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Scoliosis



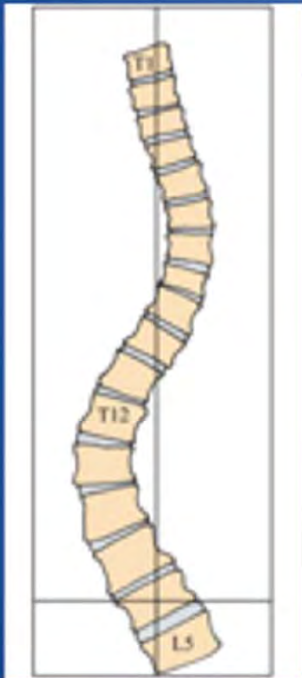
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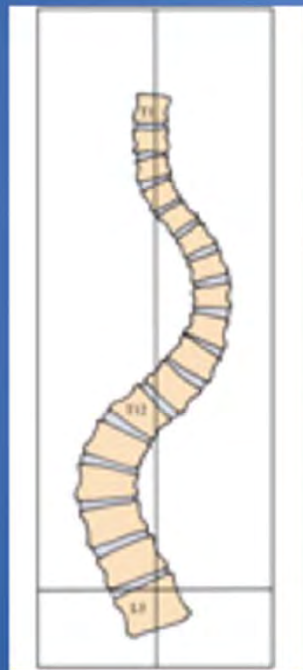
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Scoliosis

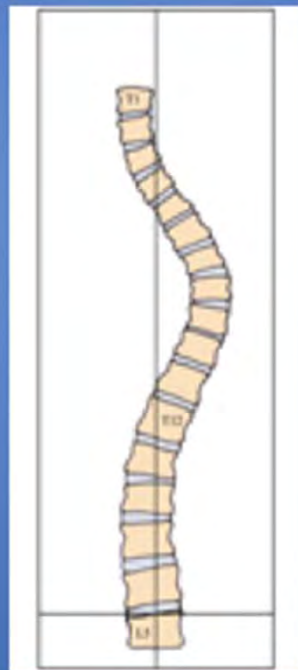
- 3D deformity of spine



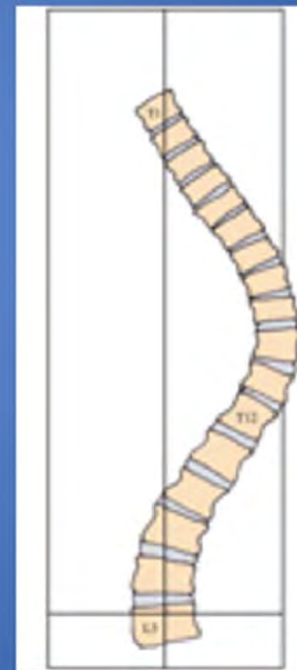
King Type I



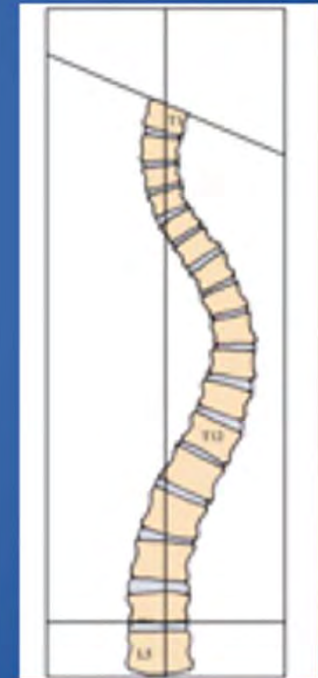
King Type II



King Type III



King Type IV



King Type V



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Scoliosis: Postural or Structural?



