CT Lung Volume Increase after Surgical Treatment in EOS

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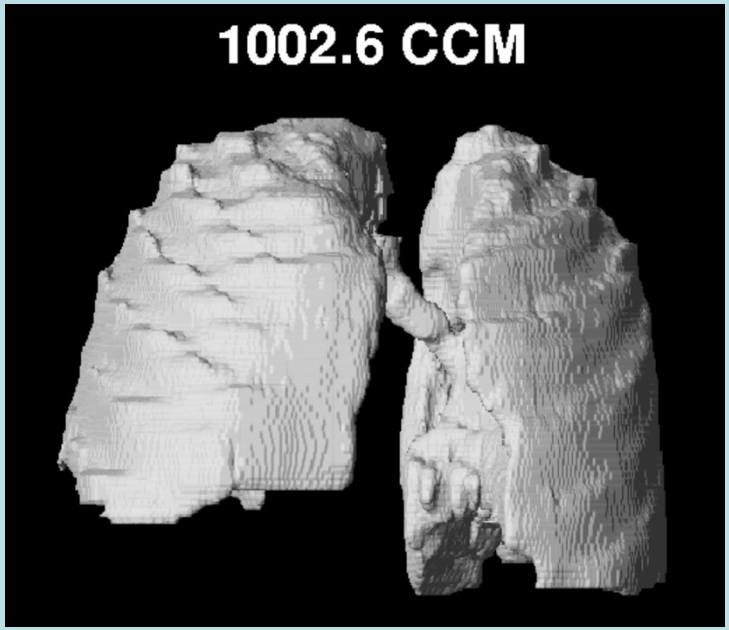
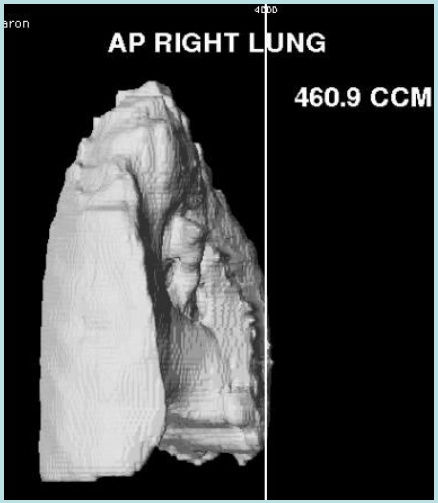
Disclosure : CJ Medtronic a,g
AMc none



CT lung volumes

concave > convex



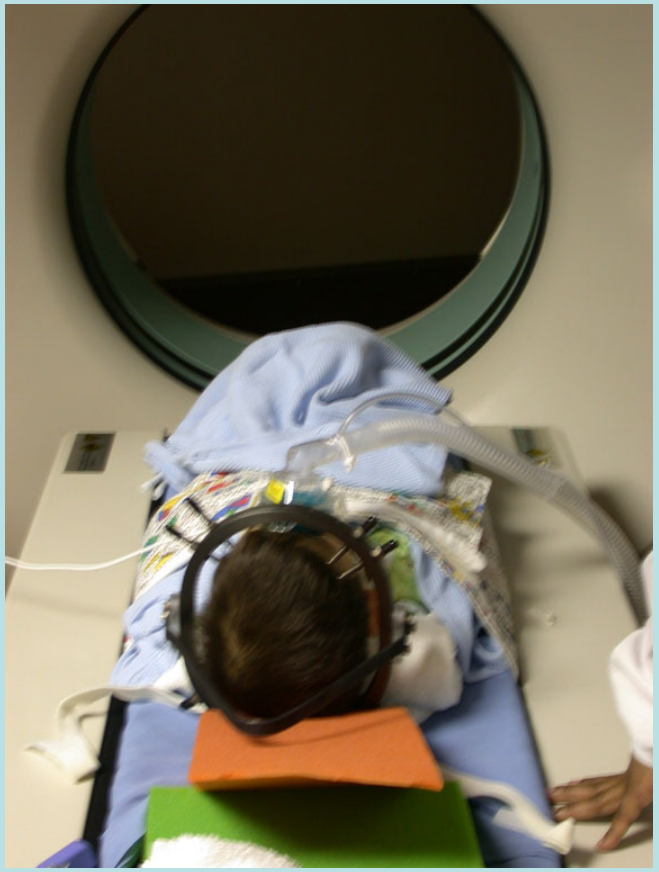
Lung vol 860 cc

PURPOSE : to evaluate anatomic results of treatment, especially in patients too young to perform traditional PFT (physiologic measure of outcome)

Methods

- 20 pts (8 congenital, 12 non-cong.)
- mean age 3.6 yr (0.8-8.8) @ initial scan

  (usually w/ MRI)
- F/u scan @ 6.3 yr (2.9-11.4) (IRB protocol = q 2 yr)



