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## Surgery for Adjacent Segment Changes after Lumbosacral Fusion

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### – Abstract –

**Purpose** : To report upon surgical outcome in terms of adjacent segment changes after lumbosacral fusion and to analyze for risk factors indicating early surgical intervention for adjacent segment changes.

**Material and Methods** : This was a retrospective study of twenty patients who underwent revision surgery for adjacent segment changes after lumbosacral fusion. Inclusion criteria were as follows: 1) minimum 24 months follow-up, 2) confirmed adjacent segment changes by CT-myelogram or MRI, 3) conservative treatment for at least 3months, 4) available preoperative X-ray films and 5) posterolateral fusions at a prior fusion. Correlation analysis was performed for age, sex, the number of fused levels, grade of radiographic degeneration and instrumentation using the independent sample t-Test.

**Results** : Age, sex, the number of fused levels, the use of instrumentation and the preservation of lumbar lordosis were not correlated with the interval to revision (IR). However, the grade of radiographic degeneration (plain film and CT) were highly correlated with IR ( $R = -0.699, -0.654$ ). Degenerative scoliosis had a shorter IR, with statistical significance ( $P < 0.05$ ), than other disease examined. Excellent and good clinical results were obtained in 14 patients (60%), and solid bony fusion was achieved in 18 patients (90%).

**Conclusions** : When deciding upon fusion level, especially in cases of degenerative scoliosis, the need for caution could not be overemphasized. The grade of radiographic degeneration provides a useful indicator for predicting earlier adjacent segment changes.

**Key Words** : Adjacent segment, Degeneration, Lumbosacral fusion

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가 1,7,9-11,14,21,24-26)

가 1.

1997 1 2000 5

가 1,6,19,20,23)

가 2 가 가 20

2,6,8,15,19,26,27)

(Table 1).

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3

20 , , , , 2)

가 , 3)

(Interval to Revision, IR) 20 4 , 16 , , 30.4

70.2 (57~81 ) ,

(24~49 ) .

6.3 (3~15 )

Table 1. Patients Demographics

Case No.	Age/ Sex	Initial . Dx	Interval to Revision (months)	Initial No. of fusion levels	Kellgren Grade	CTN Grade	Instrumentation (1 ° operation)	Lumbar Lordosis ( ° )	Remarks
1	81/F	SS	62	2	I	I	No	15	Retrolisthesis
2	59/F	SS,SPL	48	1	I	I	Yes	48	Listhesis
3	50/F	SPL	96	2	III	III	Yes	20	Listhesis
4	57/F	SS	72	1	II	II	No	-2	
5	64/M	SS	105	2	II	III	No	45	Retrolisthesis
6	61/F	SS	102	1	II	II	Yes	10	
7	58/F	SS	72	2	I	I	Yes	36	Listhesis
8	70/F	SS	48	2	III	II	No	20	
9	62/M	DS	60	2	II	III	Yes	25	Pedicle stress fracture
10	63/F	DS	72	2	III	IV	Yes	1	
11	62/F	SS	86	1	II	III	No	45	Retrolisthesis
12	71/F	SPL	192	3	IV	IV	Yes	30	Retrolisthesis
13	67/F	SS	120	3	II	II	Yes	25	Retrolisthesis
14	65/F	DS	48	2	IV	IV	No	10	Listhesis
15	70/F	DS	36	4	I	I	No	40	
16	53/F	DS	39	3	III	III	Yes	0	
17	63/F	SS	49	2	I	I	Yes	30	Retrolisthesis
18	67/M	SPL	57	1	I	I	No	45	Retrolisthesis
19	68/M	DS	36	3	II	II	Yes	35	Listhesis
20	70/F	SPL	62	2	I	II	No	36	Retrolisthesis

SS: Spinal stenosis, SPL: Spondylolisthesis, DS: Degenerative scoliosis, Lordosis: (-) mean kyphosis.