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Classification

- Early onset scoliosis
- Late onset scoliosis

- Congenital
- Syndromal
- Neuromuscular
- Idiopathic

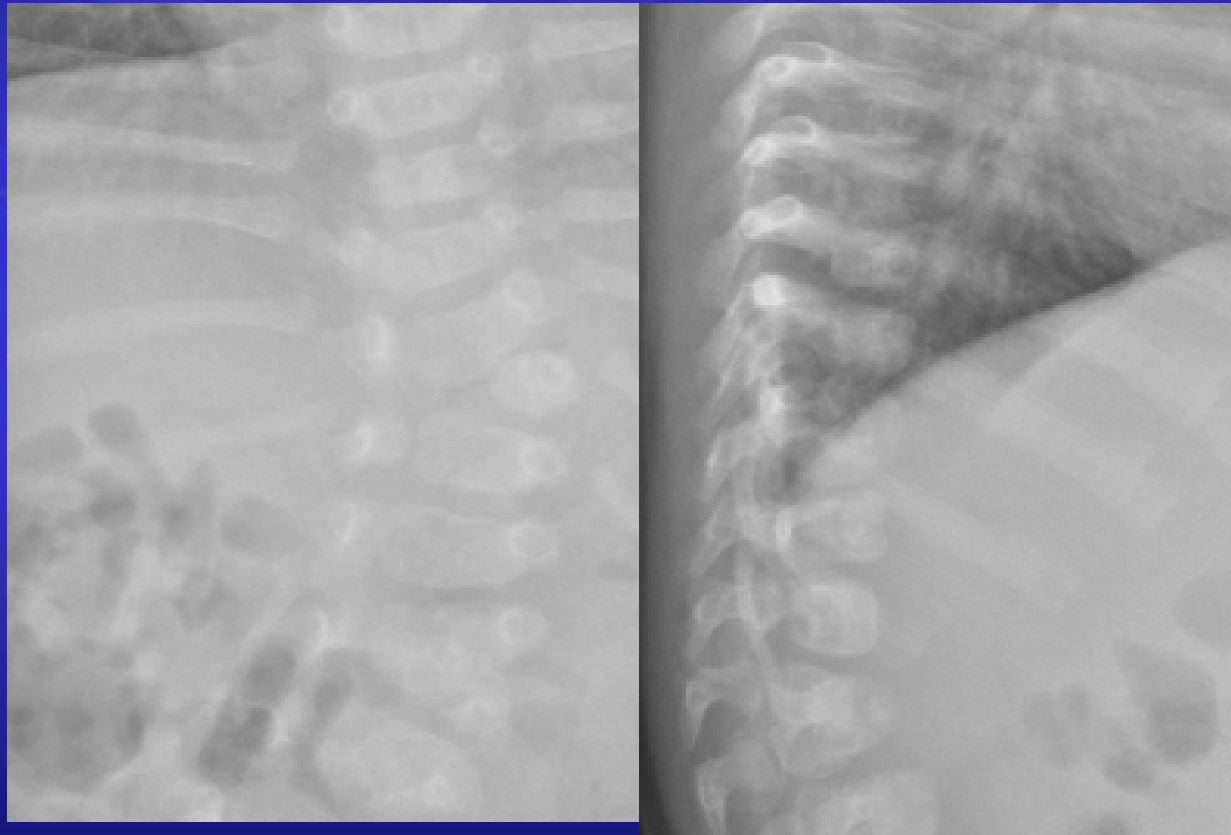


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Congenital Scoliosis



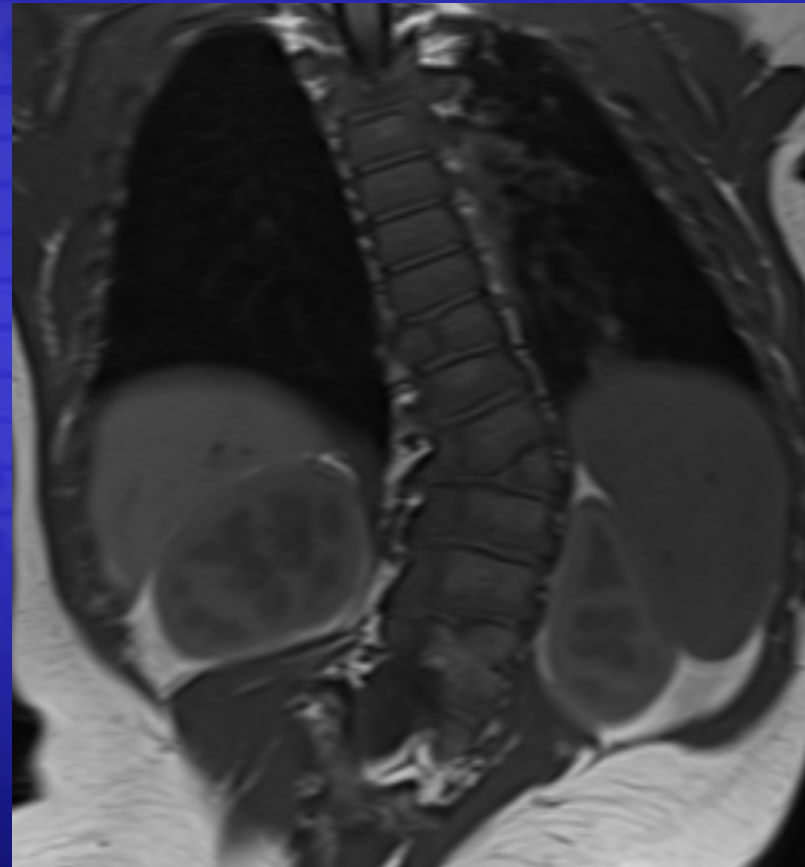
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What is it?

- Scoliosis associated with congenital vertebral malformations that occur *in utero*
- The most important component is the association with other malformations that may affect patient's health



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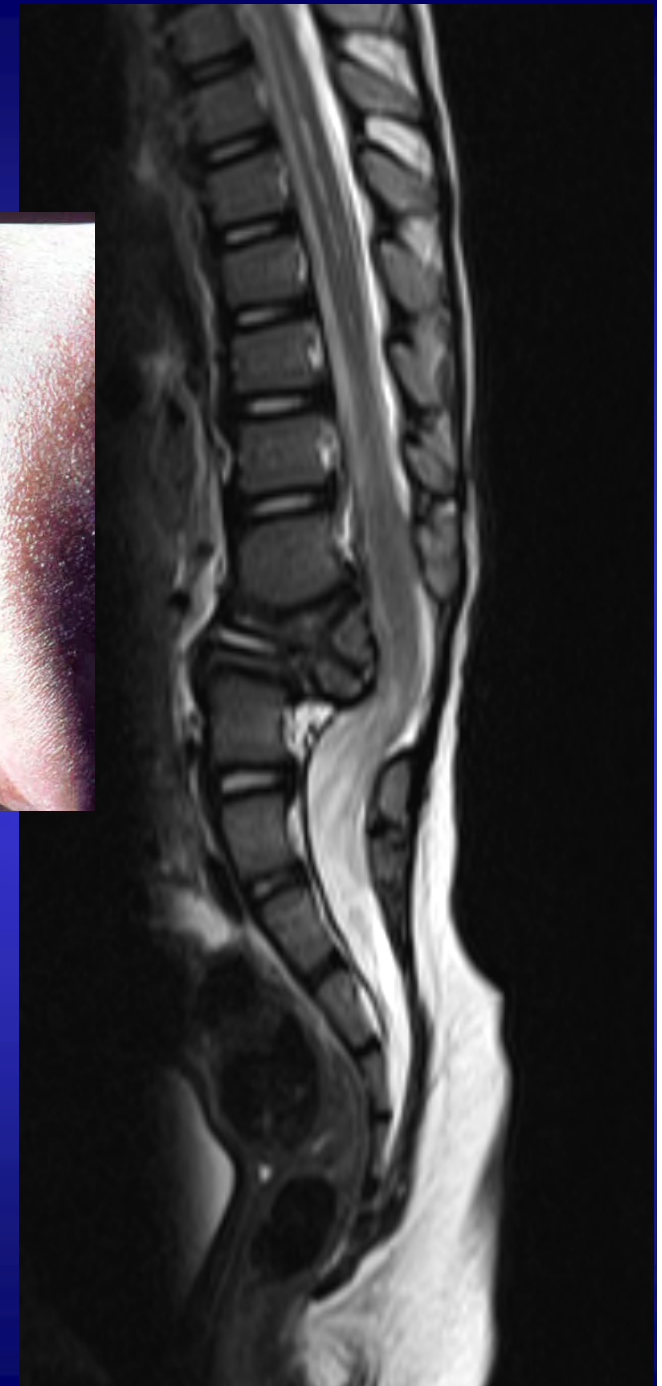
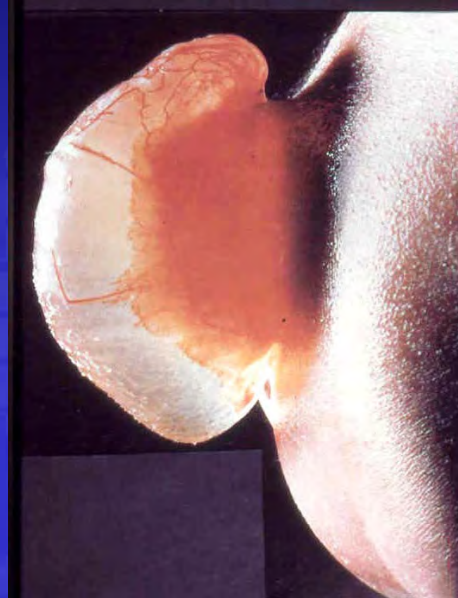


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“Spinal Dysraphism”

- Neurological (18-38%)
- Incr risk
 - cervical/ thoracic abN
 - Mixed patterns and congenital kyphosis
- Diastematomyelia is commonest
- Intraspinal lipoma, tethered cord, Chiari +/- Syrx
- Dermoid and epidermoid cyst



