

Radiolucent Zones Surrounding Transpedicular Screws After Lumbar Spinal Instrumented Fusion

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– Abstract –

Study Designs: A retrospective study for radiographic and clinical assessment.

Objectives: To clarify the clinical significance of the radiolucent zones surrounding transpedicular screws that occasionally appears following lumbar spinal instrumented fusion.

Summary of Literature Review: that the formation of radiolucent zones surrounding pedicular screws are significantly frequent after transpedicular fixation.

Materials and Method: 88 cases, age 50 or older, which underwent lumbar spinal fusion with transpedicular screws, between January 1999 and December 2002, were included in this investigation. The postoperative radiographs of all patients were analyzed for radiolucent zones around the transpedicular screws. These radiolucent zones were evaluated in relation the number of fusion levels, the existence of osteoporosis, and the fusion status and satisfaction rates.

Results: Radiolucent zones were observed in 30 cases (34%, 30/88), 13 (43%, 13/30) of which disappeared during the follow-up period. The average number of fixation levels in the cases with and without radiolucent zones were 2.33 (range 1-4, SD 0.94) and 1.74 (range 1-4, SD 0.82), respectively. Osteoporosis was found to accompany 43.3 and 20.7% of the cases with and without radiolucent zones, with the latter cases showing a statistically significant higher fusion rate and greater patient satisfaction.

Conclusion: Radiolucent zones, a frequent finding following pedicle screw fixation, resulted in less favorable outcomes. Surgeons should be alert to radiolucent zones and their transformation during follow-up. Methods for improving the stability of the interface between the pedicle screw and vertebral bone will require further research.

Key Words: Radiolucent zone, Transpedicular Screw

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22

15

가

10

가

, Jansson ⁵⁾ 1987

1999

17

88

Hologic dual X-ray absorptiometry (DEXA)

가 10 4.7 13.2

가 . Reindl ¹⁵⁾

가

가

가

88 59

, 19

가

Gibson ^{2,3)}

가 2

50 59

가 26 , 60

가 48 , 70 79 가 12

, 80

가 2 65.4 ± 5.6

2 4 11

(interface)

, Sanden ^{18,19)}

3 4

1 33 , 2 32 , 3

18 , 4 5

CD 26 ,

WSI 24 , Diapason 22 , TSRH 14 , 2

3 1 1

, 6 2~3

, 1 2

,

11,14,20), Sanden ¹⁸⁾

1 mm

가

가

가

1 mm

가

가

3 3

3

가

, 가

가

가

1~2 mm, 2~3 mm, 3

mm

가

1999 1 2002 12

가

50 193

, 2

가 가 53

58 1 27 , 2 12 , Lenke B 10 , Lenke C 6 , Lenke D
 21 , 3 8 , 4 2 , 2 , 58 Lenke
 1.74 ± 0.82 가 가 A 32 , Lenke B 19 , Lenke C 6 , Lenke D 1
 1 가 3 , 2 가 21 3 , 4 30 22 가
 가 1 , 5 (Table 2). Lenke A B 73.3%
 , 58 51 , 87.7%
 , 88 CD 26 Lenke A B
 8 (30.7%) 가 , WSI visual analog scale (VAS)
 24 9 (37.5%) 0, 10 ,
 . Diapason 23 7 (30.4%), TSRH 13 5 가 가 4.69 ± 1.26 (2,
 (38.4%) , 7) 가 가 4.80 ± 1.26 (2,
 (p>0.1). 7) , 6
 T-score -2.5 , 0.564 gm/cm² , 가 1.93 ±
 가 25 28.4% , 0.67, 2.12 ± 0.67 , 가
 T-score -2.86 ± 0.69 , 0.522 ± 0.124 gm/cm² 3.06 ± 0.72 , 3.58 ± 0.83
 , 63 T-score .
 -1.43 ± 0.31 , 0.687 ± 0.132 gm/cm² . 30 23
 30 13 (43.3%) (76%) Kirkaldy-Willis
 , 58
 58 12 (20.7%) 52 (89%) ,
 가 (p<0.05), , chi-square
 가 p<0.05 , 가
 가
 30 Lenke A (Table 3).

Table 2. Radiolucent zones according to number of fusion segments

	Radiolucent zone (+)	Radiolucent zone (-)	Number
1 segment	6	27	33
2 segments	12	20	32
3 segments	8	10	18
4 segments	4	1	5
Total	30	58	88
Mean ± SD	2.33 ± 0.94	1.74 ± 0.82	

Table 3. Clinical results

	Fusion status	Preoperative VAS	Postoperative VAS	Kirkaldy-Willis grade	
Radiolucent zone (+)	Lenke A 12	4.80 ± 1.26	3.58 ± 0.83	Excellent	11
	Lenke B 10			Good	12
	Lenke C 6			Fair	5
	Lenke D 2			Poor	2
Radiolucent zone (-)	Lenke A 32	4.69 ± 1.26	2.12 ± 0.67	Excellent	30
	Lenke B 19			Good	19
	Lenke C 6			Fair	7
	Lenke D 1			Poor	2

Kim⁷⁾ 가 0.782 gm/cm² ,

가

(loosening), 가

(screw lucency), (halo), (clear Lu¹⁰⁾ .

zone), 5,13,14,20,21) 가

Okuyama^{12,13)} .

