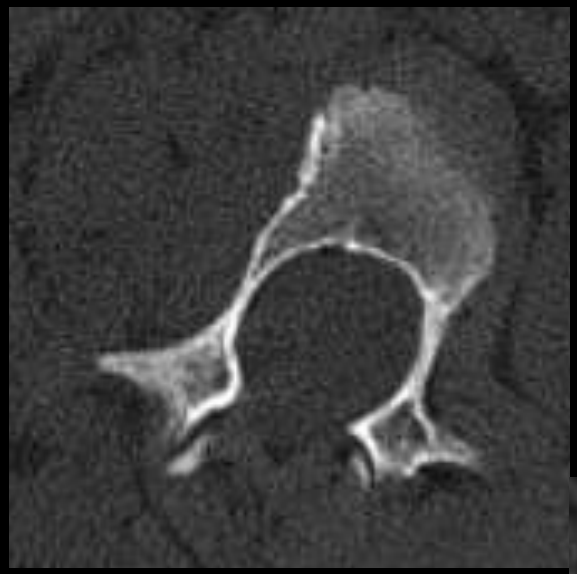
Table 4
Indications for MR Imaging in a Patient with Presumed Idiopathic Scoliosis

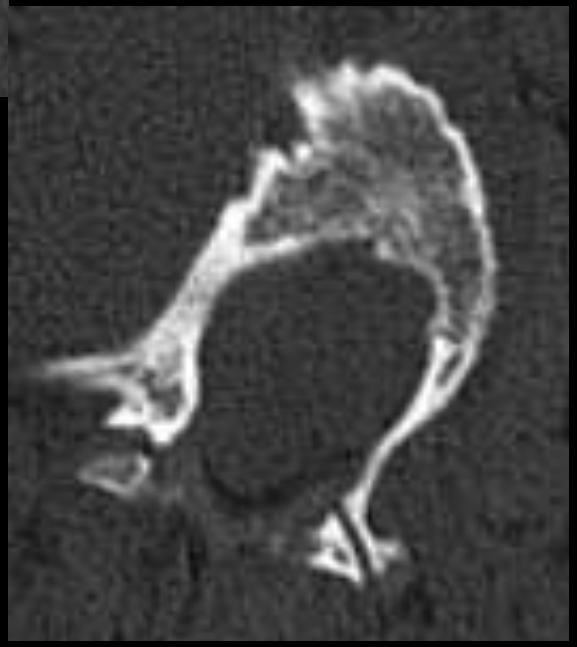
Clinical features
Age <10 years
Signs of neurologic deterioration
Rapid progression
Foot deformity
Back pain, neck pain, headache
Radiographic features
Curve type commonly associated with neuropathy (left thoracic, double thoracic, triple major, short-segment, or long right thoracic curve; severe curvature after skeletal maturity)
Wide spinal canal, thin pedicle, wide neural foramina, or other features suggestive of a nonosseous lesion

Computed tomography

- Better visualisation of complex anomaly
- Assessment of Pedicle size
- Bony bar in diastometomyelia