**Table 2.** Radiologic grading of adjacent segment degeneration (prior to 1<sup>st</sup> surgery).

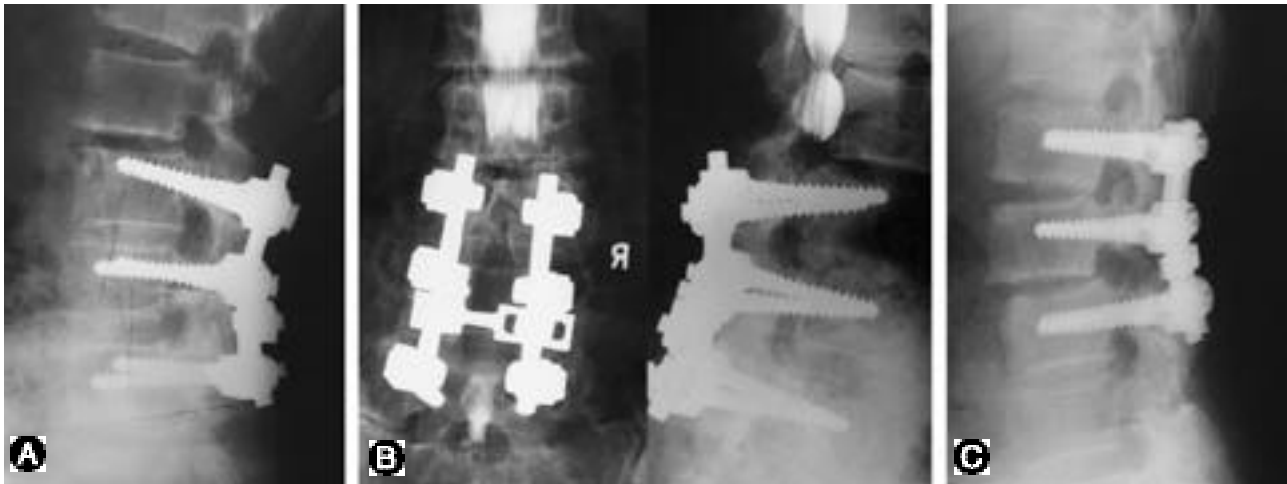
Kellgren Grade:	Grade 1: Minimal osteophytosis only Grade 2: Definite osteophytosis with some sclerosis of anterior part of vertebral plates Grade 3: Marked osteophytosis and sclerosis of vertebral plates with slight narrowing of disc space. Grade 4: Large osteophytosis, marked sclerosis of vertebral plates and marked narrowing of disc space
CT Grade	Grade 1: Normal to minimal osteophytosis only Grade 2: Definite osteophytosis Grade 3: Marked osteophytosis and facet arthritis Grade 4: Marked osteophytosis, facet arthritis and Knuttson's sign

**Table 3.** Brodsky's criteria

Designation	Criterion	2)	가 1	2
Excellent	No pain	, 3) Kellgren	grade II	grade III
Good	Occasional back or leg pain No change of work No change of leisure activity	, 4) 35 °, 5) 1		35 ° , 6) t-
Fair	Frequent back or leg pain Some change of work Some change of leisure activity	.		
Poor	Disabling pain Long-term medication Unable to work			

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11  
가 Kellgren  
1 (n=6, mean IR=68 months), 2  
가 Modified Kellgren (n=14, mean IR=71 months)  
(Table 2). Kellgren  
가 .  
3. 가  
Brodsky 가  
(Table 3).  
4. (n=6, mean IR=47 months),  
IR=80.8 months) (n=14, mean  
가 (p< 0.05).  
3.  
Pearson (SPSS v10.0)  
, 1) ,  
. Kellgren grade I 7 ,

grade II 7 , grade III 4 , grade IV 2 . Kellgren (n=11, mean IR= 64.3 months),  
 CT (n=9, mean IR=76 months),  
 grade I 6 , grade II 6 , grade III 5 , grade IV 3 months)  
 . Kellgren CT  
 p<0.01  
 (R= -0.699). Kellgren grade II 6. 1  
 (n=14, mean IR=84.3months), grade III 1 가 (n=7, mean IR= 61.3months)  
 (n=6, mean IR= 37.4months) (n=13, mean IR= 75.9 months)  
 가 (p< 0.05), CT grade III 8  
 가  
 (p< 0.05).  
 3 mm (3~10 mm) 5 7.  
 , 8 (3~5 mm) , 2  
 가 . 20  
 4.  
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 (Fig. 1).  
 , 2  
 8 35 ° (35~48 °) , 12 35 ° 6  
 (-2~30 °) , 35 ° (n=8, 가  
 mean IR= 6.2months) 35 ° (n=12, mean IR=77.1months)  
 가 , 1  
 5.