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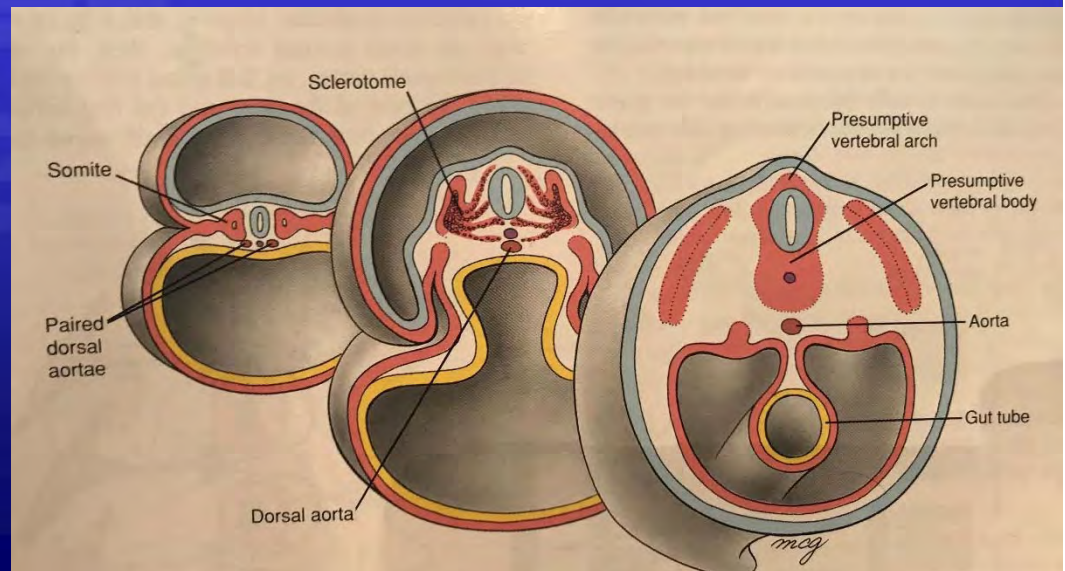
Other system pathology

Assoc'd congenital malformations:

- Renal 40%
- Cardiac 10%
- TOF/ Ao 'rings and slings'
- Anorectal abN
- Limb abN

2dary system pathology bc progressive EOS:

- Pulmonary DysFn incr if cong rib fusion
- Otherwise as per EOS



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Syndromal Scoliosis

- Various connective tissue disorders (such as Marfan's and Ehlers-Danlos) can be associated with rapidly progressive curves.
- Treatment includes bracing and surgery.



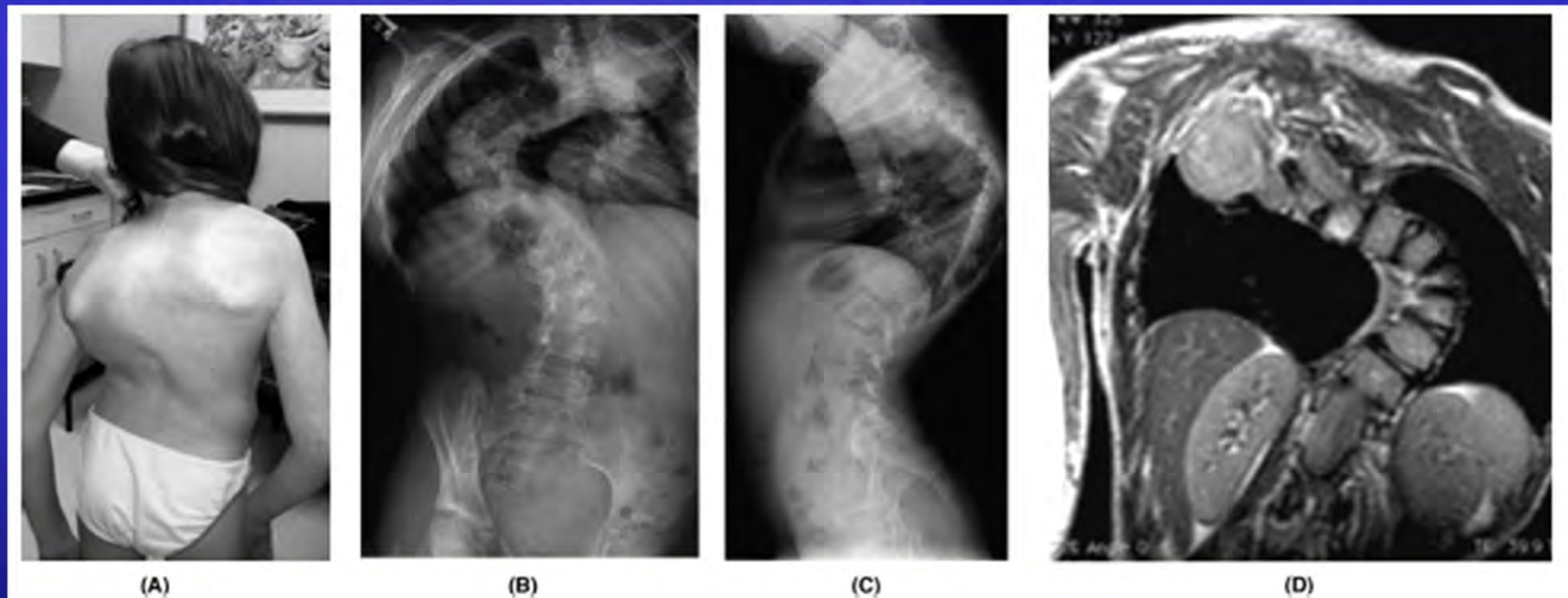
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Neurofibromatosis

- Can develop “idiopathic” or dysplastic curve.
- Dysplastic curves short, sharp and threaten cord.



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Neuromuscular Scoliosis

- Long list of causes
 - Spinal Muscular Atrophy
 - Cerebral Palsy
 - Duchenne's Muscular Dystrophy
- Long collapsing/ C-shaped curve.
- Surgery if it will improve quality of life, and patient able to tolerate it.



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Neuromuscular Scoliosis

- Aetiology
 - Muscle imbalance and weakness
 - Tone and/ or neurological driver assoc'd
 - Poor postural/ truncal control also contributor
- Increased risk with
 - Coronal Cobb >40 degrees
 - non-ambulatory patients (GMFCS IV-V)
 - UL hip dislocation/ pelvic obliquity and windswept lower limbs
- Scoliosis is progressive, even after cessation of growth



Treatment Options

- DMO/ Second Skin
- Asymmetric wheelchair supports
- Bracing
- Surgery
 - Growing Rods/ Fusionless surgery
 - Spinal Fusion
 - Anterior/ Posterior Fusion “click-clack”
 - Posterior Spinal Fusion
 - Fusion to Pelvis

*Seating balance
Spinal balance
Safe surgery*

*Correction of spinal deformity with minimal complications
Minimise recurrence or progression of deformity
Control pelvic obliquity*

*Allow growth of spinal column
Improve respiratory function
Improve gastric emptying and weight gain*



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SURGERY

OPEN

Minimally Invasive Surgery for Neuromuscular Scoliosis

Results and Complications in a Series of One Hundred Patients

Lotfi Miladi, MD,* Mathilde Gaume, MD,* Nejib Khouri, MD,* Michael Johnson, PhD,†
Vicken Topouchian, MD,* and Christophe Glorion, PhD*