R
L





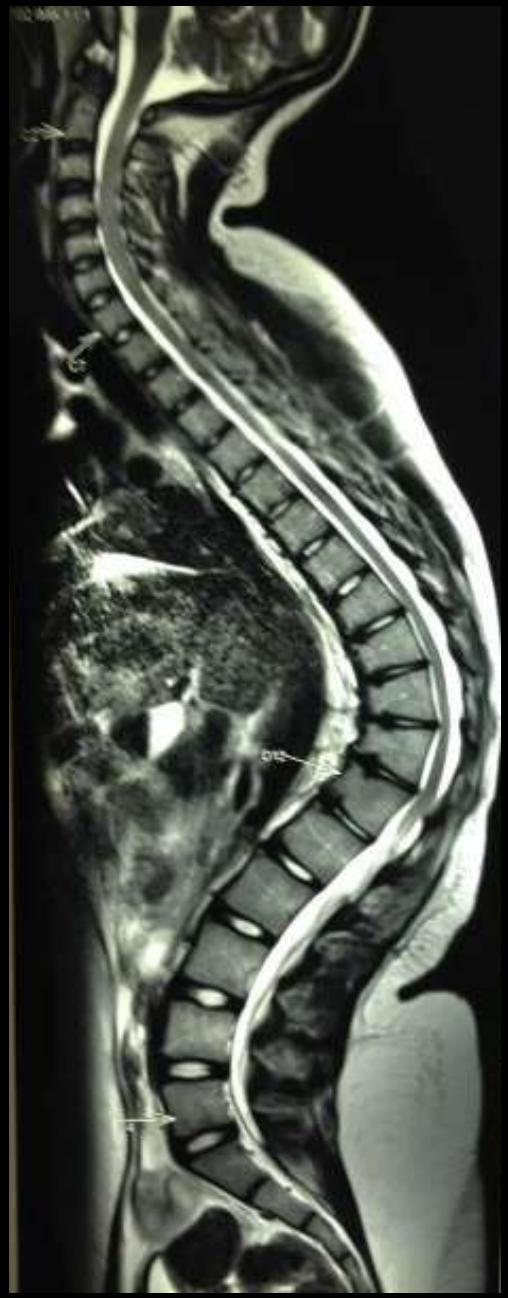

A
A


R

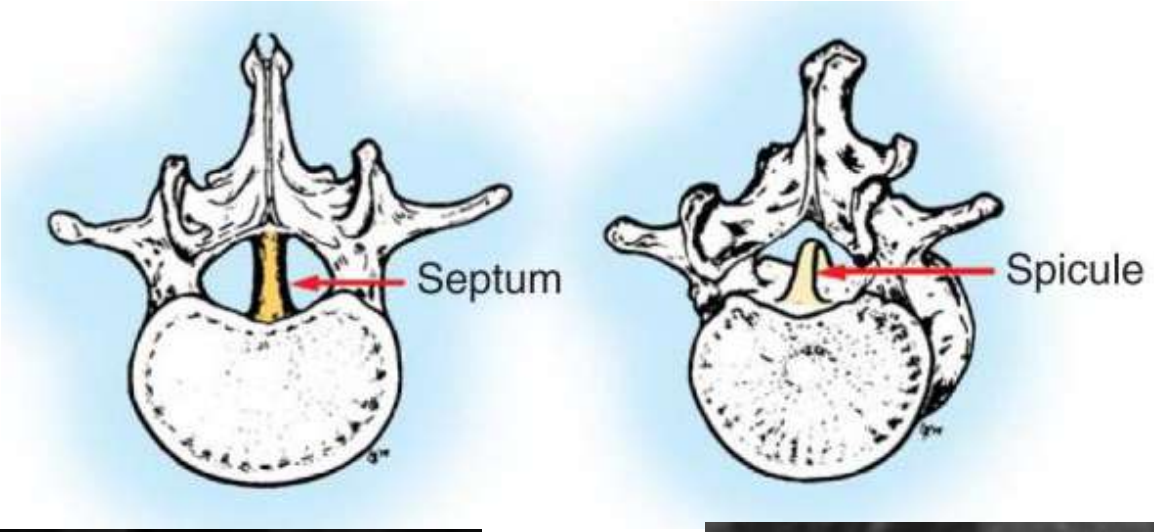
MRI

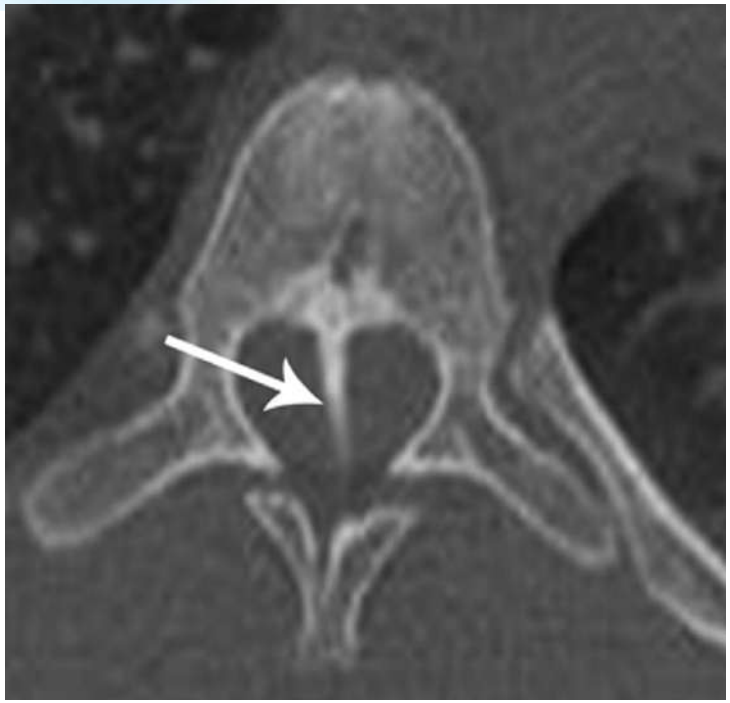
Status of cord

- Neurological defecit
- Absence of reflexes
- Neurocutaneous markers
- Before surgery
- Rapid progression
- Pain – severe

