



Does Minimally Invasive Posterior Instrumentation (PPI) Prevent Proximal Junctional Kyphosis (PJK) in Adult Spinal Deformity (ASD) Surgery? A Prospectively Acquired Propensity Matched Cohort Analysis

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Introduction

Proximal junctional kyphosis (PJK) is an unwanted complication of ASD surgery. Multiple theories exist why PJK occurs. One potential contributor is damage to the paraspinal musculature and intervertebral stabilizers frequently disrupted during exposure and screw placement. This study aims to investigate the effect of PPI vs. Open screw placement on PJK development.

Methods

280 pts in 2 prospective databases (MIS n=85; OPEN n=195) were retrospectively reviewed, divided in 2 separate approaches and propensity matched for pelvic incidence – lumbar lordosis (PI-LL) and change of LL. Inclusion criteria: age >45, Cobb >20°, min 1 yr follow up. Groups defined as: 1)cMIS- lateral interbody fusion (LIF) with PPI (n= 31) and 2)Hybrid (HYB)- LIF followed by open posterior instrumentation (n=31). PJK was defined as Proximal junctional angle (PJA) >10° and change post op >10°.

Results

- With exception of Maximum Cobb Angle, preoperative radiographic parameters were not statistically significantly different.

	CMIS		HYB		T test
	Mean	SD	Mean	SD	P
Maximum Coronal Cobb	31.3	11.1	45.3	19.0	.001
Thoracic Kyphosis	31.1	10.0	30.4	16.6	.849
Lumbar Lordosis	32.7	11.5	34.8	17.5	.593
Pelvic Tilt	25.9	11.8	27.4	11.1	.597
Pelvic Incidence	52.6	13.9	55.4	12.2	.389
Sagittal Vertical Axis	29.2	41.7	53.3	61.4	.076
PI-LL	19.8	11.7	20.7	21.4	.845

Operative Comparison

- No significant difference in terms of interbody levels fused.
- Less EBL and operative time with CMIS group.

	CMIS		HYB		P
	Mean	SD	Mean	SD	
# Levels fused Post	4.8	2.8	8.8	3.6	.000
# Levels fused Int	4.2	0.9	4.1	1.2	.646
EBL Total	547	874	2,095	1,375	.000
EBL Post	632	1,220	1,857	1,317	.007
EBL Int	262	300	591	800	.036
EBL (% due to post approach)	75%	15%	83%	11%	.062
OR time Total	453	162	773	276	.000
OR time Post	310	84	438	140	.004
OR time Int	313	132	444	208	.005
OR time (% due to post approach)	57%	9%	57%	15%	.917

Results

A mean of 4.1 levels were fused (range 2-6). The mean age was 64 years and mean BMI was 26.1. Mean follow-up was 27.5 months. There was no preop difference between groups for LL-PI or SVA. Both groups showed significant improvement in LL (cMIS: 33°-41°; HYB: 35°-44°; p<0.001) and PI-LL (cMIS:19.7°-12.4°; HYB: 19.6°-7.4°) and significant difference in PT. SVA remained physiologic for cMIS (29-26mm) and improved in HYB (54-31 mm; p=0.024). The cMIS group had a smaller change in PJA (+1.3°) than HYB (+6°) (p=0.005). PJK developed in 19.4% of HYB patients and 0% in cMIS (p<0.01). One patient in the Hybrid group required vertebroplasty for PJK. Both groups saw significant improvement in ODI (cMIS 39 to 20.1; HYB 46.7 to 30; p<0.001).

Conclusions

The addition of PPI seems to have a protective effect on the development of PJK. The analysis controlled for preoperative sagittal alignment as well as for correction of PI-LL. HYB was effective in restoring sagittal global alignment and cMIS in maintaining it.

Post OP Results

- With exception of Maximum Cobb Angle, postoperative radiographic parameters were not statistically significantly different.

	CMIS		HYB		T-test
	Mean	SD	Mean	SD	P
Maximum Coronal Cobb	31.3	11.1	45.3	19.0	.001
Thoracic Kyphosis	31.1	10.0	30.4	16.6	.849
Lumbar Lordosis	32.7	11.5	34.8	17.5	.593
Pelvic Tilt	25.9	11.8	27.4	11.1	.597
Pelvic Incidence	52.6	13.9	55.4	12.2	.389
Sagittal Vertical Axis	29.2	41.7	53.3	61.4	.076
PI-LL	19.8	11.7	20.7	21.4	.845

HRQL Results

- Post OP both groups demonstrated statistically significant improvement in ODI and VAS Back Pain
- There was no statistical difference between the groups.

- Delta ODI
 - CMIS:-19 vs Hybrid: -17
- Delta VAS Back
 - CMIS -3.5 vs HYBrid: -4.7

PJK Results

- Junctional segment analysis revealed that CMIS had a smaller change in PJA (1.3degrees vs 6 degrees, P=0.005)
- PJK developed in 19.4% of patients in the hybrid group by 1 year
- No PJK was detected at 1 year in the CMIS group.

Learning Objectives

By the conclusion of this session, participants should be able to: (1) Understand that development of proximal junctional kyphosis remains a significant potential complication following adult deformity surgery; (2) Appreciate that minimally invasive pedicle screw placement may be protective against development of proximal junctional kyphosis.