- T1 to Pelvis fusionless surgery
- Coronal Cobb improved from 89 to 35 degrees
 - (61% correction)
- Pelvic Obliquity improved from 29 to 5 degrees
 - (83% correction)
- 26 patients had complications
 - decreased rate compared to traditional spinal fusion



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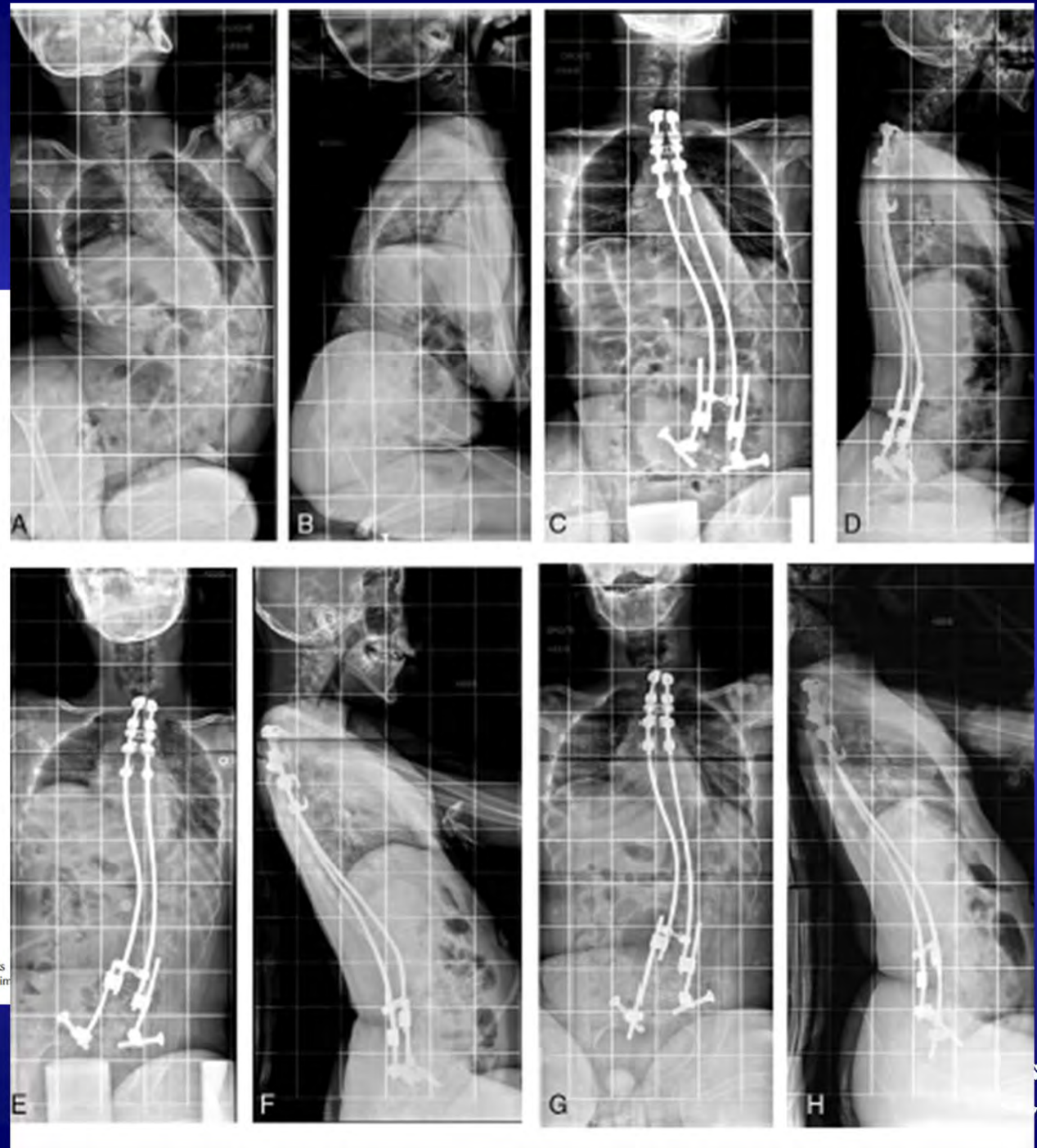
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So what is a BiPolar?



Figure 1. The bipolar construct anchored proximally by hooks double claw and distally by iliosacral screws through a minimally invasive approach.



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Allow for gradual correction and spinal derotation

Through viscoelastic relaxation of spinal column and tissues

With a reduction in neurological complications

And avoids final arthrodesis.



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Early Onset (Idiopathic) Scoliosis

- Infantile forms are often successfully treated non-operatively.
- Juvenile forms are often more pervasive, >50% going onto surgical intervention.
- Aims are to maximise growth, esp alveolar number and chest/ lung capacity.
- By age 10, 80% adult thoracic height reached.
- Growth maximisation strategies including rods utilised prior to this, with fusion surgery considered after 10.



Late Onset Idiopathic Scoliosis

- The typical patient...
 - 90% are female
 - 90% Right thoracic/ thoracolumbar curves
 - >90% don't need surgery
- How to predict
 - Who to observe
 - What to do with these patients
 - When to operate... and why?



LOS/ AIS – Natural History

- Risk of Progression (Nachemson)

Cobb Angle	AGE		
	10 - 12	13 -15	16
<19°	20%	10%	5%
20 - 29°	50%	40%	10%
30 - 59°	90%	70%	30%
>60°	100%	90%	70%



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AIS – Natural History

- 2-3% adolescent population have scoliosis
 - 5% of these patients may require surgery
 - Most curves have minimal/no impact on health
 - Respiratory complications/ cor pulmonale may be more likely in AIS if Cobb angle $>100-120^\circ$

- Risk of progression after skeletal maturity
 - (Weinstein et al 1980's):

