Pulmonary Function Following Early Thoracic Long Fusion in Congenital Scoliosis
- Long-term Follow-up Study -

Toshiki Saito, Noriaki Kawakami, Taichi Tsuji, Tetsuya Ohara, Yoshitaka Suzuki, Ayato Nohara, Ryo Sugawara, Kousuke Takimura, Kyotaro Ohta, Kazuki Kawakami

Department of Orthopedic and Spine Surgery,
Meijo Hospital, Nagoya, Japan

Disclosure

Toshiki Saito ： No relationship

Noriaki Kawakami ： Medtronic, DepuySynthes

Taichi Tsuji ： No relationship

Testuya Ohara ： No relationship

Yoshitaka Suzuki：No relationship

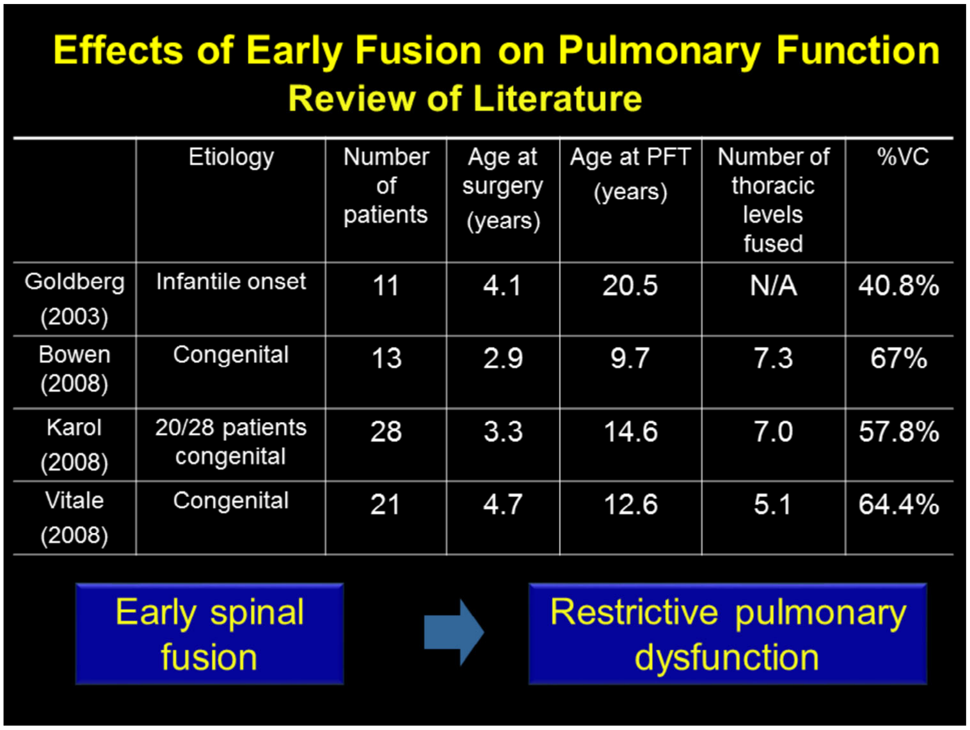
Ayato Nohara ： No relationship