**Fig. 1.** A 50-year-old female’s radiographs (Case #3). (A) Immediate postoperative radiographs shows Kellgren grade III degeneration at L2, 3 level with L3-5 fusion for degenerative spondylolisthesis. (B) At postoperative 8 years, complete block at the adjacent segment is noted on myelogram. (C) For the adjacent segment stenosis, revision surgery was done with L1-3 fusion.

8.

Brodsky 14 (70%)

18 (90%)

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4

1

2,12,23)

4

24.6~49 %

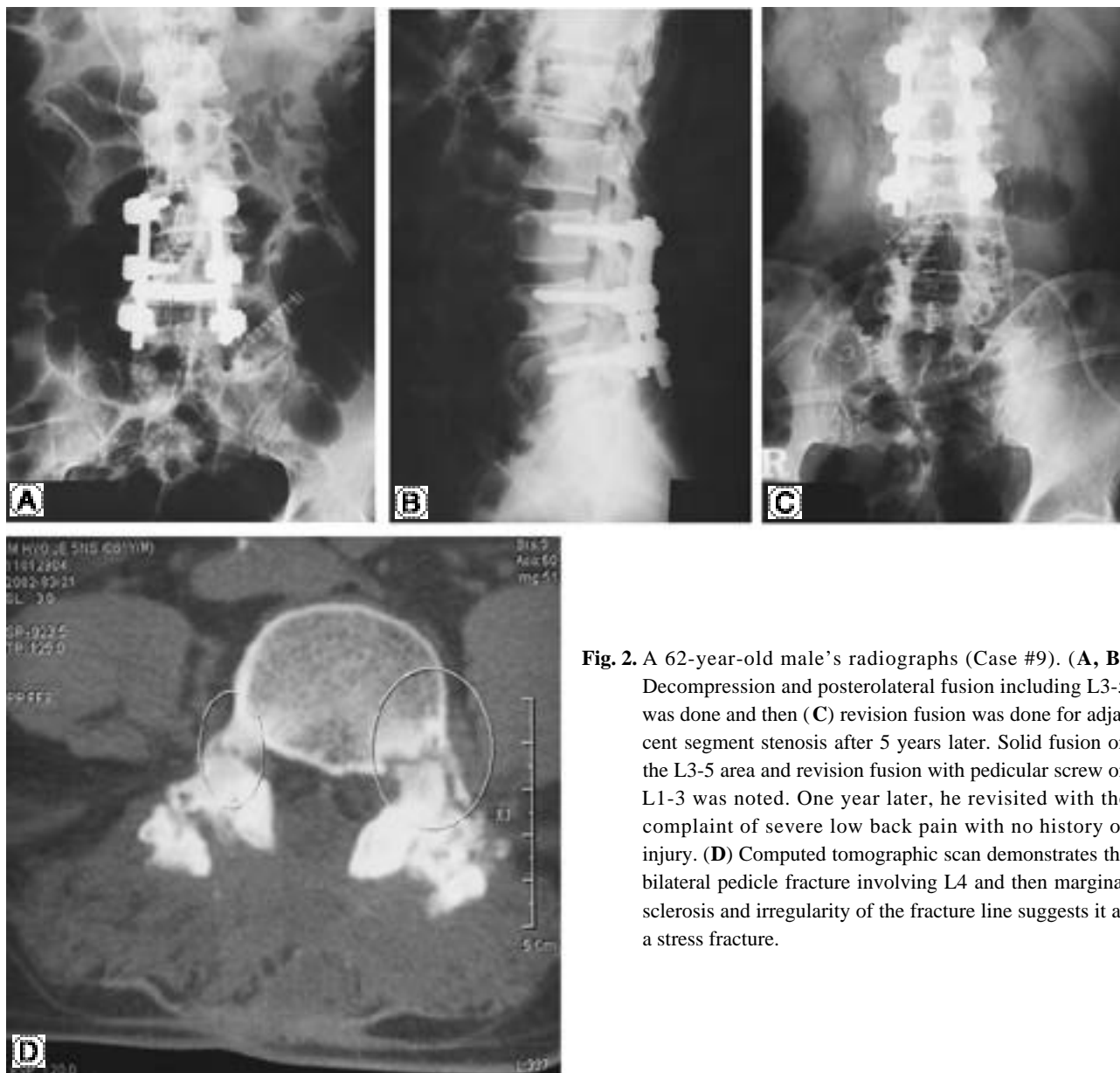
(Fig. 2), 1

5

1,4,8,10,13,15)

(Fig. 3), 2

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**Fig. 2.** A 62-year-old male's radiographs (Case #9). (A, B) Decompression and posterolateral fusion including L3-5 was done and then (C) revision fusion was done for adjacent segment stenosis after 5 years later. Solid fusion on the L3-5 area and revision fusion with pedicular screw on L1-3 was noted. One year later, he revisited with the complaint of severe low back pain with no history of injury. (D) Computed tomographic scan demonstrates the bilateral pedicle fracture involving L4 and then marginal sclerosis and irregularity of the fracture line suggests it as a stress fracture.