Thoracic curves

30-50° progress ~ 10-15° over life time

Over 50° progress by $\frac{1}{2}$ - 1° year

Lumbar curves

$>35^\circ - 40^\circ$ poor natural history



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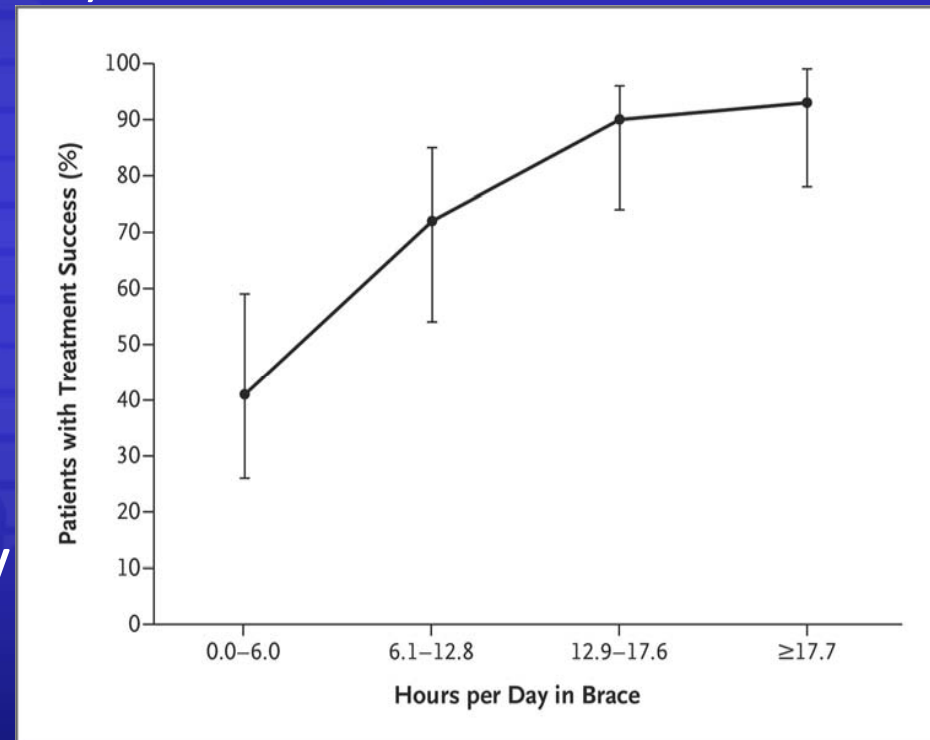
Red Flags!!!

- Male
- Early onset <10y
- Skin lesions
- Abnormal neurology
- Curve type and behaviour:
 - Left thoracic, right lumbar
 - Associated kyphosis
 - Rapid progression
- Symptoms: pain, occipital headaches



AIS - Bracing

- Halts curve progression only.
- Effective in 60-80% (Nachemson).
- BrAIST 72% (Weinstein NEJM 2013).
 - Primary indication:
progressive curve between 20 and 40° in the skeletally immature.
 - Requires:
 - Growth – 18 months remaining
 - Compliance – 16hrs/day minimum
 - Braceable curve



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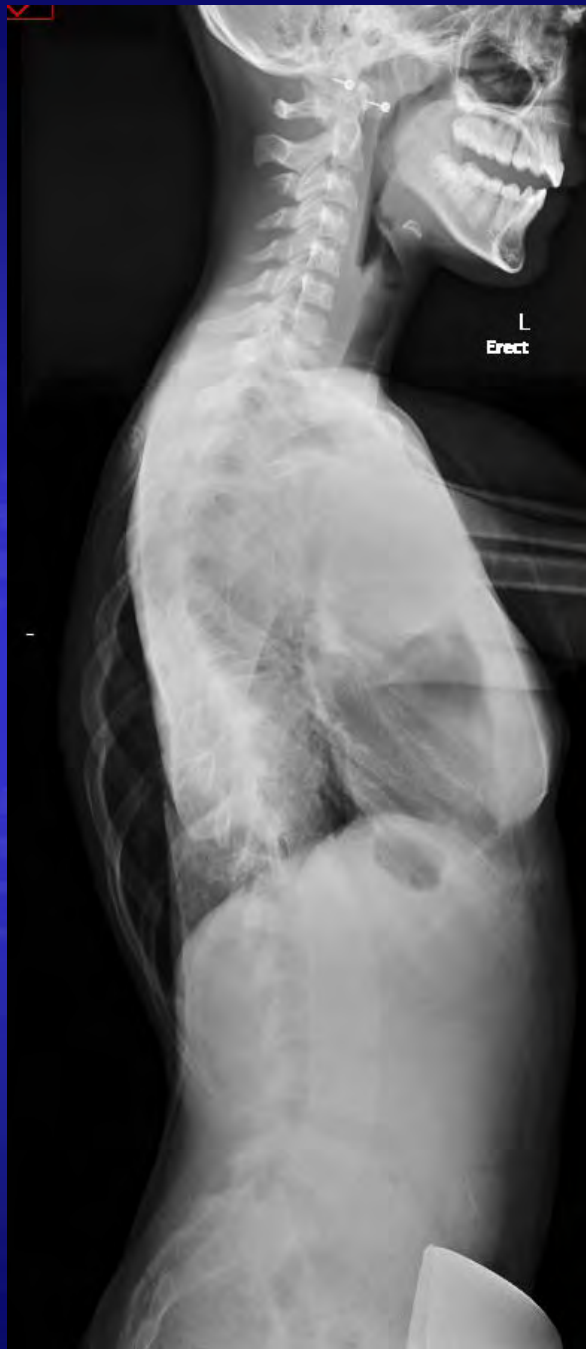
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AIS – Surgical Indications

- Risk of progression
 - Cosmesis.
 - Risk of lumbar disc degeneration.
- ? Pain - No evidence.
- ? Neurological compromise - rare.
- ? Risk of respiratory compromise - rare.