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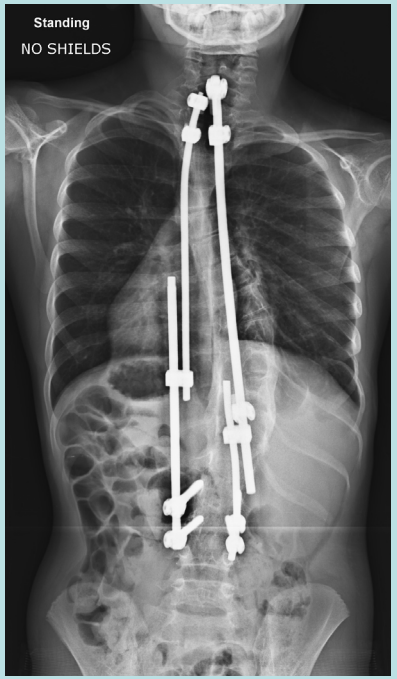
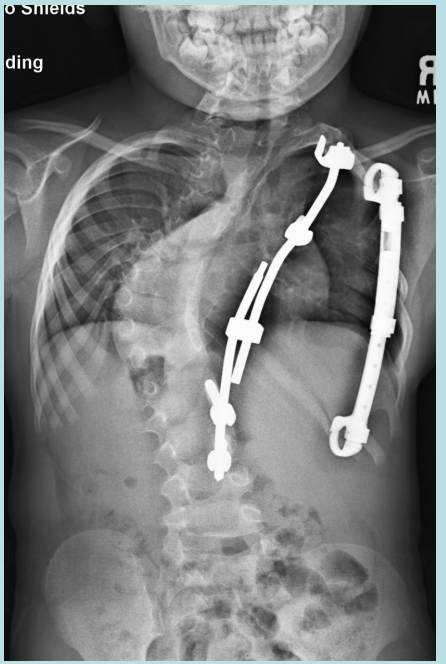
Index terms:
Children, respiratory system
Computed tomography (CT), in infants and children, 60.12118
Lung, CT, 60.12118
Lung, function

Radiology 1999; 212:588–593

Lungs in Infants and Young Children: Improved Thin-Section CT with a Noninvasive Controlled-Ventilation Technique—Initial Experience[1]

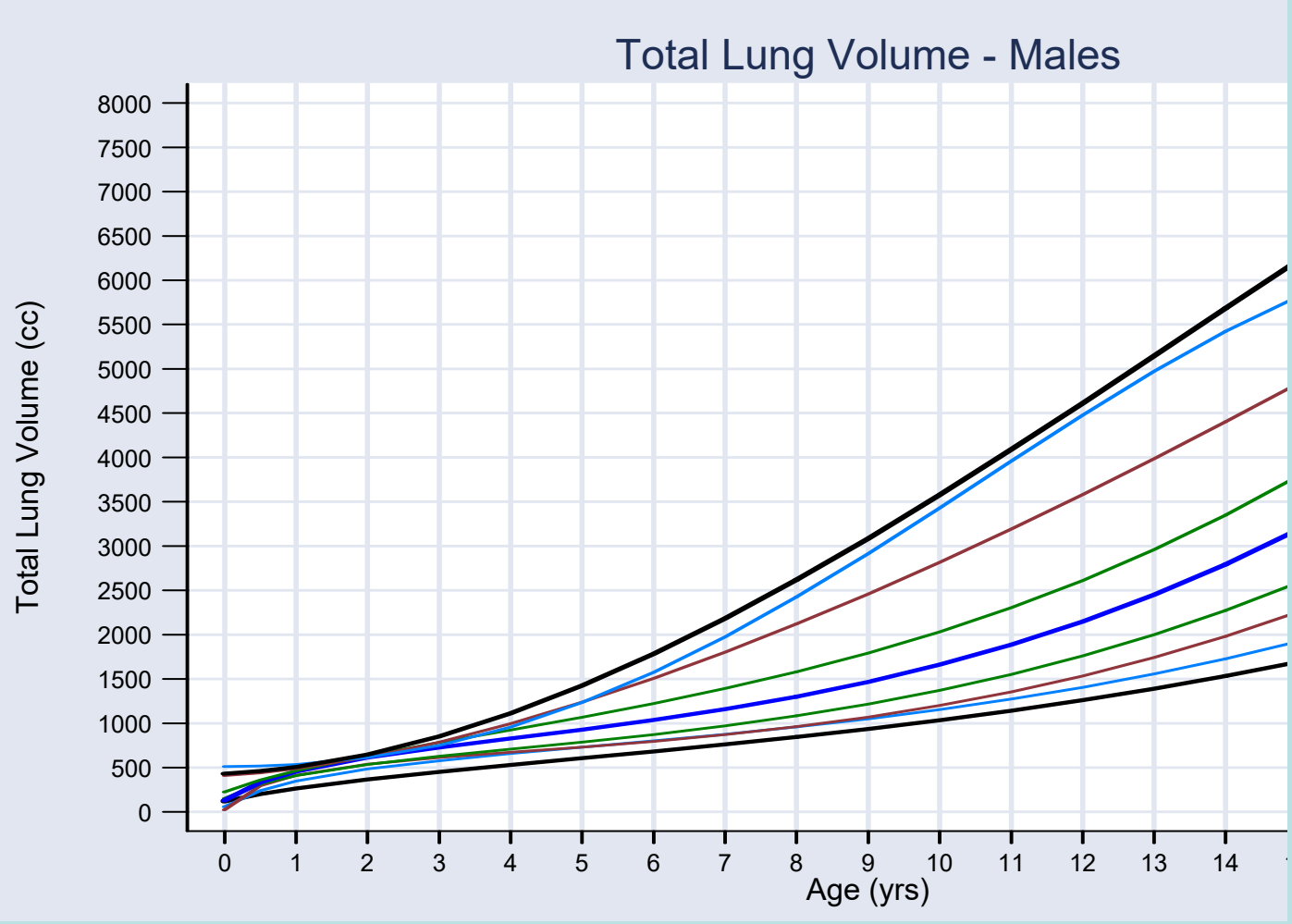
- 11 pts – spine-based (SB) growth-friendly rx
- 9 pts – rib-based (RB)
- CT volumes preop & f/u
- T1-12 height & width, pelvic width
- Curve magnitude (Cobb)