Ryo Sugawara ： No relationship

Kousuke Takimura ： No relationship

Kyotaro Ohta ： No relationship

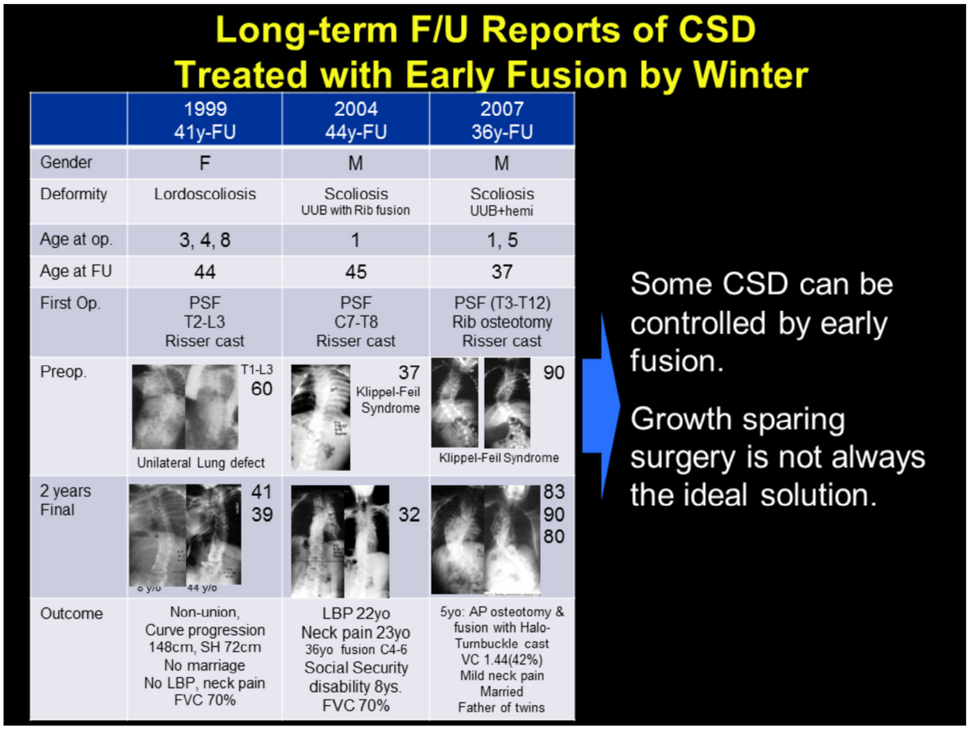
Kazuki Kawakami ： Medtronic, DepuySynthes



Effects of Early Fusion on Pulmonary Function
Review of Literature

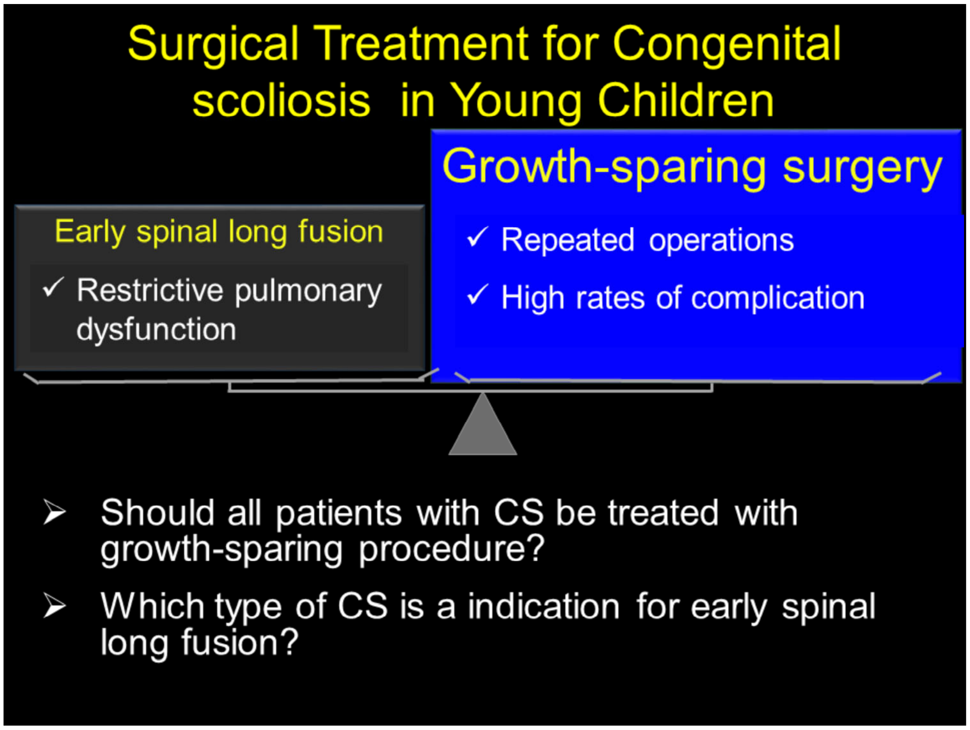
	Etiology	Number of patients	Age at surgery (years)	Age at PFT (years)	Number of thoracic levels fused	%VC
Goldberg (2003)	Infantile onset	11	4.1	20.5	N/A	40.8%
Bowen (2008)	Congenital	13	2.9	9.7	7.3	67%
Karol (2008)	20/28 patients congenital	28	3.3	14.6	7.0	57.8%
Vitale (2008)	Congenital	21	4.7	12.6	5.1	64.4%