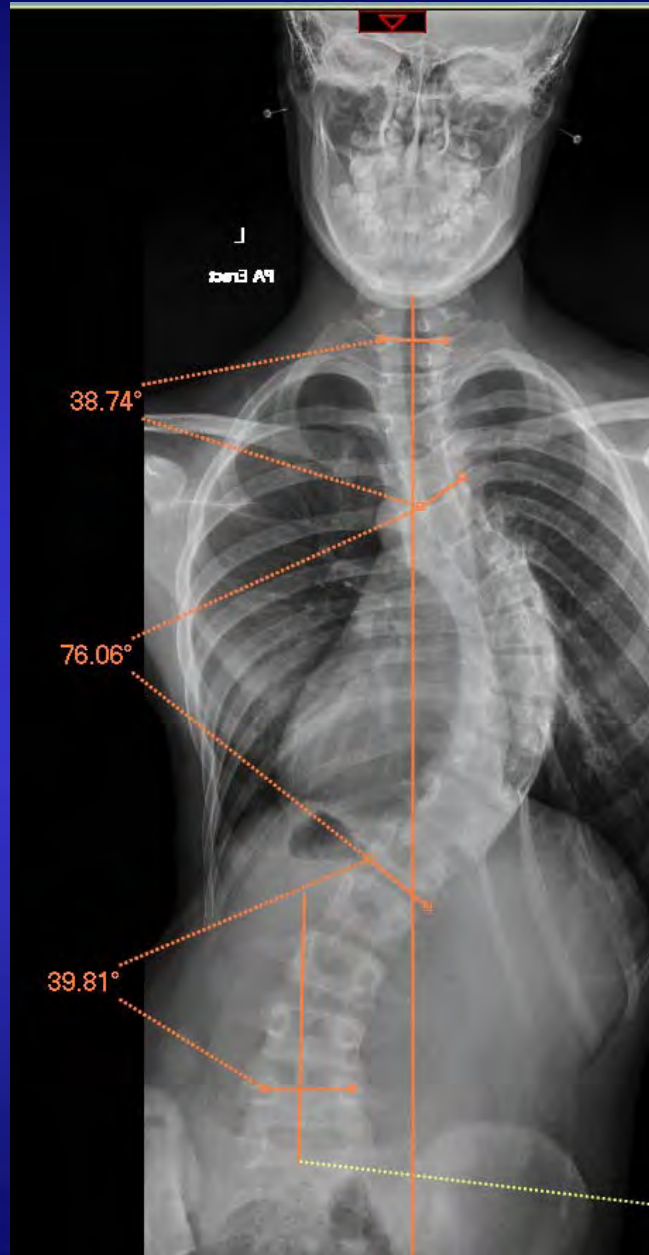
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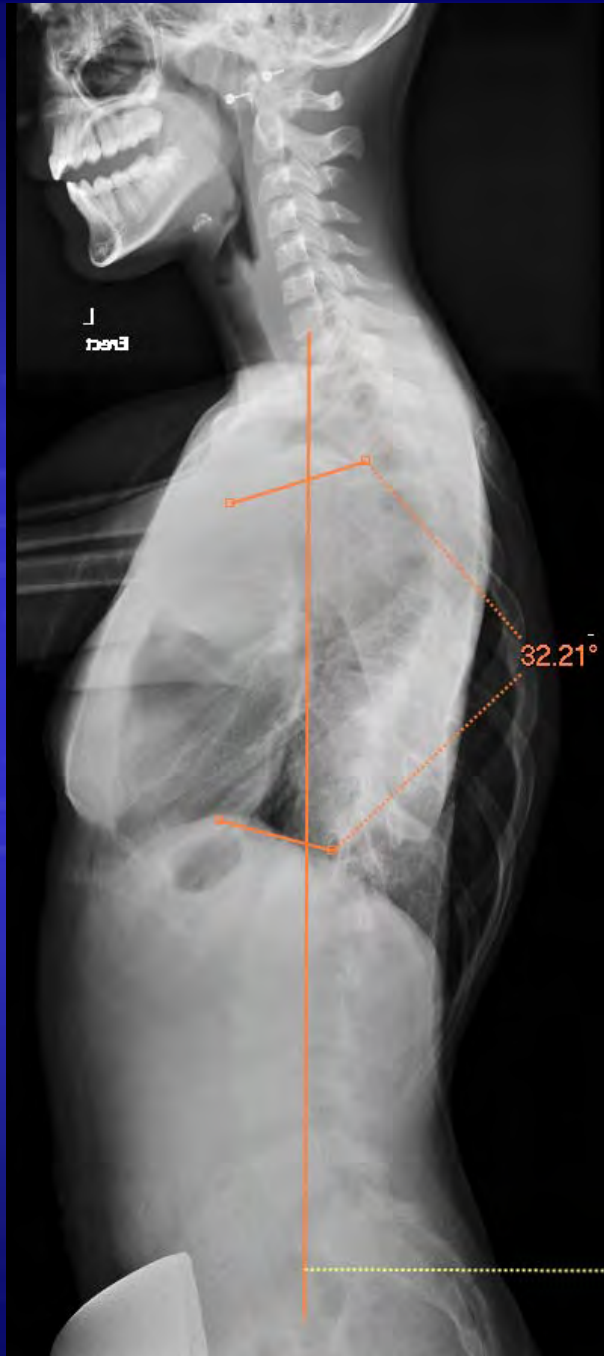
- Primary R-thoracic
- Apex T9, Cobb 76
- Compensatory lumbar and high thoracic curves
- ?LLD, check clinically
- BUT off balance coronal plane with shift to Right
- Growth remaining

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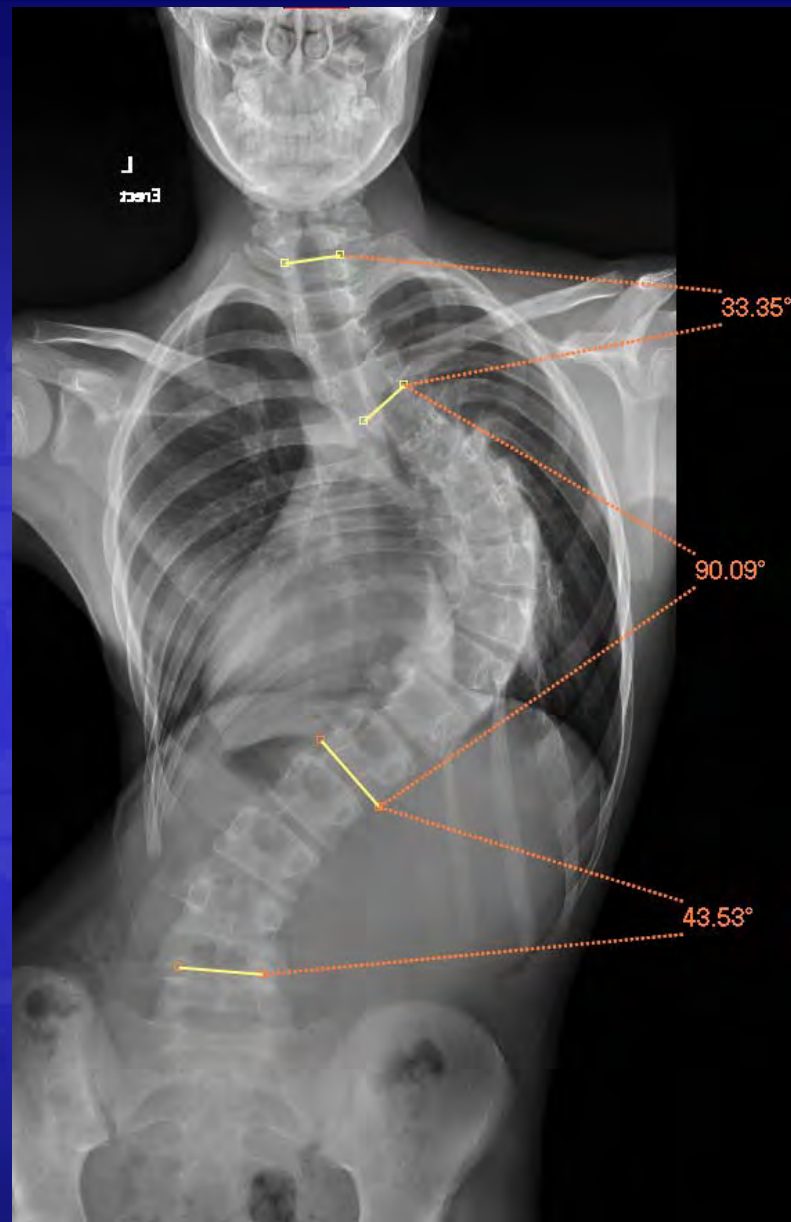
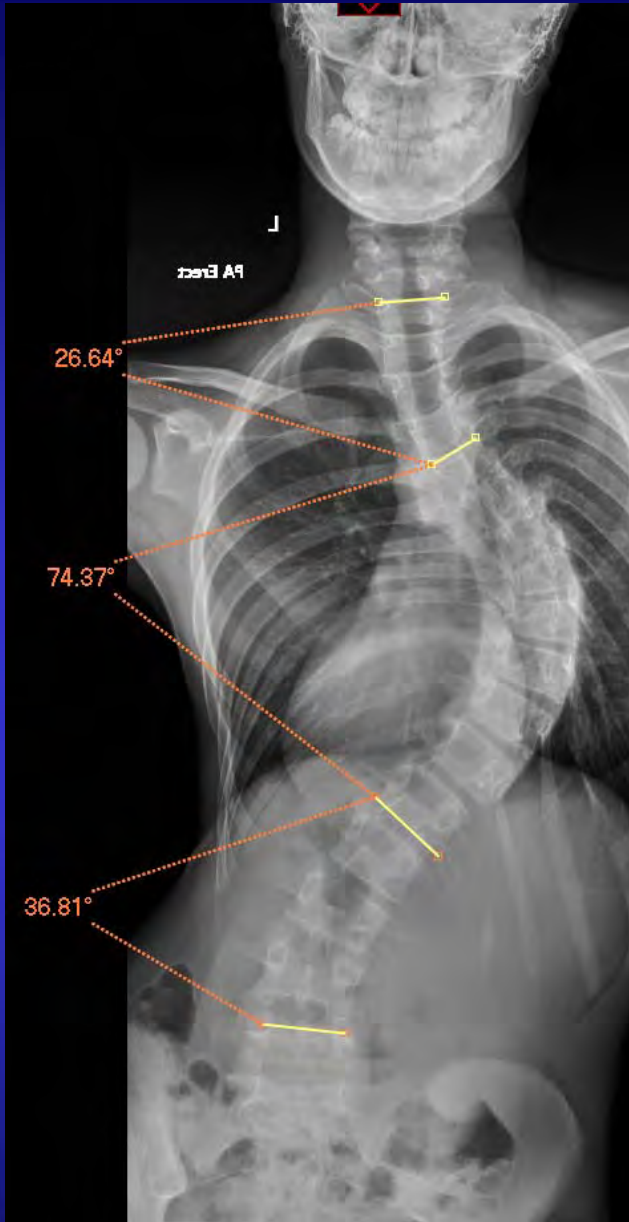
- Thoracic kyphosis of 32 so within normal range
- Significant rib prominence
- Neutral sagittal balance C7 plumb

