

Should Pedicle Subtraction Osteotomy be Always needed for Iatrogenic Flat back Syndrome?

- Comparison Between Lateral Lumbar Interbody Fusion and Pedicle Subtraction Osteotomy -

Hyung-Youl Park, MD¹, Hoon-Seok Sung, MD², Soo-Bin Park, MD¹, Hyung-Chul Park, MD², Sang-Il Kim, MD, PhD², Young-Hoon, Kim, MD, PhD²

1. Department of Orthopedic Surgery, Eunpyeong St. Mary's Hospital
2. Department of Orthopedic Surgery, Seoul St. Mary's Hospital



Purpose of Study

- To compare the **PSO** with **LLIF** for **iatrogenic flat back deformity** as fixed sagittal deformity
- To suggest **effective surgical treatment** for **iatrogenic flat back deformity**



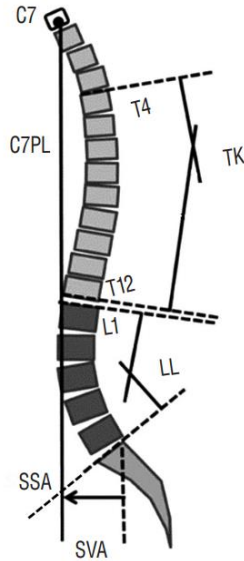
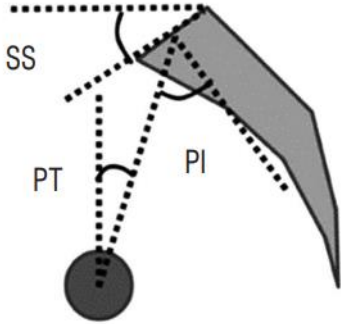
Materials & Methods

- **Patients cohorts**
 - **Iatrogenic flat back with sagittal imbalance (SVA > 5cm)**
 - Revisional instrumented fusion between 2012 and 2017
 - **LLIF vs. PSO ending at lumbar vertebra (below D12)**
 - With a minimum 2-year follow-up

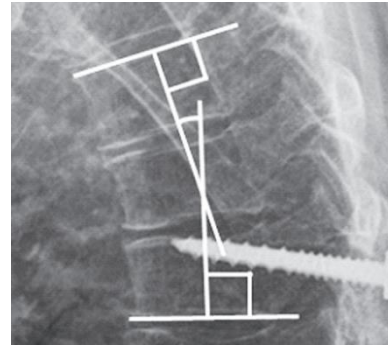


Materials & Methods

▪ Radiologic parameters



PJK: 10°



Optimal correction

- **SVA < 5cm**
- **PT < 20°**
- **PI-LL < ±9°**

Cho YJ et al. JKNS, 2017

Glattes RC et al. Spine, 2005

Schwab F et al. Spine, 2010



■ Results - Patients demographics and surgical outcomes

Parameters	LLIF	PSO	p-value	Parameters	LLIF (n=20)	PSO (n=13)	p-value
Patients number	20	13		Previous fusion level	2.0 ± 0.6	1.9 ± 1.0	0.772
Age	71.6 ± 5.8	67.6 ± 7.4	0.093	Newly fusion level	1.7 ± 0.6	2.5 ± 1.0	0.002
Sex (F:M)	15 : 5	13 : 0	0.131	Total fusion level	3.7 ± 0.5	4.5 ± 0.7	0.000
BMI	25.5 ± 3.4	25.6 ± 2.8	0.947	LLIF level	1.5 ± 0.5	-	
BMD	-3.2 ± 0.7	-2.8 ± 1.1	0.209	Iliac screws	1 (5.0%)	8 (61.5%)	0.001
Smoking	19 : 1	13 : 0	1.000	Hospital day	15.9 ± 4.8	19.9 ± 7.4	0.07
ASA grade (1:2:3-4)	1 : 19 : 0	1 : 11 : 1	0.645	Operation time (minutes)	247.6 ± 40.7	272.4 ± 95.2	0.308
Follow-up (months)	33.2 ± 10.3	32.7 ± 13.9	0.905	Estimated blood loss (mL)	995 ± 828	2790 ± 1342	0.000
				Transfusion (mL)	610 ± 545	1427 ± 644	0.000
				Admission to ICU care	3 (15.0%)	7 (53.8%)	0.026

