

**Risk factor for adjacent segment
degeneration after surgical correction
of
degenerative lumbar scoliosis**

In- Soo Oh, MD., Kee -Yong Ha, MD.

**Department of Orthopaedic surgery, College of
Medicine, The Catholic University of Korea,
Seoul, Korea**

None of the authors has any potential conflict of interest

Introduction

Although ASD has been considered a debating late complication of spinal fusion, there are no consensus of incidence, risk factor, morbidity and correlation between radiological adjacent segment degeneration and clinical symptoms

Introduction

Objective:

1) clinical, radiographic and surgical factors that are associated with adjacent segment degeneration after surgical correction and fusion of degenerative lumbar scoliosis.

2) period of occurrence of radiological adjacent segment degeneration after surgical correction of degenerative lumbar scoliosis.

MATERIALS & METHODS

A total of 98 patients with minimum 5-year follow-up who had surgical correction and lumbar/thoracolumbar fusion with pedicle screw instrumentation for degenerative lumbar scoliosis.

Risk factor:

Patient parameters (age at operation, sex, body mass index(BMI), medical comorbidities, BMD)

Radiological parameter (Cobb's angle, angle type, lumbar lordosis, pelvic incidence, intercrystal line, preoperative existence of an adjacent segment degeneration on plain radiograph and magnetic resonance imaging(MRI))

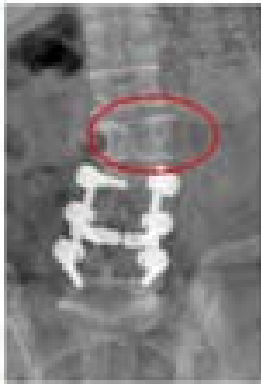
Surgical parameters (number of the fusion level, OP type, floating OP, posterolateral interbody fusion(PLIF)).

Clinical outcomes : Visual analogue score (VAS) and Oswestry disability index (ODI).

Radiologic ASD

1) translation greater than 4mm, 2) angular change greater than 10° 3) severe collapse of intervertebral collapse, 4) herniated nucleus pulposus and stenosis , 5) vertebral compression fracture and 6) pedicle screw loosening and nonunion

1)



2)



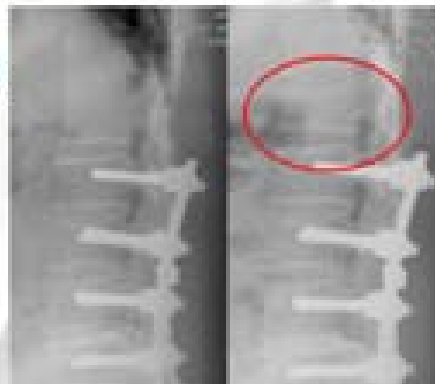
3)



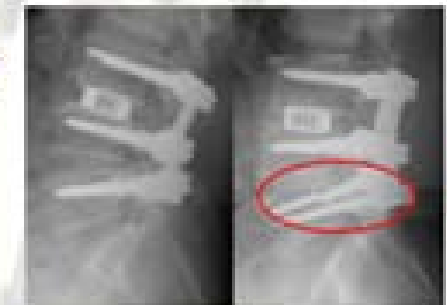
4)



5)



6)



