



Prevention of Adjacent Segmental Disease After Fusion in Degenerative Spinal Disorder

: Correlation Between PI-LL Mismatch and Segmental Lumbar Lordosis for a Minimum 5-Year Follow-Up

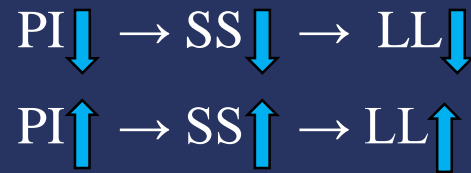
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Introduction

- Lumbar lordosis : $40^\circ \sim 60^\circ$
 - 33 to 88 degrees : a large standard deviation
 - Different normal values for each individual
 - Inappropriate to compare

- Optimal $LL = PI \pm 9^\circ$



- **About 60%** at L4-5-S1(lumbar lordosis)



Purpose

To analyze the prevention of ASD by

– Sagittal balance

- $\Delta\text{PI-LL} < 10$

– Regional balance

- Ratio of L4-5-S1/L1-S1 to physiological lordosis



Materials and Methods

- Jan 2010 ~ Dec 2012 (274 patients)
 - F/U > 5 years after operation
 - Pre & postoperative whole spine standing X-ray
- Inclusion criteria
 - Fusion of below 3 levels
 - Previous surgery(-)
 - **Sagittal imbalance(-)**
- 77 patients
 - ASDs (37 cases) : op (+) with ASD
 - CTRL (40 cases) : op (-) without ASD
Randomly selected in a similar distribution



Methods : Radiologic Evaluation

- Spinopelvic parameter
 - Lumbar lordosis (LL) : L4-5-S1, L1-S1
 - Pelvic tilt (PT)
 - Sacral slope (SS)
 - Pelvic incidence (PI)

- Δ PI-LL
 - <10, >10

- Ratio (L4-5-S1 / L1-S1)
 - <30%, 30~40%, 40~50%, 50~60%, >60%

Results : Radiologic measurements

	ASDs (n = 37)			CTRL (n=40)		
	Preop	Postop	p-value	Preop	Postop	p-value
LL (L1-S1) (°)	40.6 ± 9.5	40.7 ± 11.8	0.131	41.8 ± 10.1	45.2 ± 10.8	0.072
LL (L4-5-S1) (°)	21.3 ± 9.1	19.2 ± 9.4	0.114	22.1 ± 8.4	24.8 ± 7.7	0.241
Pelvic tilt(PT) (°)	23.9 ± 8.5	22.3 ± 8.7	0.275	21.4 ± 8.8	21.3 ± 7.7	0.214
Sacral slope(SS) (°)	31.1 ± 6.6	31.5 ± 8.1	0.301	30.5 ± 7.1	32.1 ± 8.6	0.355
Pelvic incidence(PI) (°)	54.9 ± 9.4			52.3 ± 11.3		

Results : Radiologic measurements

	ASDs (n=37)	CTRL (n=40)	ASD occur
PI-LL<10	12	24	12/36 (33.3 %)
PI-LL>10	25	16	25/41 (61 %)
	Ratio (%)	p-value	
	<30	0.478	
	>30	0.223	
	>40	0.089	
	>50	0.045	
	>60	0.031	