Absolute & %tile CT volume vs age

Gallogly, Smith Spine 2004



Technique not standardized from center to center

Difficult to document change in %ile at young age

Standardized Th height & width % iles

Prediction of Thoracic Dimensions and Spine Length Based on Individual Pelvic Dimensions in Children and Adolescents: An Age-Independent, Individualized Standard for Evaluation of Outcome in Early Onset Spinal Deformity

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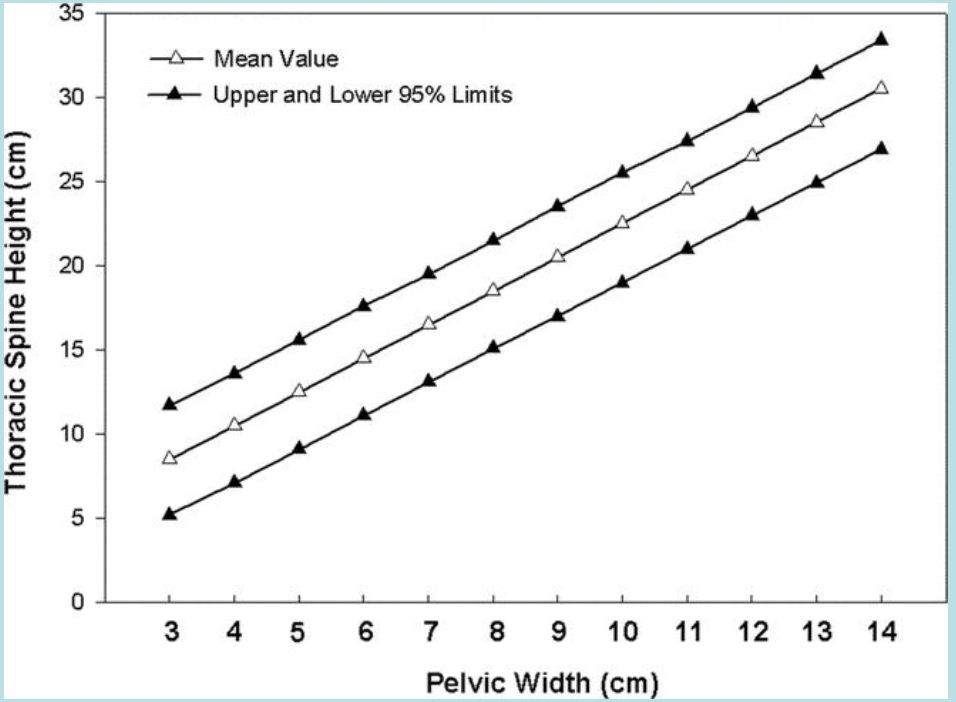
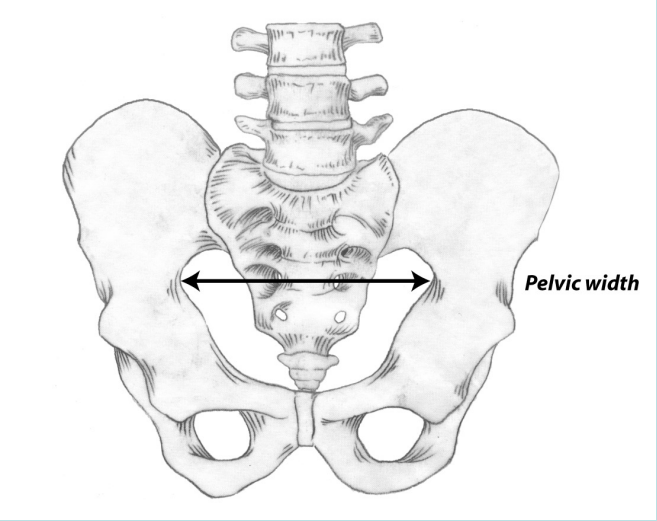
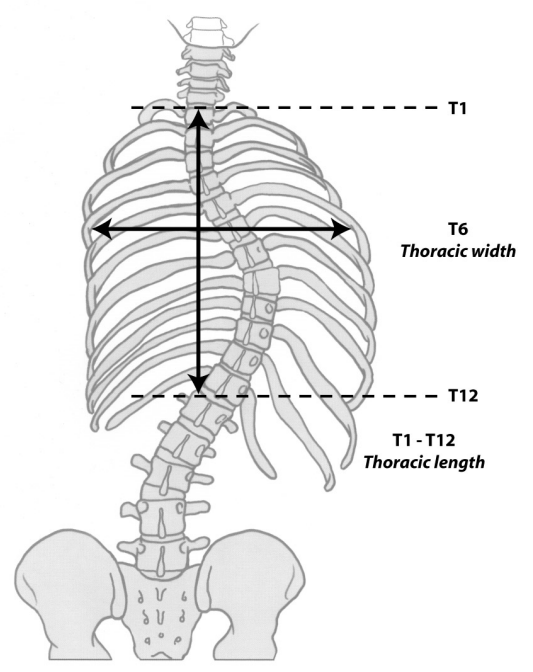