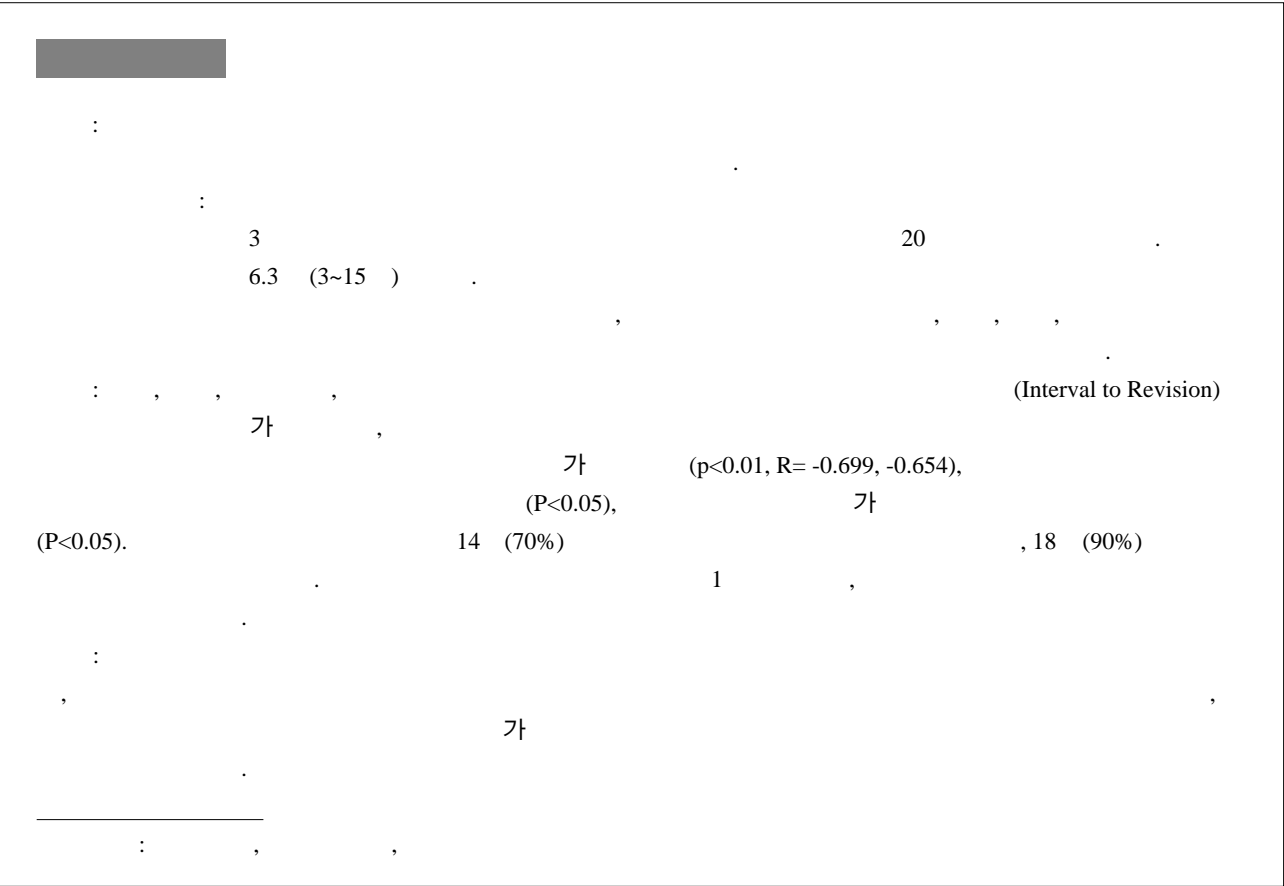
17) .  
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20,21,26)  
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6,19,26,27) ,가  
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5,19,27) . 30%  
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가 cantilever  
3,15)  
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5,22)  
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