To our knowledge, we have four studies that report on the effect of early fusion on pulmonary function. All of them concluded that early spinal fusion results in a restrictive pulmonary dysfunction.



By 2012, Dr. Winter presented 3 cases where long time follow-up was possible and concluded that early fusion did not deteriorate the 3 patients in terms of respiratory function and surgical outcome.

What he emphasized through these case reports are that some CSD can be controlled by early fusion and that growth sparing surgery is not always the ideal solution to treat CSD with.



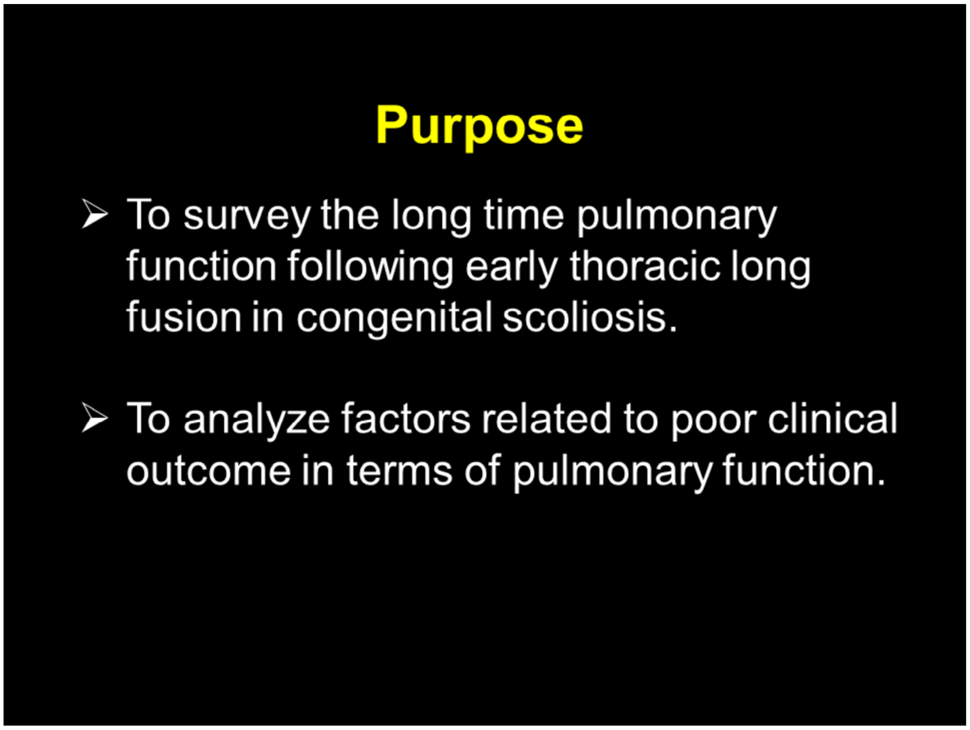
Growth sparing surgery has become a standard procedure for EOS these days, however, repeated surgeries and higher risk of complications are some existing issues in clinical practice.

Looking back to the EOS patients who were treated before, here raised questions such as;

