

1

2

3

2

: 6 가 ,

가 . ,

: 88 116

3-4 가 12 , 4-5 가 74 , 5 - 1

가 30 .

가

MRI

: 116 26 (22.4%) , 84.6%

($p=0.002$). 116 59 (50.9%)

79.7%

($p=0.001$). , 가 11 , 116

63.8%

, , 6

($p=0.000$).

33 , 28

(84.8%)

, 24 (85.7%)

($p=0.000$). 가 68 , 41 (60.3%)

32 가

($p=0.198$).

($p>0.05$). 60

(51.7%)

, 47 (78.3%)

, 41

(87.2%)가

($p=0.000$).

46 (39.7%)

, ,

가 27 ,

가 19 ,

35

(76%)가

, 31 가

($p=0.000$).

:

(MRI)

(1 - 3).

, MRI

가

(radic -

ular pain)

,

, MRI

¹가

²

³가

2001 2 19

2001 7 12

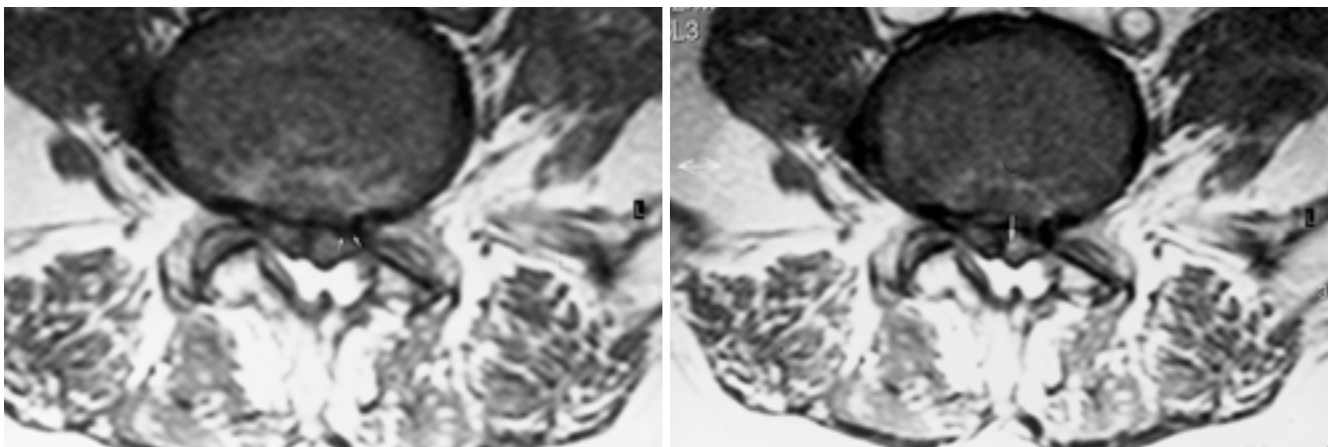
:

Gd - DTPA - (blood - nerve barrier) , , (pixel measurement)
 (4, 5), , 가
 (5, 6). (7). , (pixel value)
 6 가 , (7, 8). 가 (/
 MRI /
 ,), 1.2
 MRI , 가
 , , 2
 가 ,
 , .
 , .

MRI 88 116 .
 55:33 , 17 - 80 44
 . 3 - 4 가 12 , 4 - 5 가 74
 , 5 - 1 가 30 . MRI
 3 - 480 55 6
 23 .

0.5T(Gyroscan T5, Philips,
 Eindhoven, the Netherlands)
 T1 (TR/TE =
 740/13), T1 (TR/TE=550/25) ,
 Gd - DTPA(gadolinium DTPA, Schering, 0.1
 mmol/kg) T1
 (FOV) 320 mm,
 / 4 mm/0.4 mm, matrix size 256 × 256
 260 mm, / 4 , 1 , 2 , 3
 mm/0.4 mm, matrix size 205 × 256 .

가 MRI ,
 .
 MR , ,
 , MRI
 .
 가
 가 (2), 가
 33 14
 .
 ,
 , Ross (9)
 , 0 가
 , 3
 ,



A **B**
Fig. 1. A 53-year-old male who underwent operation 15 years ago.
A. Precontrast T1-weighted MR image shows left paracentral recurrent disc herniation at L4-5 level(arrows).
B. Postcontrast T1-weighted MR image shows contrast enhancement in the left intradural nerve root(arrow).