Results – CT Volume (n=20, all ↑)

		RB	SB	*p*
CT volume (cc)	pre	522	889	.004
	f/u	790	1302	.003
	Δ	268	413	.11
	p	<.001	<.001	
Age 1st CT (yr)		2.8	4.1	.19

- RB 51% increase (p<.001)
- SB 46% increase (p<.001)
- RB pts had significantly smaller pre-tx volume 2º congenital/chest wall dx's and 1st scan @ younger age

Results T1-12 height

		RB	SB	P
T1-12 height (mm)	pre	115	139	.15
	f/u	141	165	.14
	Δ	26.2	25.7	n.s.
	p	<.001	.04	

- Absolute length increase 2.5 cm; RB vs SB same
- Increase in absolute length significant for both (esp. RB)
- RB height < SB (cong. dx, younger age @ 1st scan)
- T1-12 length correlated with CTvol pre-tx (r^2=.64, p=.002) and f/u (r^2=.58,p=.007)

T6 Coronal & Pelvic Width

		RB	SB		p
T6 coronal width (mm)	pre	123	150		.001
	f/u	131.5	157		.004
	Δ	8.6	7.1		n.s.
	p	.09	.08		
Pelvic width (mm)	pre	65.9	76.7		.06
	f/u	76.1	88.0		.03
	Δ	10.2	11.2		n.s.
	p	.015	.02		

- PW ↑ with time/growth (expected)
- T6 width trend ↑ with time
- RB parameters < SB (2° dx and age)
- T6 width correlates best with CTvol

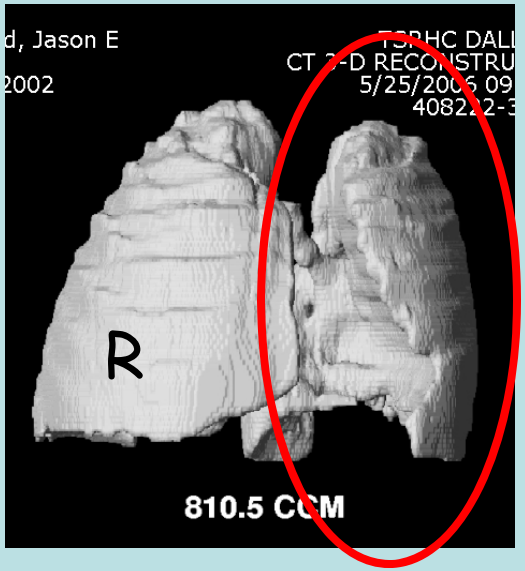
(r^2=.76, p<.0001 pre-tx, r^2=.82,p<.0001 f/u)