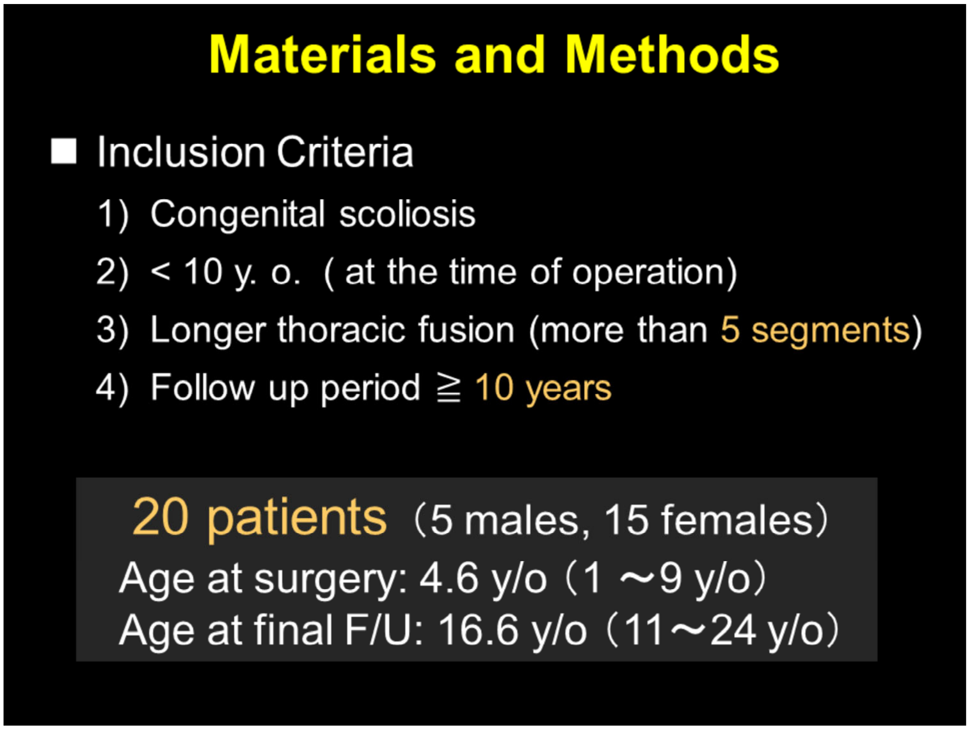
1)Should all patients be treated with growth-sparing procedure?,

2)Who really needs growth-sparing surgery?

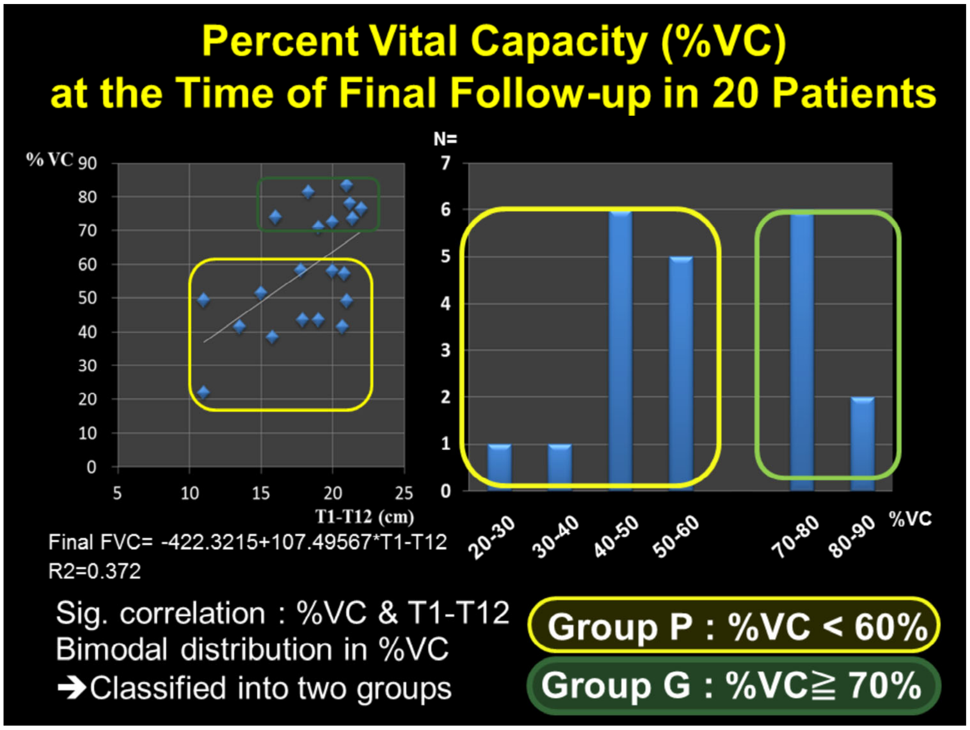
3)Which type of CS is a good indication for early spinal long fusion?