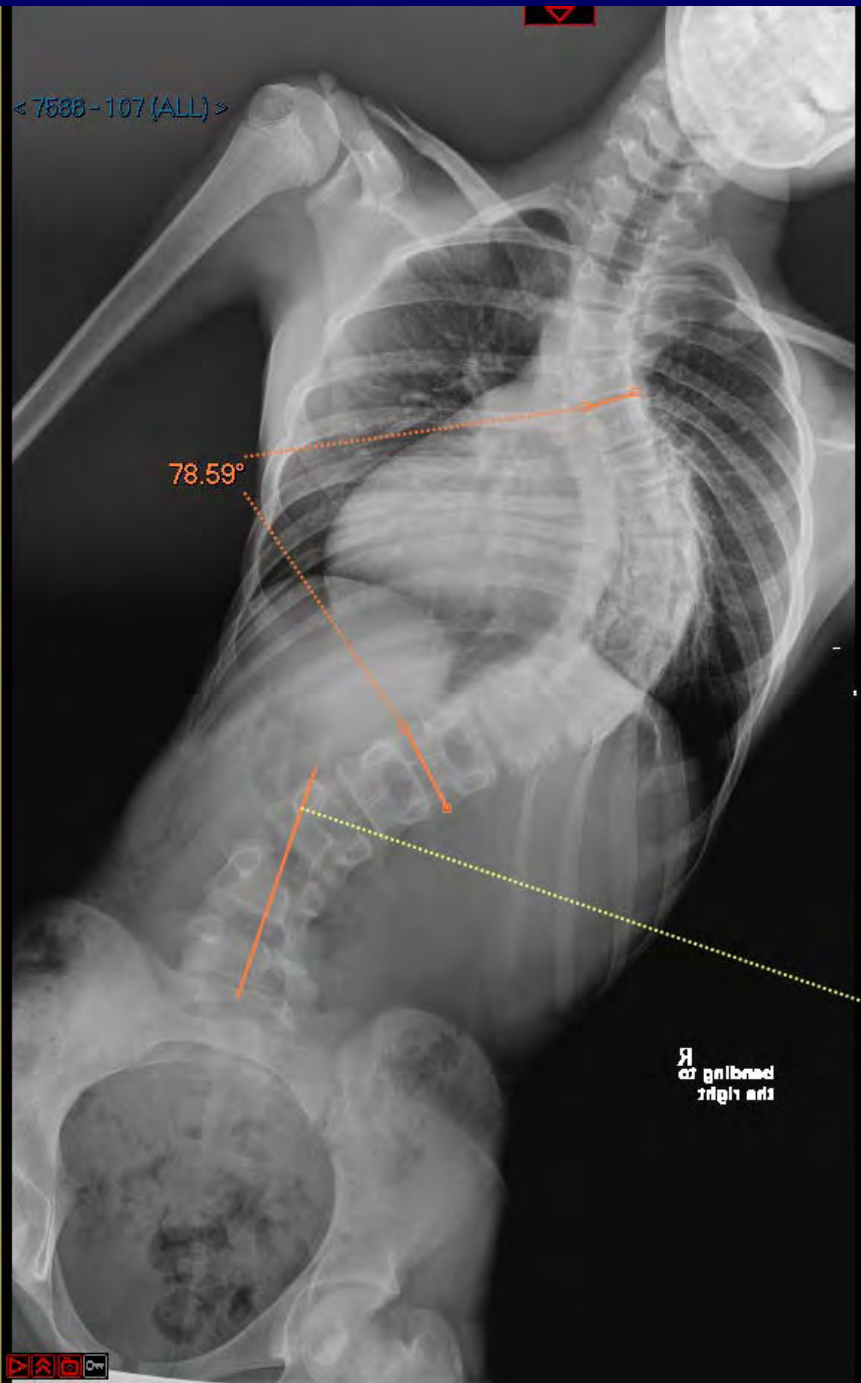
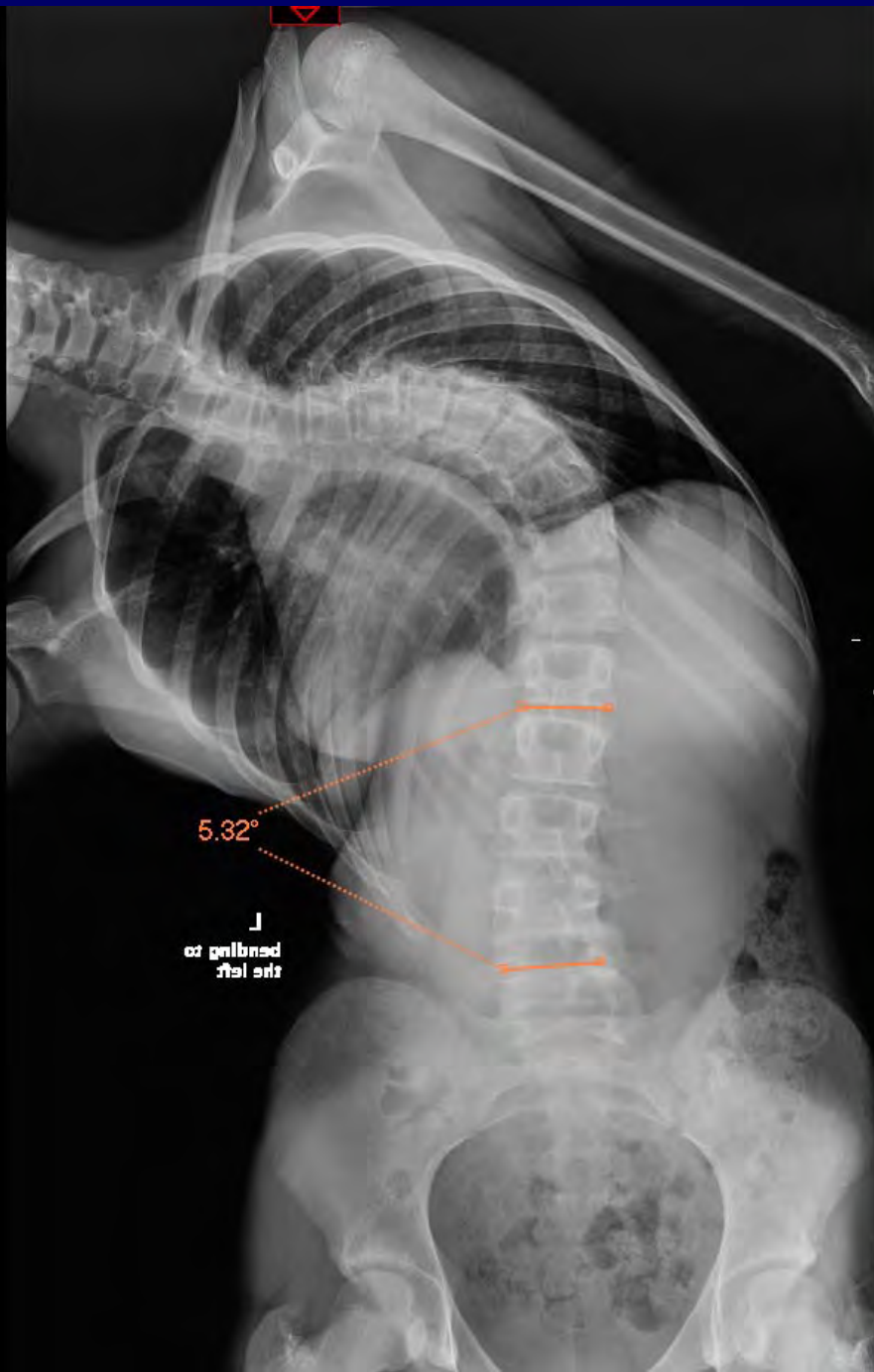