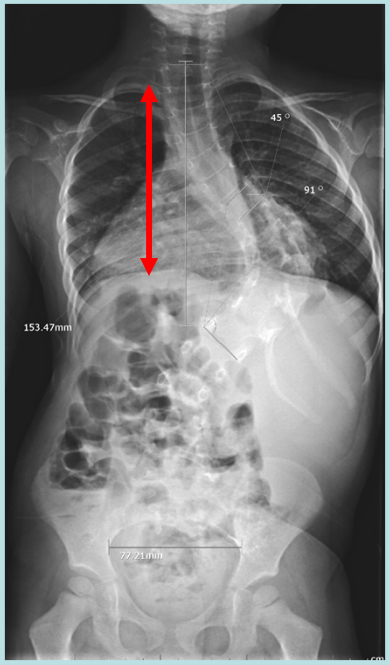
Curve Magnitude

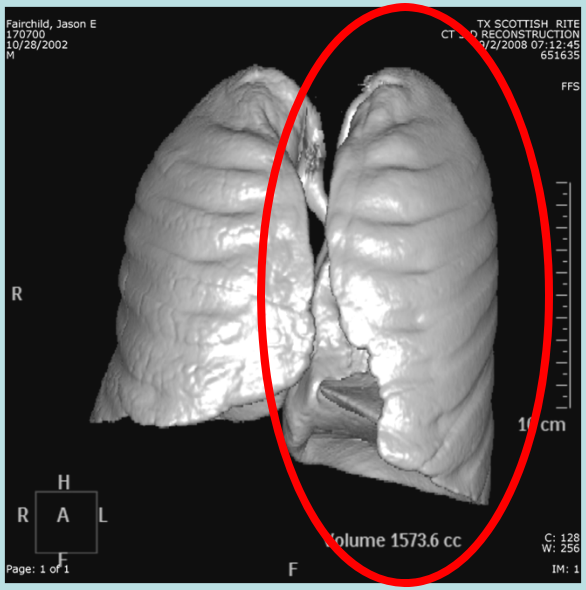
		Rib based	Spine based	p
Cobb (degrees)	pre	60.2	77.9	.09
	f/u	58.7	56.9	n.s.
	Δ	-1.5	-21	.06
	p	n.s.	.01	

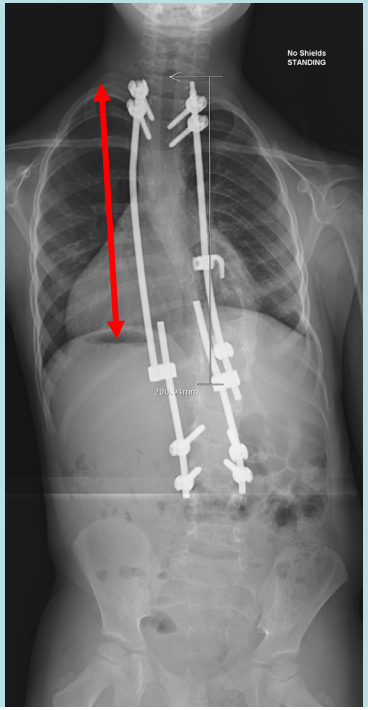
- RB constructs -> no correction, SB correction mean 27%
- No correlation between MT Cobb and CTvol pre-op or f/u
- % curve correction -> weak correlation (r^2=.48, p=.03)