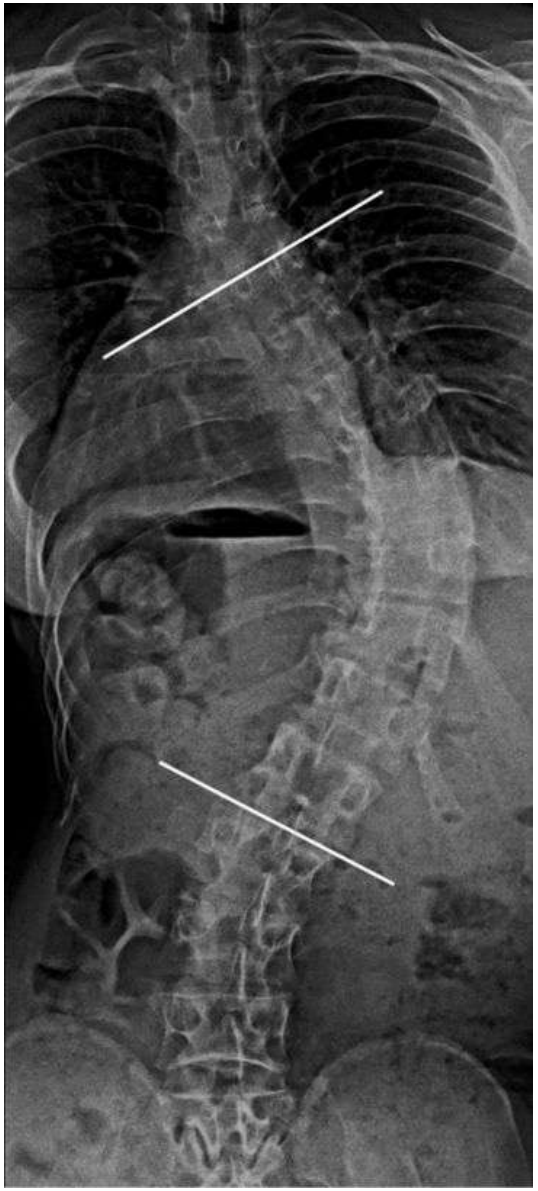


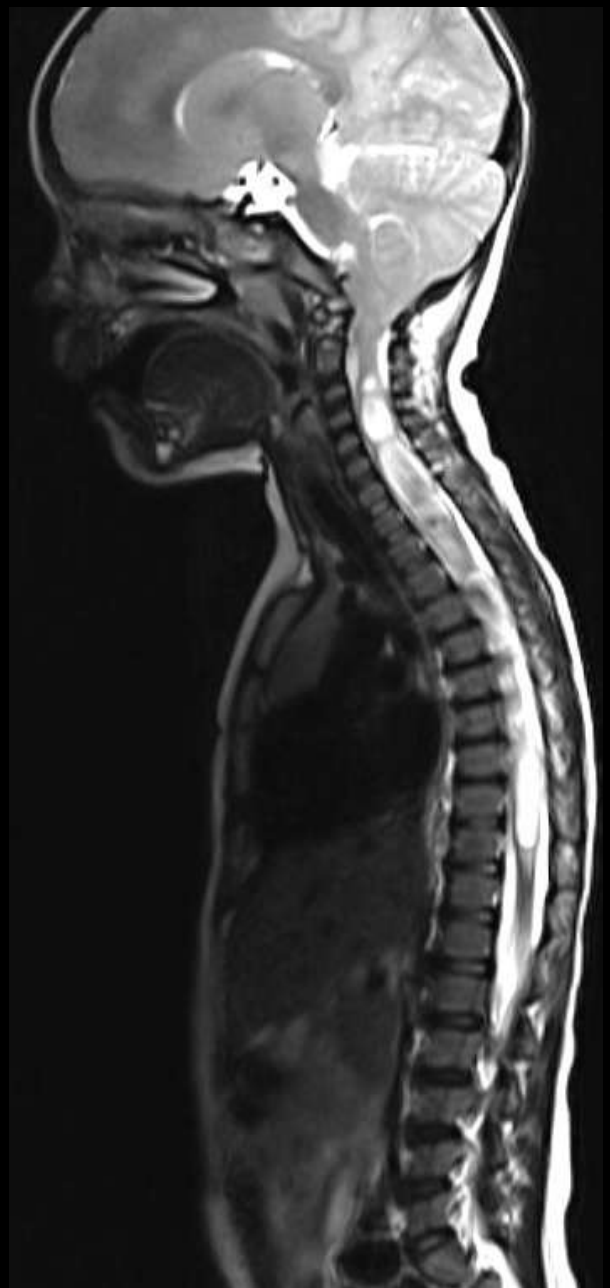
CT-Bony bar in diastometomyelia





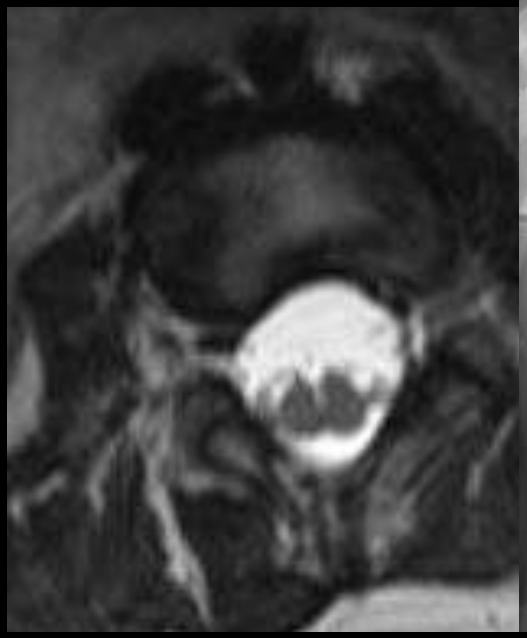