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- PSF T3-L2

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Surgical Goals...

- Correction of clinical deformity (satisfactory cosmetic result).
- Fusion of instrumented levels.
- Preservation of motion segments.
- Maintain spinal balance.
- Minimise complications.
- Patient satisfaction.

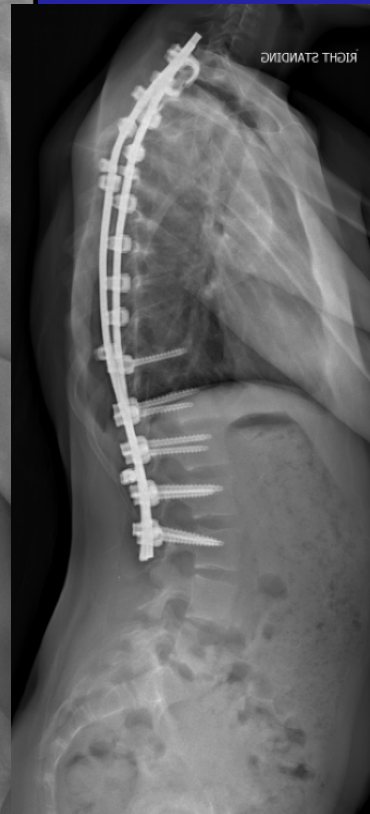
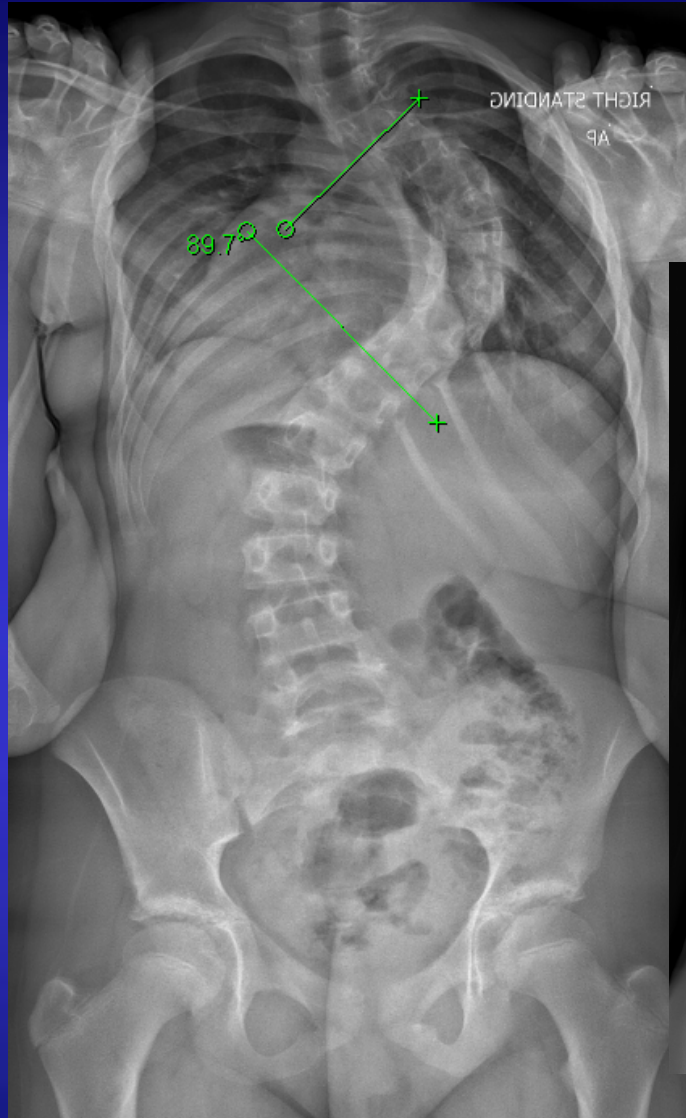


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Hybrid 2 stage



MRN:10174772

[A] [L]

EOS Lateral



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Summary

- EOS can be progressive with a high requirement for bracing and surgery.
- LOS not a threat to health, but appearance.
 - <5% AIS patients require surgery.
 - Bracing and surgery are the only proven options to effectively treat scoliosis.

Further reading please look at

Scoliosis Australia

Scoliosis Research Society



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