Example



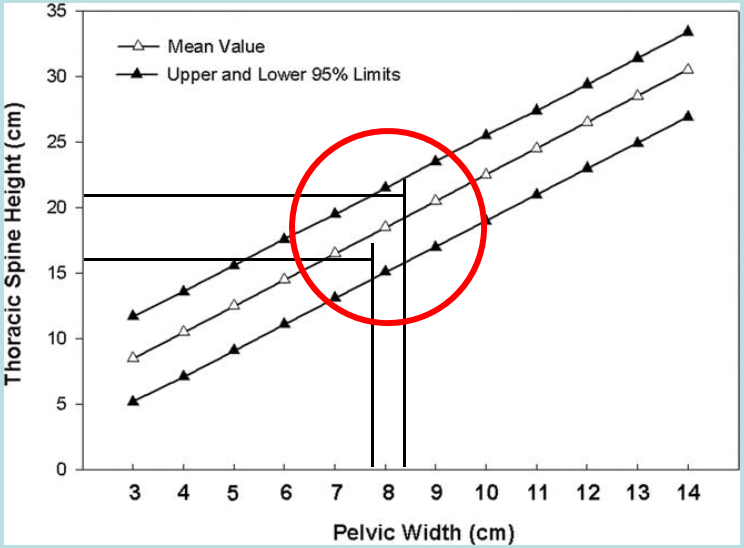






Lung volume

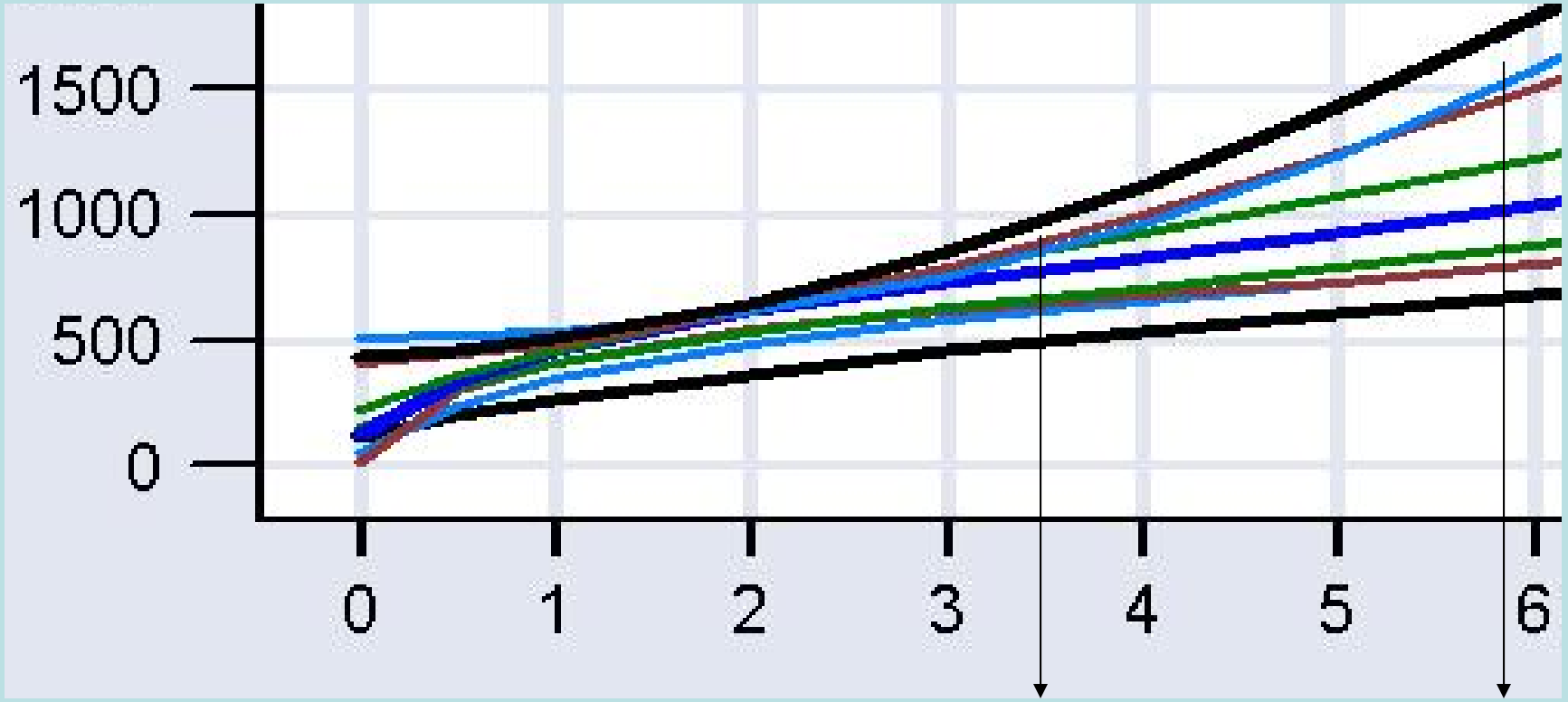
	L	R	Tot	T1-12
5/06	337	473	811	15.3
9/08	845	729	1574	20.1



L lung expanded > R

Associated with T1-12 height gain $25^{th} \rightarrow 75^{th}$ %

CT volumes -> unable to show clear effect of Rx 2° "control" data compression



Narrow % ile diff's < 4yr -> difficult comparison to "control"

3+6
811

5+10
1574

CT vol increase

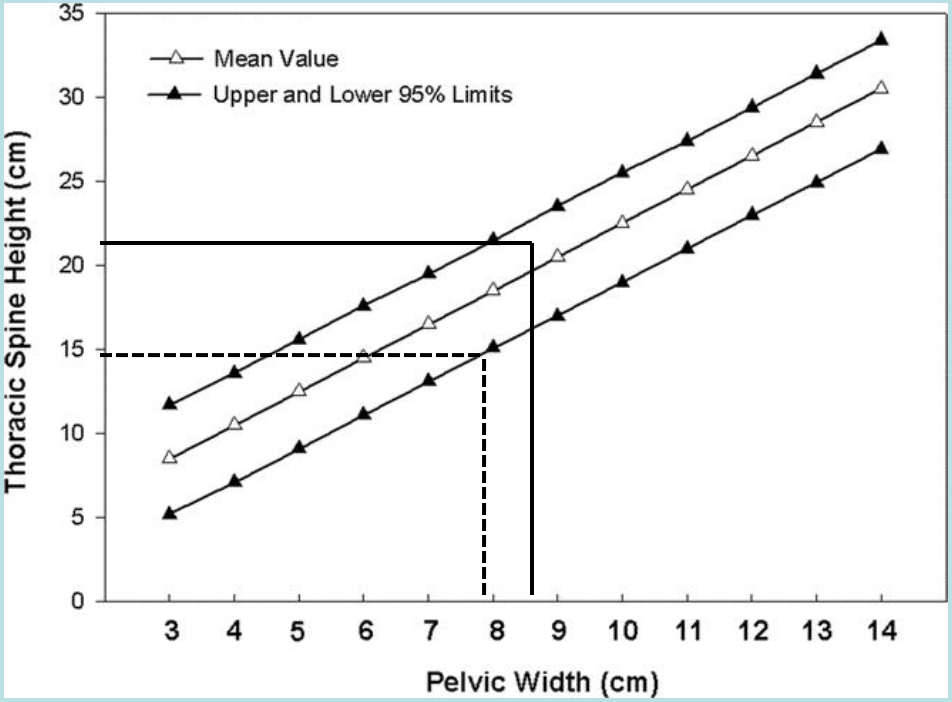
All pts ↑ volume
16-155%

- 3 ↑ > 1 SD
- 10 same < 1SD >
- 7 ↓ > 1SD

T1-12 length

Preop: all pts @ or <5th %ile

F/U : 8/20 > 5%ile (5-60)



CT volume - Summary

- Objective measure to determine if thorax larger 2° rx + growth
- Effect of RX exceeding expected growth - more obvious in thoracic parameters than in CT vol Δ
- Serial data best utilized to control rx in individual patient
- CVCT reproducibility
- Small cohort
- Apply limited control data accurately

} Ability to show significant Δ's over time due to rx ???