RESULTS

1. Overall survival ASD was found in 44(44.8%) patients. The mean ASD time : 48.0 months (median 42.9 months).

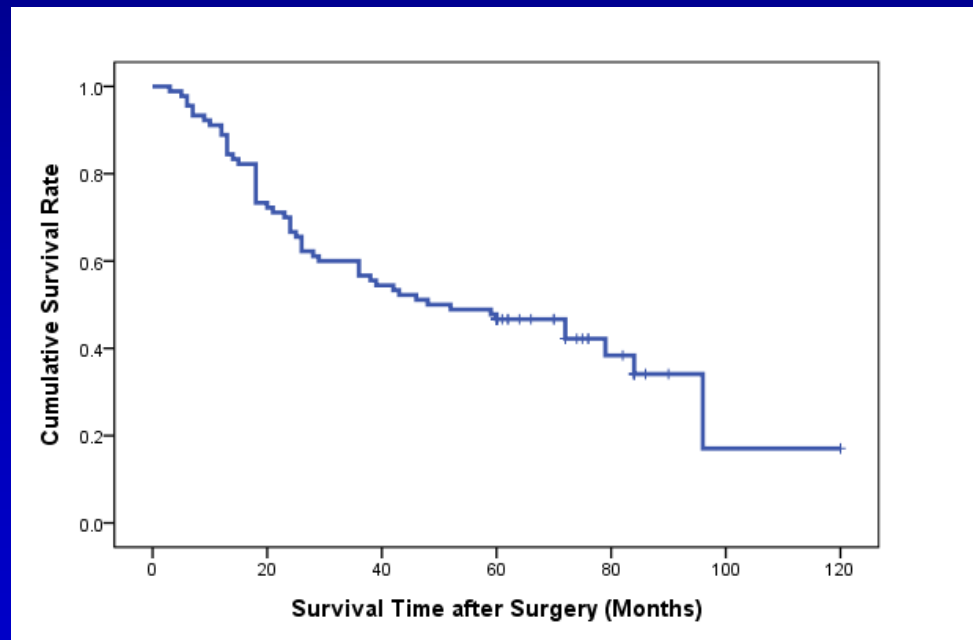


Figure 1. Kaplan-Meier survival curves of patients with adjacent segment degeneration after surgery.

2. Factors related to ASD occurrence were preoperative existence of disc degeneration on MRI and age at operation ($P=0.0001, 0.0364$).

3.No significant difference between radiological adjacent segment degeneration and clinical results statistically.

(Chi-Square Tests, $P=0.637$)

Table 1. Prognostic factor for survival in patients with adjacent segment degeneration -univariate analysis. Log-rank test.

Variables [↵]	Group [↵]	No. Patients [↵]	A mean of survival (median, Months) [↵]	<i>P</i> -value ^{a,↵}
Age [↵]	<60	57 [↵]	66.46 ± 6.65 (72.00) [↵]	0.0364^{b,↵}
	≥65 [↵]	41 [↵]	42.85 ± 5.32 (26.00) [↵]	
Sex [↵]	Male [↵]	18 [↵]	44.71 ± 9.40 (23.0) [↵]	0.3031 [↵]
	Female [↵]	80 [↵]	60.96 ± 5.64 (59.00) [↵]	
Body mass index(BMI) [↵]	≥30 [↵]	58 [↵]	52.16 ± 5.98 (36.0) [↵]	0.0543 [↵]
	<30	40 [↵]	61.97 ± 5.45 (73.0) [↵]	
Medical comobiditis [↵]	Absent [↵]	61 [↵]	66.87 ± 6.49(72.0) [↵]	0.2766 [↵]
	Present [↵]	47 [↵]	50.65 ± 6.39 (46.0) [↵]	
BMD	<3.0	32 [↵]	66.06 ± 10.51 (96.0) [↵]	0.2370 [↵]
	≥3.5 [↵]	66 [↵]	51.29 ± 5.46(48.0) [↵]	
Cobb's angle [↵]	<15.0	55 [↵]	53.97 ± 6.41 (38.0) [↵]	0.1480 [↵]
	≥15.0 [↵]	43 [↵]	56.64 ± 4.76 (72.0) [↵]	
Lumbar lordosis [↵]	<25	34 [↵]	57.13 ± 6.70 (72.0) [↵]	0.3085 [↵]
	≥25 [↵]	64 [↵]	66.09 ± 10.92 (96.0) [↵]	
Pelvic incidence [↵]	<50	48 [↵]	42.44 ± 46.30(21.0) [↵]	0.1129 [↵]
	≥50 [↵]	50 [↵]	66.72 ± 6.28 (72.00) [↵]	
Intercristal line [↵]	≤L4 [↵]	36 [↵]	43.68 ± 5.34 (36.0) [↵]	0.1544 [↵]
	L4 level	39 [↵]	67.19 ± 7.92(84.0) [↵]	
	≥ L5 [↵]	23 [↵]	52.60 ± 6.72(72.0) [↵]	

Table 1. Prognostic factor for survival in patients with adjacent segment degeneration -univariate analysis. Log-rank test.