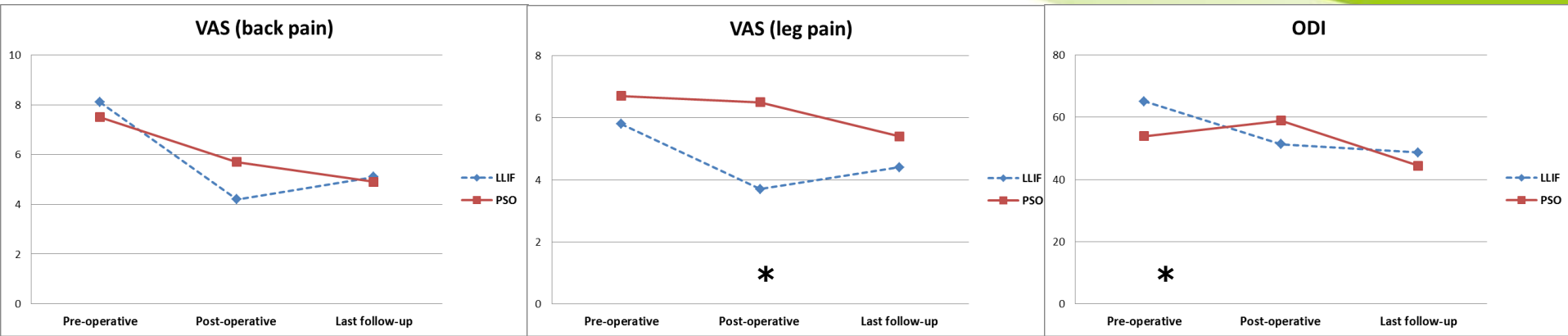


Results - Radiologic outcomes

Parameters	LLIF (n=20)	PSO (n=13)	p-value
Preoperative			
PI	55.5 ± 7.5	57.7 ± 16.4	0.611
PT	28.7 ± 9.0	34.1 ± 9.9	0.118
SS	26.8 ± 8.5	23.7 ± 13.9	0.424
LL	23.2 ± 16.0	8.1 ± 18.2	0.017
PI-LL	32.3 ± 15.9	49.6 ± 14.6	0.004
TK	21.7 ± 16.5	11.1 ± 15.7	0.092
SVA	92.6 ± 34.0	127.2 ± 53.2	0.035
Postoperative			
PI	54.9 ± 7.8	57.0 ± 15.1	0.598
PT	26.9 ± 8.2	23.4 ± 9.8	0.289
SS	28.0 ± 7.5	33.4 ± 11.7	0.117
LL	32.2 ± 14.0	43.5 ± 14.1	0.031
PI-LL	22.7 ± 13.7	13.5 ± 10.9	0.042
TK	20.5 ± 16.0	23.8 ± 13.7	0.541
SVA	51.2 ± 32.6	22.0 ± 45.2	0.039
Optimal correction	6 (30.0%)	8 (57.1%)	0.073

Parameters	LLIF (n=20)	PSO (n=13)	p-value
Post-op. change			
PT	-1.9 ± 4.5	-10.6 ± 8.6	0.001
SS	1.2 ± 5.6	9.7 ± 8.8	0.002
LL	9.0 ± 9.7	35.4 ± 13.7	0.000
TK	-1.3 ± 8.4	14.4 ± 11.6	0.000
SVA	-41.4 ± 37.5	-85.6 ± 60.0	0.014
Last follow-up			
PI	56.4 ± 8.4	57.2 ± 16.2	0.858
PT	28.6 ± 10.1	23.7 ± 9.6	0.174
SS	27.8 ± 7.9	33.4 ± 12.0	0.117
LL	29.1 ± 16.9	38.1 ± 14.8	0.127
PI-LL	27.4 ± 17.4	19.1 ± 14.6	0.167
TK	20.6 ± 15.3	26.5 ± 11.8	0.246
SVA	65.5 ± 48.1	60.3 ± 63.2	0.789
Optimal correction	5 (25.0%)	4 (30.8%)	1.000
PJK	3 (15.0%)	9 (69.2%)	0.003

Results - Clinical outcomes & Complications



Parameters	LLIF (n=20)	PSO (n=13)	p-value
Major complications	1 (5.0%)	2 (15.4%)	0.547
	1 (wound infection)	1 (hematoma) 1 (motor deficit)	
LLIF-related complications	6	-	
	3 (flexion weakness) 2 (thigh pain) 1 (thigh numbness)		
Reoperations	1 (5.0%)	7 (53.8%)	0.003
	1 (PJK)	5 (PJF) 1 (hematoma) 1 (motor deficit)	

Conclusions

- **LLIF vs. PSO in iatrogenic flat back**
 - **Surgical outcomes: LLIF > PSO (EBL, transfusion, ICU)**
 - **Radiologic outcomes**
 - **Immediate post-operative: LLIF < PSO (powerful correction)**
 - **Last follow-up: LLIF \cong PSO (due to PJK at thoracolumbar junction)**
 - **Clinical outcomes: LLIF \geq PSO (complications and reoperations)**
 - **For greater correction in healthy & young patients → PSO with extended fusion above thoracolumbar junction**
 - **In elderly and morbid patients → Lateral lumbar interbody fusion despite less correction**