The purpose of this study was to survey the long time pulmonary function following early thoracic long fusion in congenital scoliosis, and to analyze factors related to poor clinical outcome in terms of pulmonary function.



Inclusion criteria were CS, younger than 10 years at the age of surgery, longer thoracic fusion (more than 5 segments), minimum F/U was 10 years. 20 patients matched these criteria. The mean age at the time of surgery was 4.6 and that of final F/U was 16.6 years.



There was a significant positive relationship between %VC and the total length of T1-T12 at the final F/U.

%VC demonstrated bimodal distribution; patients that are in normal range (>70%) and those lower than 60% .

The 20 patients can be separated among two groups, Group P; % VC <60%, Group G: % VC > 70%

Demographic Data of Group P and Group G

		Group P (n=12)	Group G (n=8)
Gender	Male	1	4
	Female	11	4
Types of anomaly	Multiple vertebral anomalies	12(100%)	6 (75%)
	Fused ribs(+)	7	0
	Fused ribs (-)	5	6
	Unilateral unsegmented bar	2	2
	Fused ribs(+)	2	0
	Fused ribs (-)	0	2
	Solitary vertebral anomaly	0	2 (25%)
Age at the time of op. (yrs.)		4.3	5.3
F/U period (yrs.)		14.7	17.6

Patients in Group P had multiple vertebral anomalies.
All patients with fused ribs belonged to Group P.

This slide showed demographic Data of two groups.

As you can see all patients with fused ribs belonged to Group P.

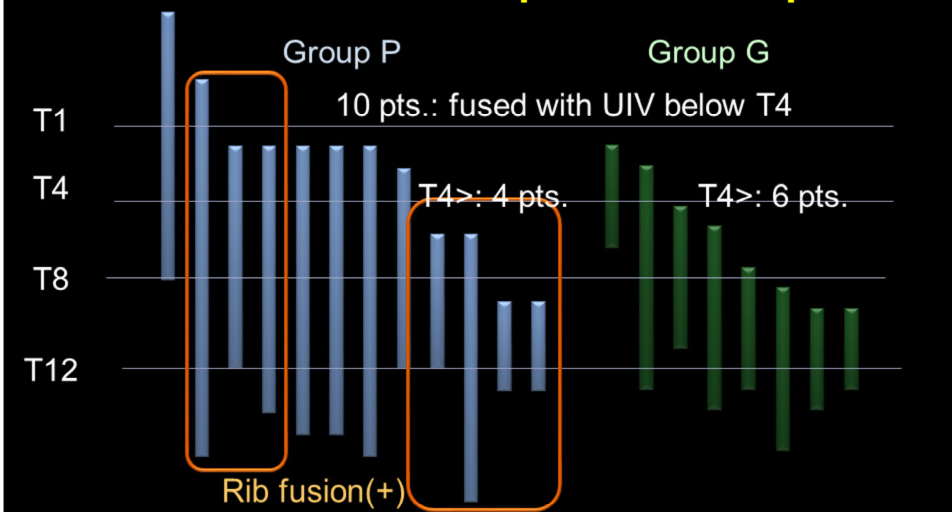
Surgical Intervention of Group P and Group G

		Group P (n=12)	Group G (n=8)
Method of operation	Ant. + Post.	9	6
	Post.	1	2
	Ant.	2	0
Patients who underwent Multiple ops.		9	7
Number of vertebrae fused	Total	11.4±4.2	6.8±2.3
	Thoracic vertebrae	8.9±2.8	5.1±2.7
UIV	Cervical	2	0
	Upper thoracic (T1-T3)	6	2
	Middle thoracic (T5-T8)	2	3
	Lower thoracic (T9-T12)	2	3

Group P: exhibited longer fusion area
had UIV that was placed higher than that of Group G.

