

Upright, Prone and Supine Spinal Morphology and Alignment in Adolescent Idiopathic Scoliosis

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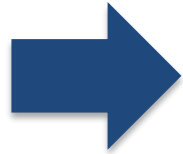


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Adolescent idiopathic scoliosis (AIS)



2-D X-ray is considered as the golden standard

However, it is a complex 3-D deformity



Imaging: different methods and body positions

Upright X-ray



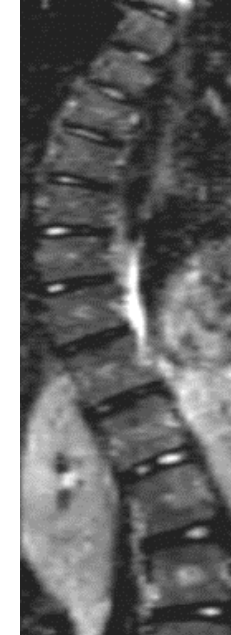
- + upright position
- 2-D imaging
- + golden standard
- radiation

Prone CT scan



- prone position
- + 3-D imaging
- + superior for bone imaging
- radiation

Supine MR scan



- supine position
- + 3-D imaging
- inferior for bone imaging
- + no radiation



Aim

To compare the morphology of the scoliotic spine on:



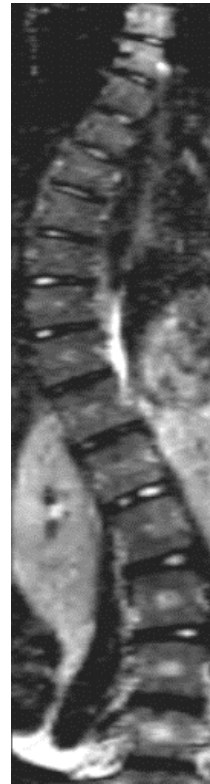
Upright X-ray

versus



Prone CT scan

versus



Supine MR scan

Outcomes:

- Thoracic and lumbar Cobb
- Thoracic kyphosis
- Lumbar lordosis
- Apical vertebral rotation

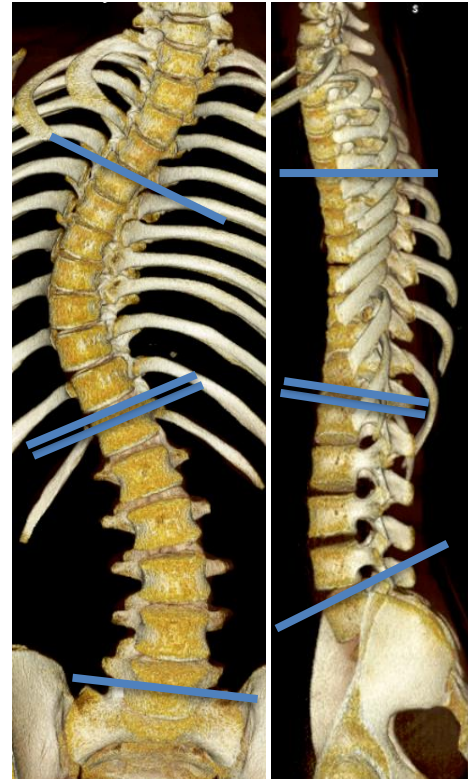


Methods – Cobb angles, thoracic kyphosis (Th4 – Th12) and lumbar lordosis (L1 – S1)