- Postop. PI-LL<10 & segmental lordosis ratio > 50%
 - ASD less occurred

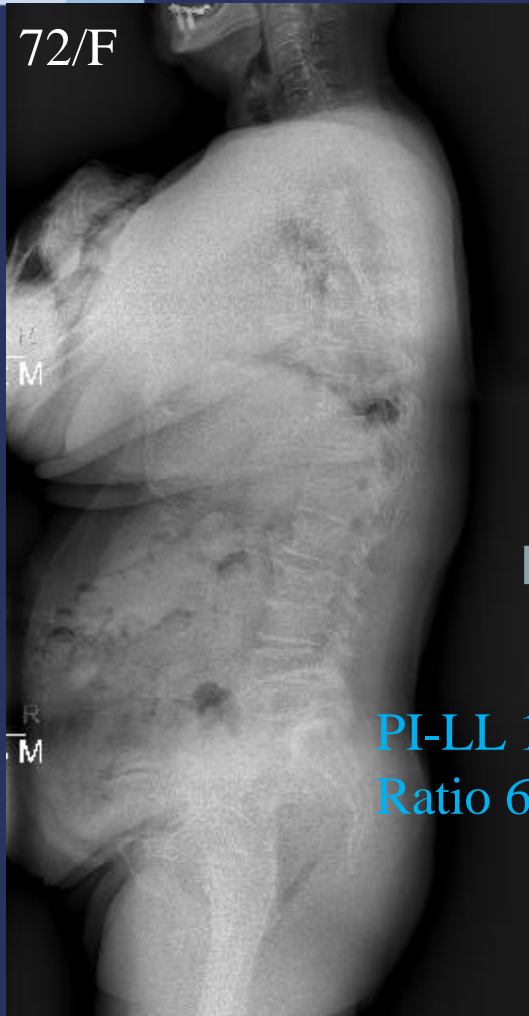
Results : Correlation of PI-LL & ratio

	Lordosis ratio <50%		Lordosis ratio >50%	
	ASDs	CTRL	ASDs	CTRL
PI-LL<10	9(75%)	9(37.5%)	3(25%)	15(62.5%)
PI-LL>10	19(76%)	6(37.5%)	6(24%)	10(62.5%)

- Incidence of ASD significantly reduced if
 - PI-LL < 10
 - Lordosis ratio > 50%