MRI- Arnold Chiari malformation





RESOLUTION AFTER SURGERY FOR ACM

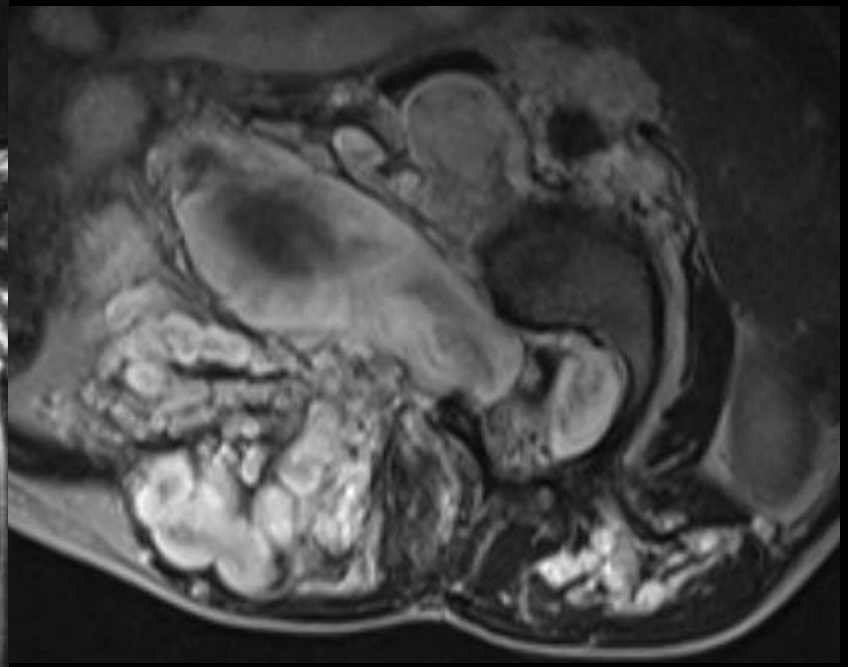

13 / 50
13 / 7