TEXAS
SCOTTISH RITE HOSPITAL
FOR CHILDREN

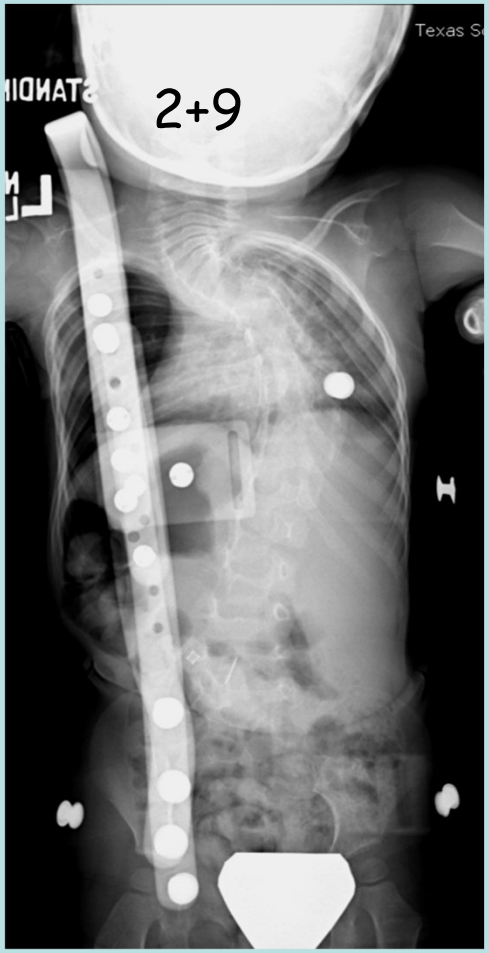
50 years

TEXAS SCOTTISH RITE HOSPITAL FOR CHILDREN

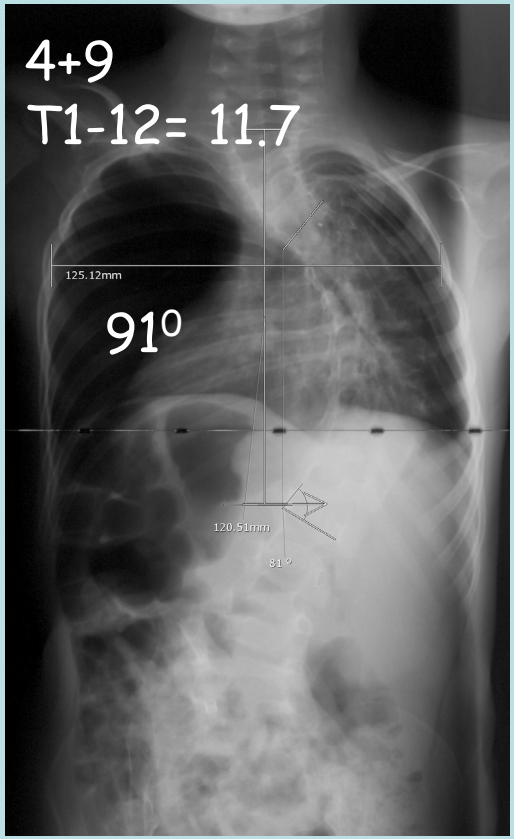
MH Hunt bridge, Dallas
A.D. 2012

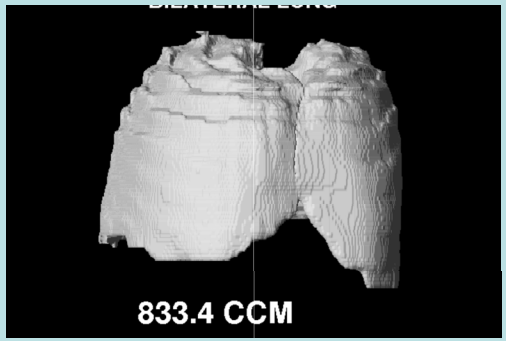
Pont du Gard
A.D. 60

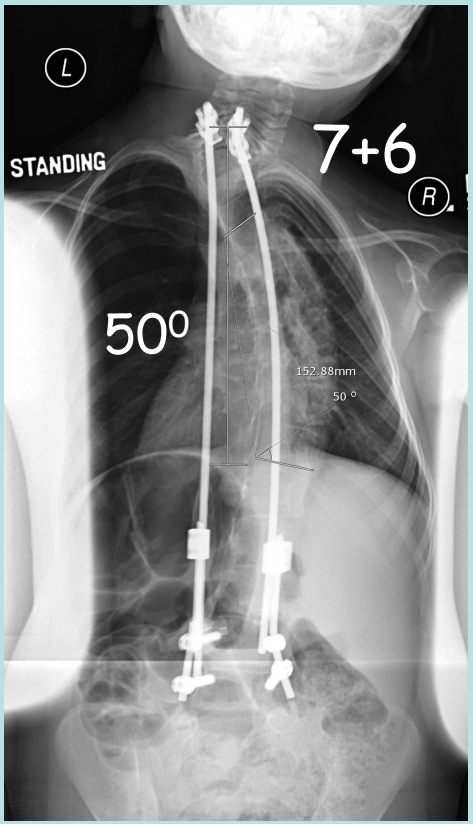
Non-op → Operative

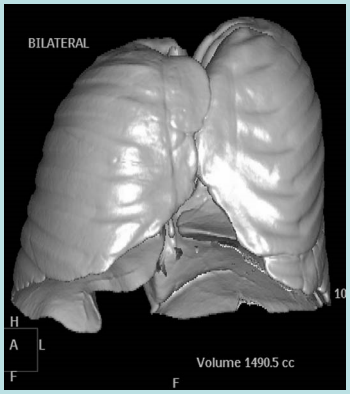


T1-12 = 11.7 cm
R 399 L 435 = 834cc