1.28 ± 0.37 Nm, 가

1.50 ± 0.40 Nm

가

가 . Tokuhashi²⁰⁾ ,

1 mm Pihlajamaki¹⁴⁾ .

(clear zone) ,

Sanden^{18,19)} 1 mm 4% ,

(thin radiolucent zone) 1 mm 22%

(wide radiolucent zone) 1 mm ,

1 mm 가

Kim⁷⁾ ,

1 mm 4가 ,

Sanden^{18,19)} 53% 가

가 (interface) .

가 . Tokuhashi²⁰⁾ 3

50 190 , 6

41.1% 가

McAfee, Esses, Yuan 10% , 3

가

가

가

18,19) .

가

가 . Okayama¹²⁾, Sanden¹⁷⁾ (cyclic

가 caudocephalad toggling)

가 14,19,21) . Wimmer²¹⁾ -

5 ,

가 , 가

가 , 가

가

17,18,20) .

가 18,20) , Tokuhashi²⁰⁾ 6

가 , Lu¹⁰⁾ 41.1%

가 , 14.7%

가 (Fig. 2), 4 .

Tokuhashi²⁰⁾

가 가 ,

가 가 , (torque)

가 가

Sanden^{17,18)} , Sanden^{17,18)} 21

6 34.0%, 19.3% 11~16

가 13 , (torque)

Lenke A, B . 15 ± 10 Ncm ,

403 ± 220 Ncm 가

가 가 , Sanden

가 가 (hydroxyapatite-coated

17,18) screw) , 11 16

가 , 447 ± 114 Ncm ,

29 ± 36 Ncm

5,19,21) . Jang

4) , ,

Renner¹⁶⁾ (cal-

cium phosphate cement) 가

(axial pullout strength)

2 mm , PMMA

5

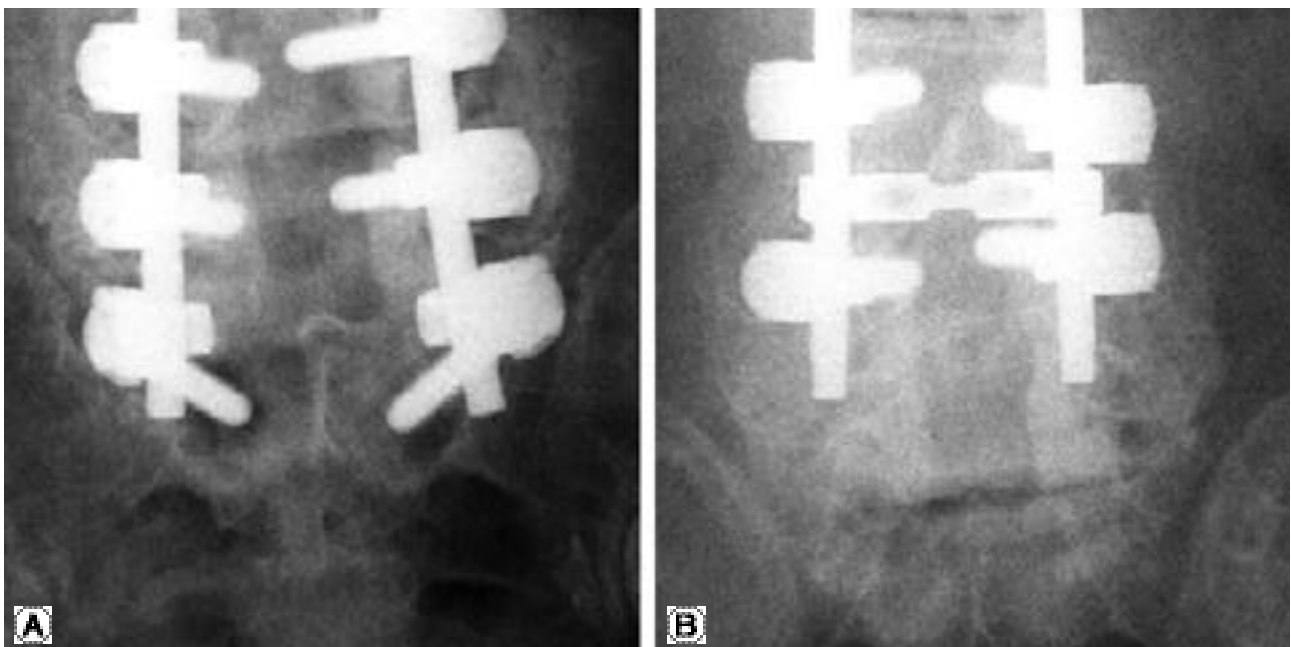


Fig. 2. (A) Wide radiolucent zones around the both sacral screws. (B) Radiograph after removal of sacral pedicle screws, which had shown severe loosening in the operating field.

Cook¹⁾ (expandable pedicle screw)

가

가

가

가

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 : 가 가
 : 1999 1 2002 12
 가 가 50 88 , ,
 : 88 30 (34.1%) 가 , 43.3% (13/30)
 . 가 2.33(1, 4, 0.94) 가
 1.74 (1, 4, 0.82) .
 43.3% , 20.7% 가 .
 , 가 .
 : ,
 가 가 , ,
 - 가 .
 : ,