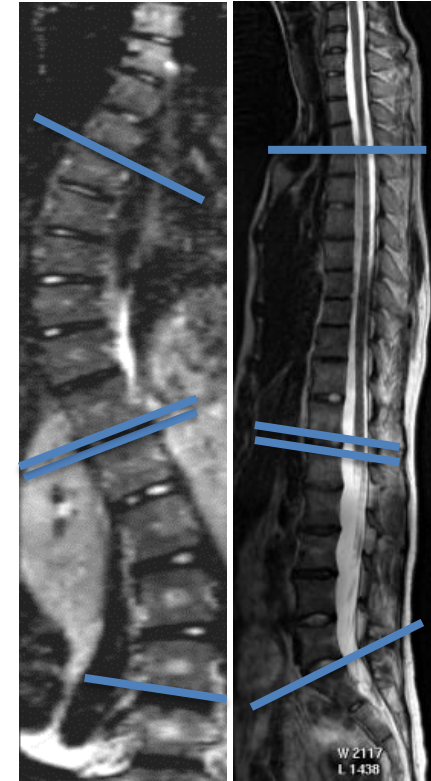
Upright X-ray



Prone CT scan

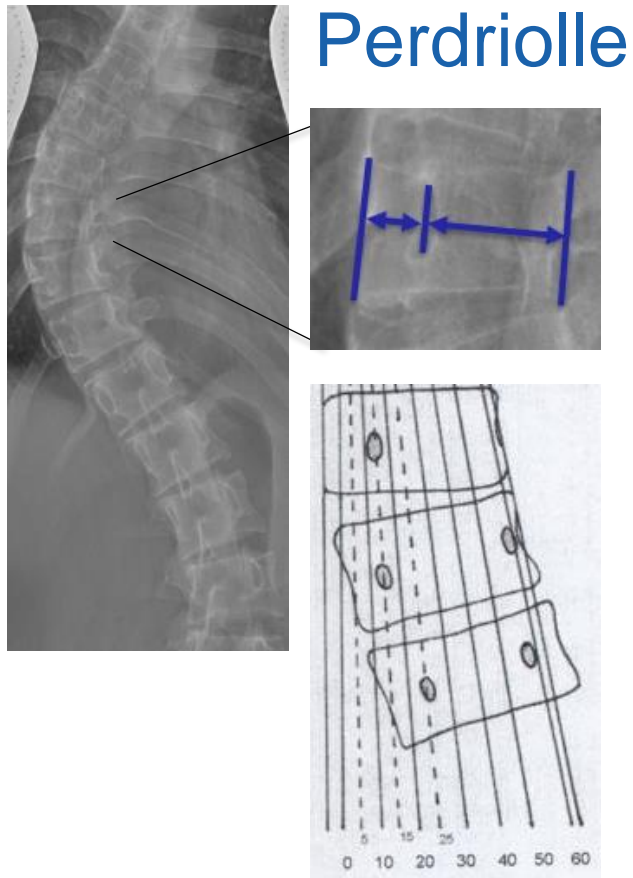


Supine MR scan

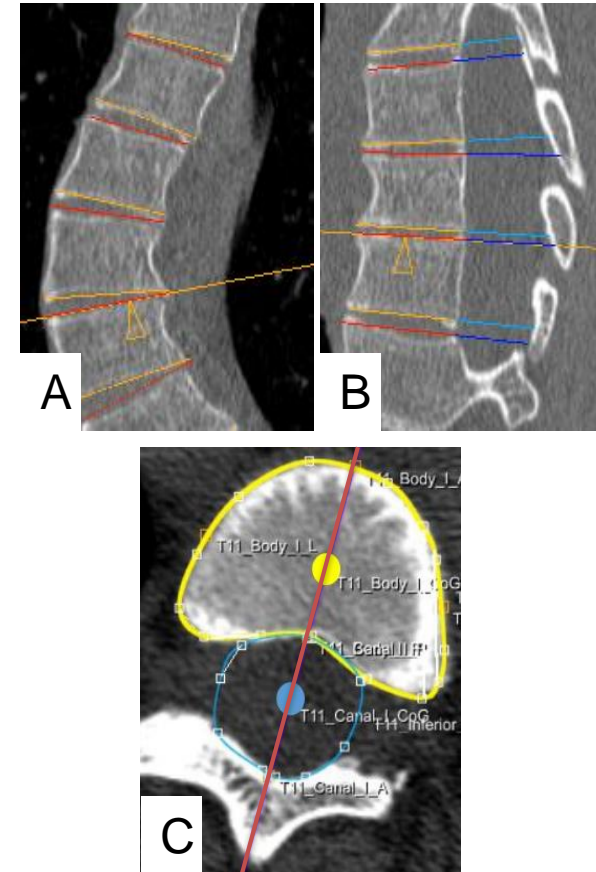


Methods – Apical vertebral rotation

2-D



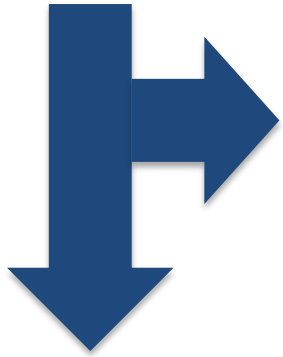
3-D



AIS patients

Inclusion

- Complete pre-operative work-up



Exclusion

- Scan interval > 6 months
- Other spinal pathology
- Previous spinal surgery

62 patients