When we compared surgical interventions among both groups, Group P exhibited longer fusion area and had UIV that was placed higher than that of Group G.

Fusion area of Group P and Group G



	Group P	Group G	p
Total	11.4±4.2	6.8±2.3	$p<0.01$
Thoracic vertebrae	8.9±2.8	5.1±2.7	$p<0.01$

Scoliosis and PFT of Group P and Group G

		Group P (n=12)	Group G (n=8)	p
Preoperative Cobb angle		72.9±26.8	63.5±14.7	0.19
Postoperative Cobb angle		48.1±21.6	39.3±13.5	0.15
Correction rate (%)		29.8±25.7	36.4±24.3	0.29
Pulmonary function test	VC (ml)	1145±315	2140±468	<0.01
	%VC (%)	46.2±10.8	76.3±4.4	<0.01
	FEV1.0 (%)	88.4±10.8	89±6.4	0.47
Height (cm) at final F/U		138.7±10.8	148.6±10.1	0.10
Thoracic height: T1-T12 (cm)		16.7±3.5	21.4±5.6	0.016

Scoliosis correction: no difference

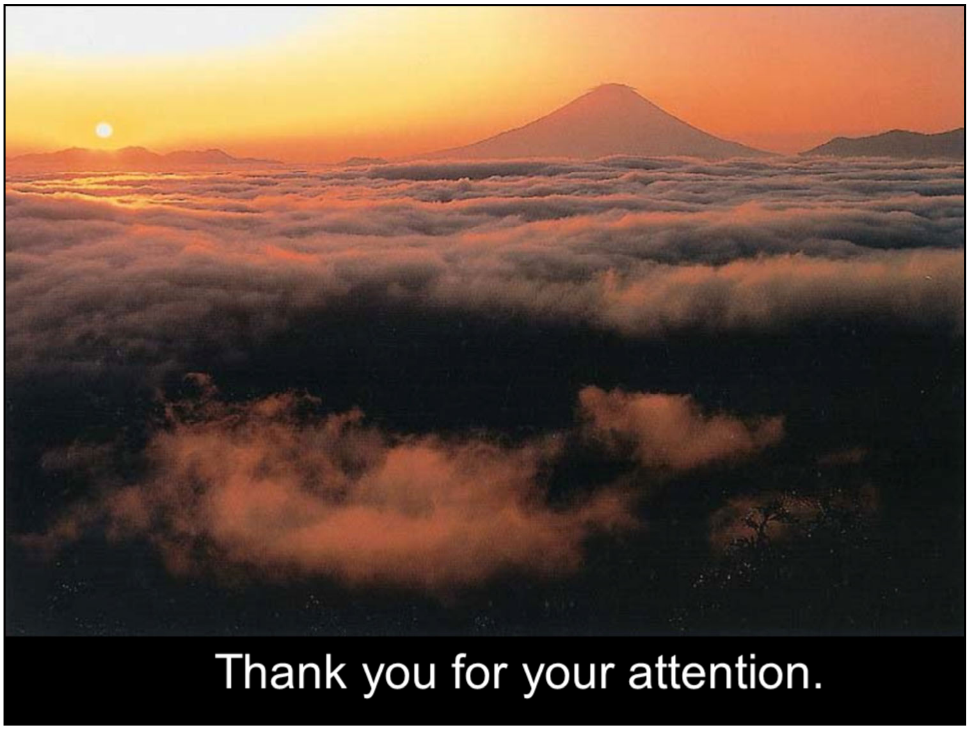
VC, %VC, and T-height: sig. different

Comparison of scoliosis and PFT of both groups showed no remarkable difference among the two groups. However, significant differences were seen in VC, compensated %VC, and thoracic height. Thoracic height of Group G was 21.4 cm.

Conclusions

- Poor pulmonary function due to early thoracic long fusion was correlated with;
  1) more extensive thoracic fusion
  2) placement of UIV higher than T3
  3) fused ribs with multiple vertebral anomalies.

- Early long thoracic fusion should not be performed for patients with risk factors as above. In another words, those patients may be good candidates for growth sparing surgery.


Thank you for your attention.