Lumbar lordosis ^a	<25	34 ^a	57.13 ± 6.70 (72.0) ^a	0.3085 ^a
	≥25 ^a	64 ^a	66.09 ± 10.92 (96.0) ^a	
Pelvic incidence ^a	<50	48 ^a	42.44 ± 46.30(21.0) ^a	0.1129 ^a
	≥50 ^a	50 ^a	66.72 ± 6.28 (72.00) ^a	
Intercristal line ^a	≤L4 ^a	36 ^a	43.68± 5.34 (36.0) ^a	0.1544 ^a
	L4 level	39 ^a	67.19 ± 7.92(84.0) ^a	
	≥ L5 ^a	23 ^a	52.60 ± 6.72(72.0) ^a	
Caphalad DISC (Pfirrmann grade) ^a	≤grade 2 ^a	47 ^a	69.30 ± 5.14 (48.0) ^a	0.0001^b ^a
	≥ grade 3 ^a	51 ^a	38.77 ± 4.66 (28.0) ^a	
Caudal DISC (Pfirrmann grade) ^a	≤grade 2 ^a	29 ^a	70.28 ± 4.80 () ^a	0.0000^b ^a
	≥ grade 3 ^a	14 ^a	33.07 ± 6.41 (23.0) ^a	
No. of the fusion level ^a	≤ 2 ^a	30 ^a	59.25 ± 8.79 (38.00) ^a	0.7749 ^a
	≥ 3 ^a	68 ^a	56.21 ±14.76(59.00) ^a	
Decompression level ^a	≤ 2 ^a	54 ^a	65.32 ± 6.51 (42.0) ^a	0.7677 ^a
	≥ 3 ^a	44 ^a	57.13 ± 6.70 (72.0) ^a	
Floating OP ^a	Performed ^a	55 ^a	65.32 ± 6.51 (42.0) ^a	0.8936 ^a
	Not performed ^a	43 ^a	56.85 ± 6.19 (72.0) ^a	
Posterolateralinterbody fusion(PLIF) ^a	Not Performed ^a	46 ^a	54.32 ± 5.22 (42.0) ^a	0.0539 ^a
	Performed ^a	52 ^a	67.28 ± 7.87 (72.0) ^a	

^aStatistical significance test was done by Log-rank test ^a

^bP value < 0.05 was significant and shown in bold.^a

Table 2. Prognostic factor for survival in patients with adjacent segment degeneration -multivariate analysis. Cox proportional hazards model

Variables ^a	HR ^a	95% CI ^a	<i>P</i> -value ^a
Age ^a	2.027 ^a	0.800-5.084 ^a	0.132 ^a
Cephalad DISC (Pfirrmann grade) ^a	2.872 ^a	0.809-10.201 ^a	0.103 ^a
Caudal DISC (Pfirrmann grade) ^a	2.929 ^a	0.953-9.003 ^a	0.061 ^a

^aStatistical significance test was done by Cox proportional hazards model ^a

^b*P* value < 0.05 was significant and shown in bold.^a

HR: hazard ratio, CI: confidence interval^a

CONCLUSION

- **The mean survival time of patients with adjacent segment degeneration was 48.0 months**
- **Patients over the age of 65 and with preoperative disc degeneration on plain radiograph and MRI were at higher risk of developing ASD.**
- **Surgeons select appropriate treatment modalities based on considerations of risk factor and the advantage and disadvantages of the treatment alternatives.**