Intra-interobserver reliability

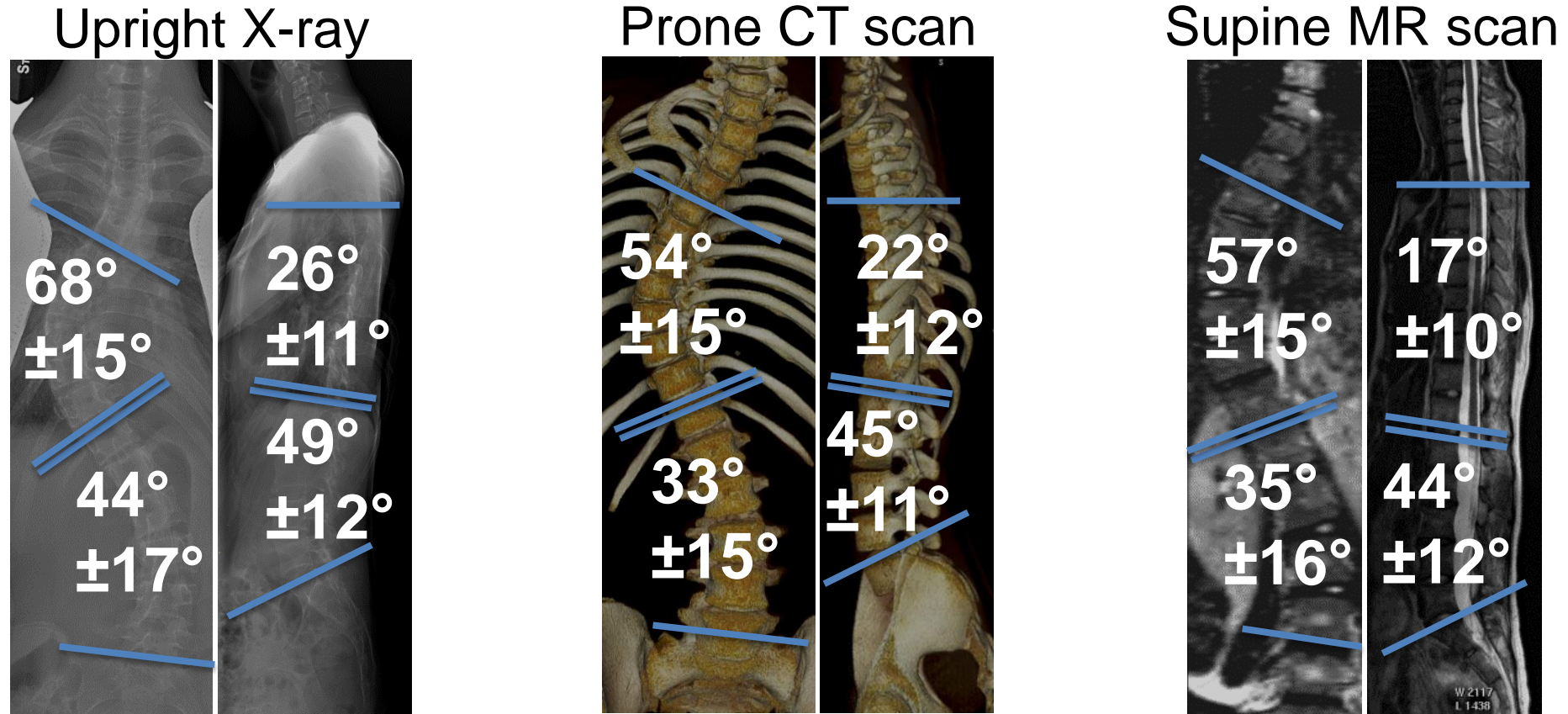
	X-ray		CT scan		MRI scan	
	Intra	Inter	Intra	Inter	Intra	Inter
<i>Thoracic Cobb</i>	0.99	0.97	1.00	1.00	1.00	0.97
<i>Lumbar Cobb</i>	1.00	1.00	1.00	1.00	1.00	0.99
<i>Thoracic kyphosis</i>	0.99	0.92	0.93	0.86	0.99	0.94
<i>Lumbar lordosis</i>	0.99	0.99	1.00	0.97	1.00	0.97
<i>Thoracic rotation</i>	0.98	0.98	0.92	0.89	0.94	0.74
<i>Lumbar rotation</i>	0.98	1.00	0.92	0.89	0.91	0.89