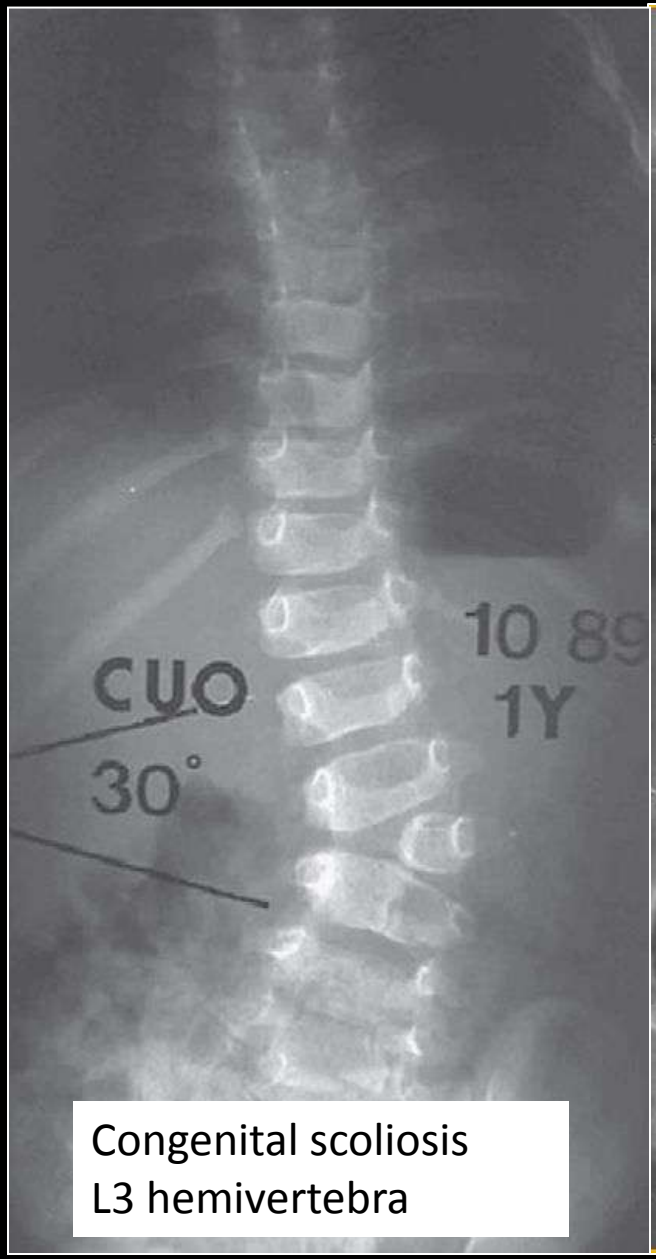



R


R


H
F
X





Congenital scoliosis
L3 hemivertebra

Dystropic scoliosis
Neurofibromatosis

Degenerative scoliosis