T1-12= 15.4
R 679 L 801
= 1480

RESULTS

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Cobb (degrees)	pre	60.2	77.9	.09
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	Δ	-1.5	-21	.06
	p	n.s.	.01	
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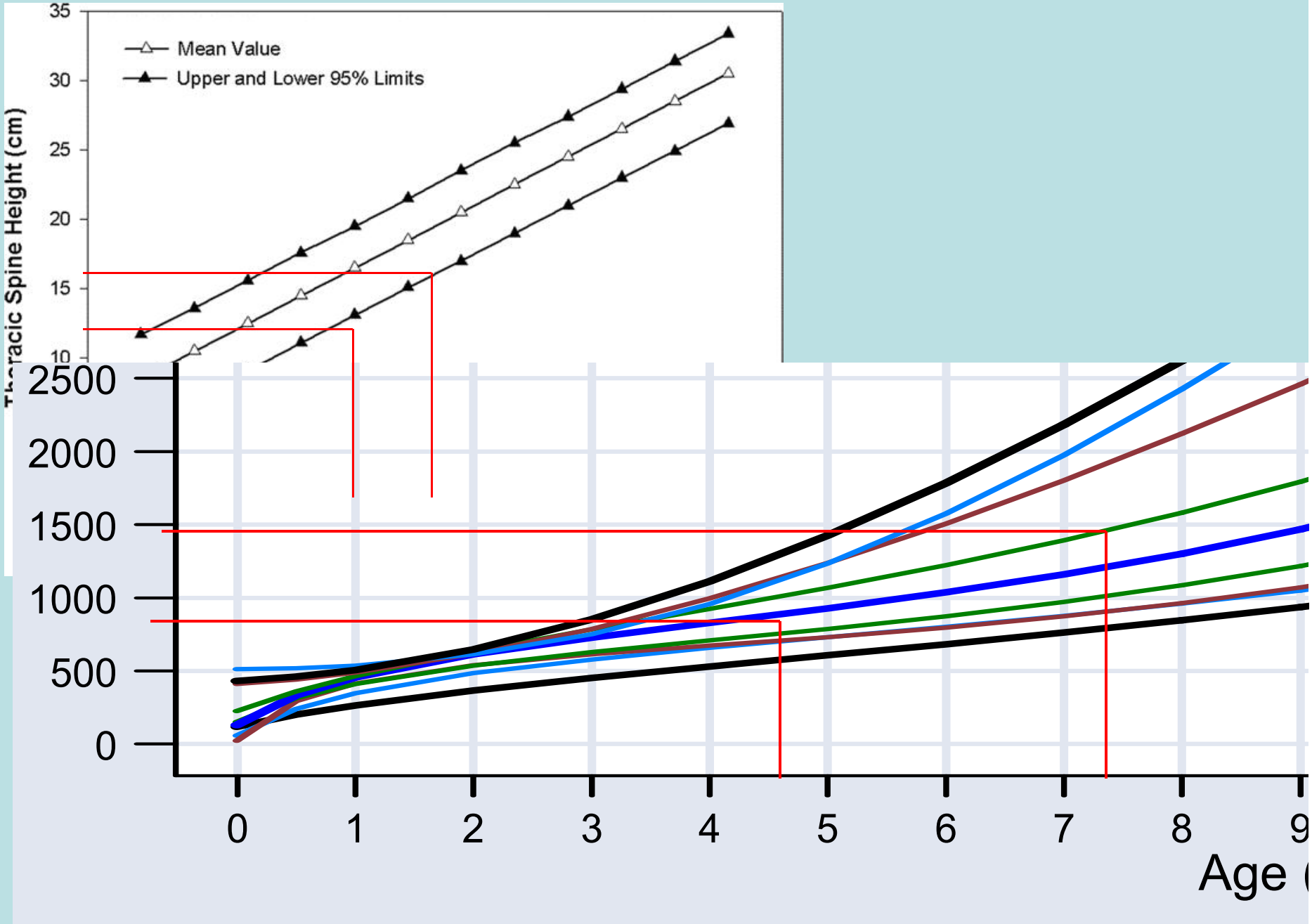
Mean Value
Upper and Lower 95% Limits
Thoracic Spine Height (cm)
35
30
25
20
15
10
2500
2000
1500
1000
500
0
0
1
2
3
4
5
6
7
8
9
Age