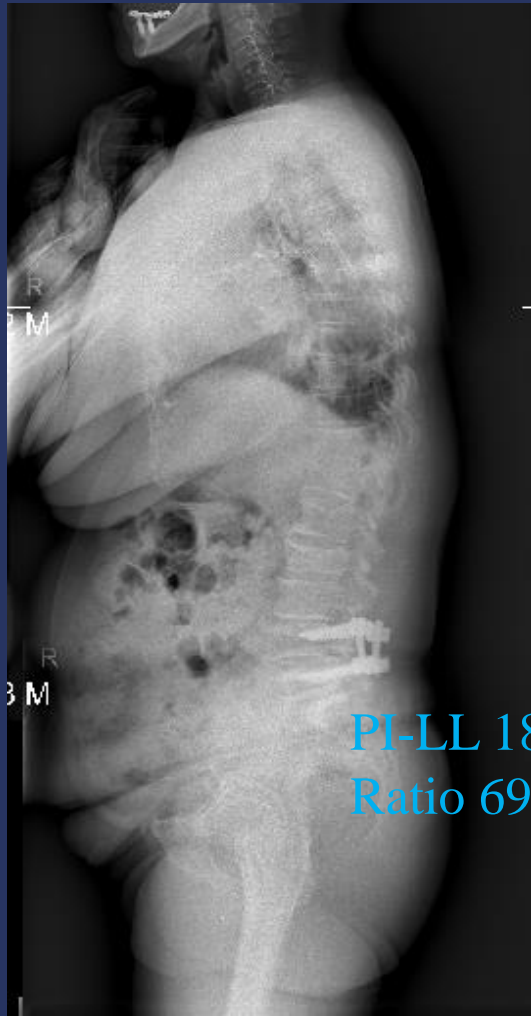
Case 1

72/F



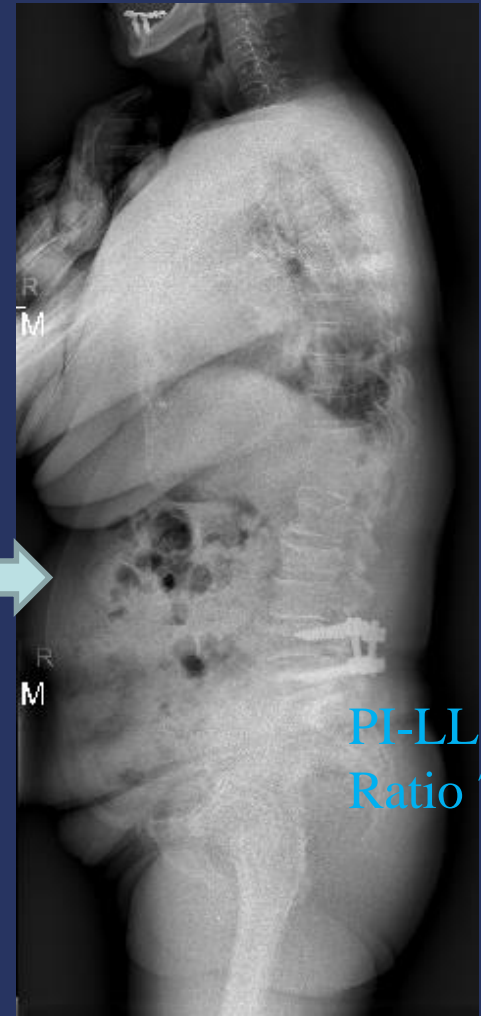
PI-LL 14
Ratio 67%

Initial Lat



PI-LL 18
Ratio 69%

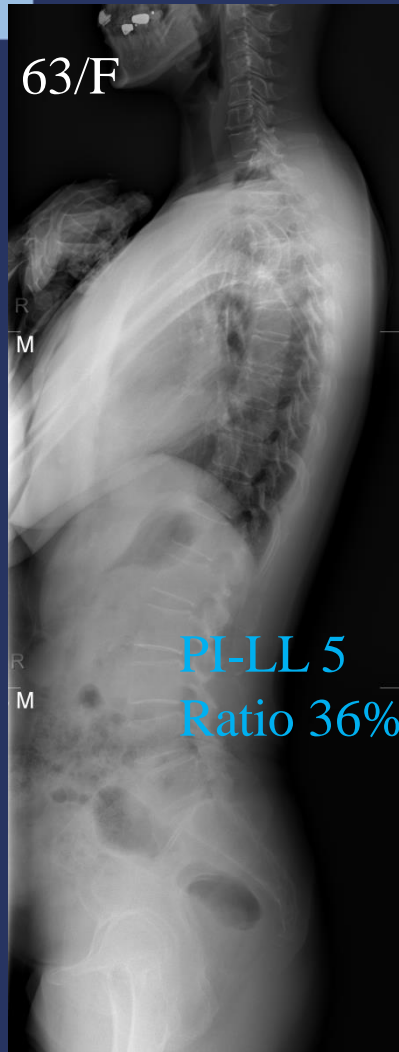
POD 2Y



PI-LL 18
Ratio 72%

POD 5Y

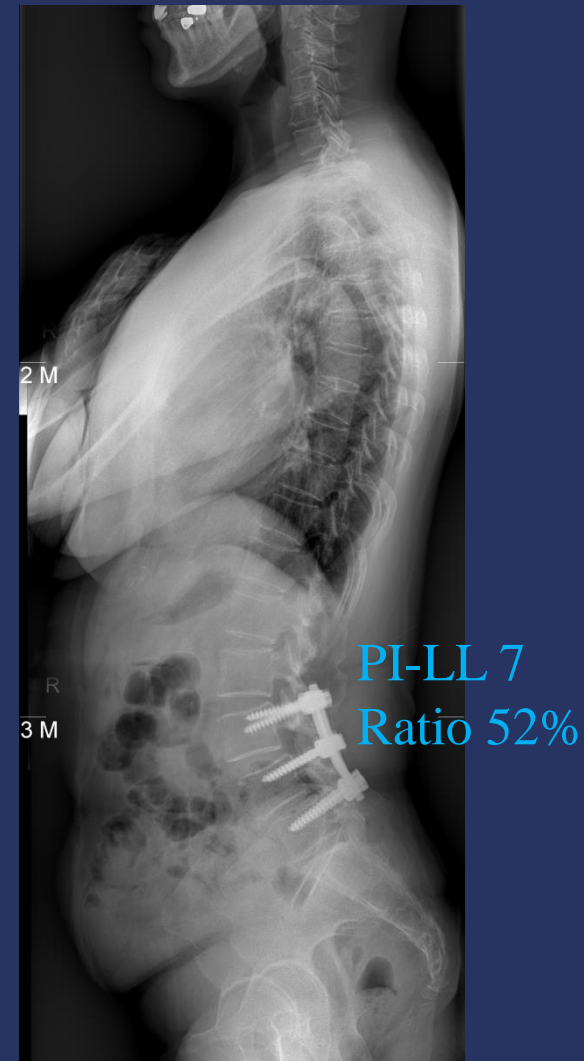
Case 2



Initial Lat



POD 2Y3M



After revision



Conclusion

- To prevent ASD
 - Correcting the LL according to PI
 - L4-5-S1/L1-S1 to 50%
 - Not only sagittal balance but also regional balance is important!



Disclosure declaration

- None of the authors has any potential conflict of interest