50% 가
(10).
MRI
chi-square test
 $p < 0.05$
116 26 (22.4%)
(Fig. 1), 84.6%
($p = 0.002$).
116 59 (50.9%) (Fig. 2),
79.7%
($p = 0.001$). 가
11 116 74 (63.8%)
88.2%, 70.8%, (positive predictive
value) 81.1%, (negative predictive value)
81% , ($p = 0.000$).
6 23 (2.9), 19
11
91.7%, 27.3% ,
57.9%, 75% , 6

($p = 0.231$). 6 93 (68.2), 55
49
87.5%, 83.8%,
89.1%, 81.6% . 6
($p = 0.000$).
(Table 1)
가 33 14
28 (84.8%)
24 (85.7%)
($p = 0.000$) (Fig.
3).
가 68 , 1 19 ,
27 25 , 3 24 . 41 (60.3%)
(Fig. 4), 32 가
($p = 0.198$).

Table 1. Correlation of Recurrent Disc Herniation, Scar and Nerve Root Enhancement

HNP/Scar	Nerve Root Enhancement		
	Present	Absent	Total
HNP	28	5	33
Symptom(+)	24	4	28
Symptom(-)	4	1	5
Scar	41	27	68
Symptom(+)	32	3	35
Symptom(-)	9	24	33
No HNP/Scar	5	10	15
Symptom(+)	4	1	5
Symptom(-)	1	9	10
Total	74	42	116

HNP: herniated nucleus pulposus

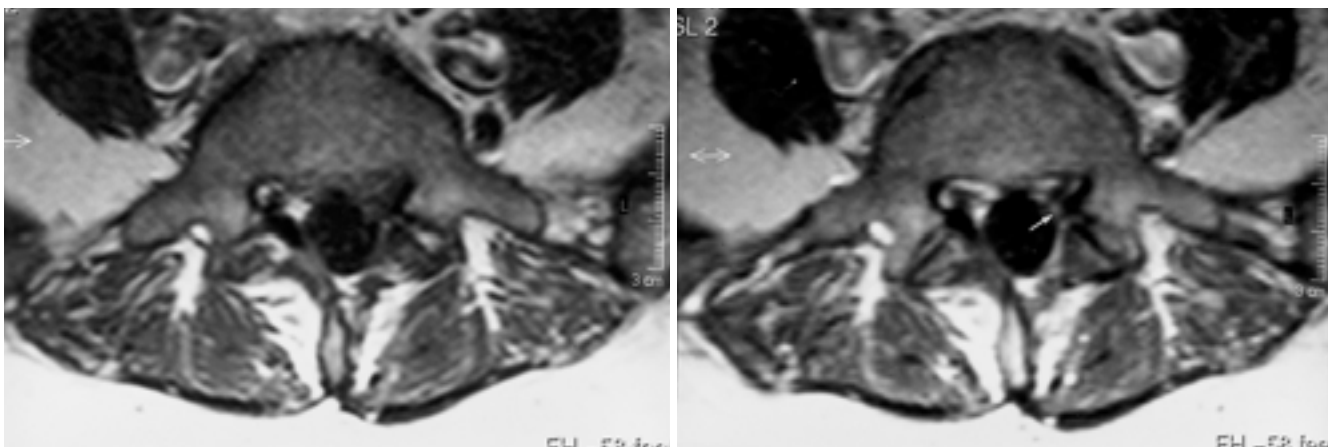


Fig. 2. A 45-year-old woman with left S1 radiculopathy by EMG, who underwent operation 36 months ago.
A. Axial T1-weighted MR image before contrast injection.
B. Axial T1-weighted MR image after contrast injection. Focal enhancement (arrow) is noted in the left epidural S1 nerve root.

:

, (p>0.05).

(Table 2)

60 (51.7%) , 47
(78.3%) , 41 (87.2%)가 13). , (radicular pain)
(p= 0.000). (6, 9, 12).