All intra-observer ratios > 0.91

All inter-observer ratios > 0.74



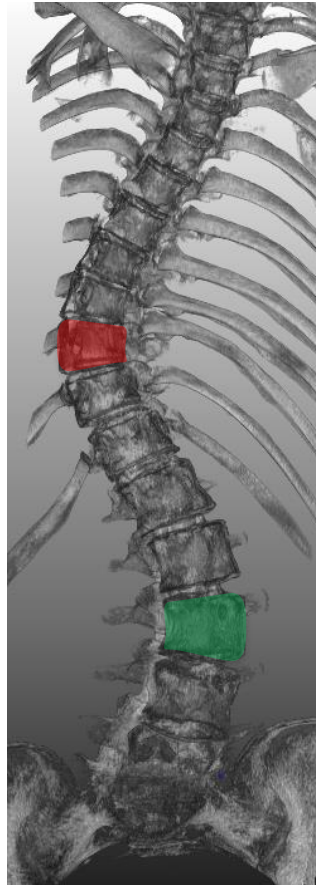
Results – Coronal and sagittal plane



$P < 0.01$ for all the parameters between the upright X-ray, prone CT scan and supine MR scan



Results – Transverse plane



Apical vertebral rotation

<u>Upright</u>	<u>Prone</u>	<u>Supine</u>
22° ±12°	20° ±9°	16° ±11°
11° ±13°	8° ±11°	6° ±14°



$P < 0.01$ for all the parameters between the upright X-ray, prone CT scan and supine MR scan

Results – Strong correlation between three positions

	ICC (95% CI)	P-value
<i>Thoracic Cobb angle</i>	0.967 (0.950 – 0.979)	<0.001
<i>Lumbar Cobb angle</i>	0.964 (0.945 – 0.977)	<0.001
<i>Thoracic kyphosis</i>	0.873 (0.806 – 0.919)	<0.001
<i>Lumbar lordosis</i>	0.854 (0.777 – 0.907)	<0.001
<i>Thoracic apical rotation</i>	0.815 (0.718 – 0.882)	<0.001
<i>Lumbar apical rotation</i>	0.900 (0.848 – 0.937)	<0.001



Conclusions

In upright position more deformity; “which is real?”

Strong correlation between the morphology in all three planes between three positions.

Severity of scoliotic deformity can be to a large extent represented by different imaging modalities despite the differences in body position.



Disclosures

Rob C. Brink

Alexandre Suerman MD PhD Stipendium, UMCU

Tom P.C. Schlösser

European AOSpine Young Researcher Award 2016

Winnie C.W. Chu

Fondation Yves Cotrel de l'institut de France

Jack C.Y. Cheng

Peer reviewed competitive research grants

René M. Castelein

Medtronic research grant, K2M research grant