(Table 3)

46 (39.7%) , ,
가 27 , 가 19 . 가 , Toyone (15)
35 (76%)가 31
(88.6%)가 (p=0.000). , Taneichi (18)
, 21

Jinkins (5, 12) -

Table 2. Correlation of Nerve Root Thickening and Enhancement

Nerve Root Thickening	Nerve Root Enhancement		
	Present	Absent	Total
Nerve Root Thickening	47	13	60
HNP	16	2	18
Symptom(+)	15	1	16
Symptom(-)	1	1	2
Scar	29	7	36
Symptom(+)	24	1	25
Symptom(-)	5	6	11
No HNP/Scar	2	4	6
Symptom(+)	2	1	3
Symptom(-)	0	3	3
No Nerve Root Thickening	27	29	56
Symptom(+)	22	3	25
Symptom(-)	5	26	31
Total	74	42	116

Table 3. Correlation of Nerve Root Displacement and Enhancement

Nerve Root Displacement	Nerve Root Enhancement		
	Present	Absent	Total
Nerve Root Displacement	35	11	46
HNP	22	5	27
Symptom(+)	21	1	22
Symptom(-)	1	4	5
Scar	13	6	19
Symptom(+)	10	1	11
Symptom(-)	3	5	18
No Nerve Root Displacement	39	31	70
Symptom(+)	35	1	36
Symptom(-)	4	30	34
Total	74	42	116

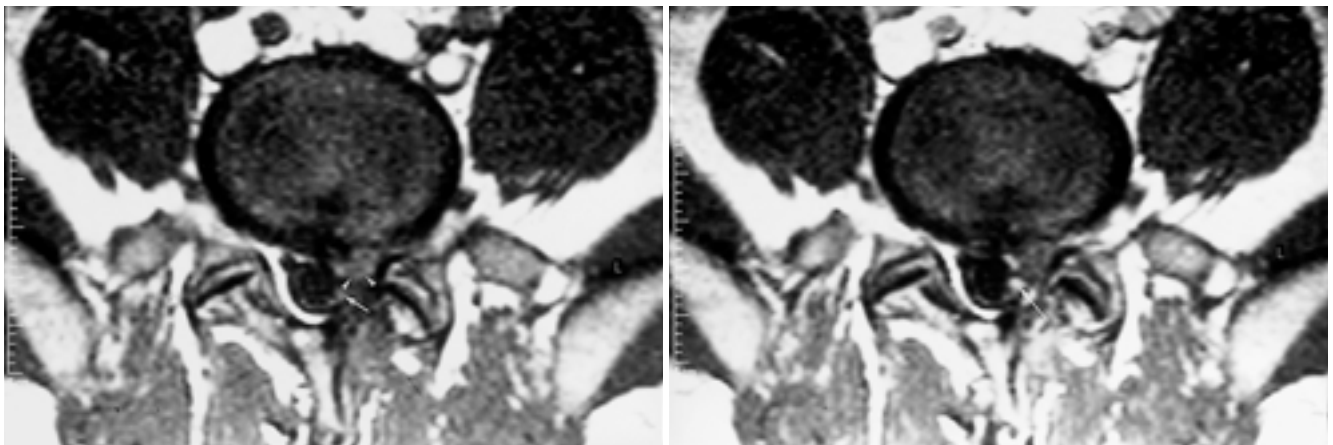


Fig. 3. A 27-year-old man with recurrent disc herniation confirmed by reoperation.
A. Precontrast axial T1-weighted MR image at the L5-S1 level shows recurrent herniated disc with intermediate signal intensity on the left (arrowheads). Thickened and posteriorly displaced left intradural S1 nerve root (arrow) is noted.
B. Postcontrast axial T1-weighted MR image again shows recurrent disc herniation with no contrast enhancement. The displaced nerve root (arrow) enhances.

:

ROI
(25).
가 1.2
(2). Fandino (26)
(9, 27)
(8, 28, 29).
Grane (7) (30). Ross (9)
59%
94%
84.6%
79.7%
25%
Bende bba (28)
Shirash (29) 32%
(18, 19, 21 - 24), Van de
Kelft (19) 6 6 MRI
(12) 8
(18)
(19) 50%
3 MRI 62%
(dural sleeve) 81% (7) 55%
Taneichi (18) 1 MRI
(24) 6 20%
Goethem
(21)
Grane (10)
60.3%
78%
MRI 6
, failed back surgery
syndrome(, FBSS)
Jenkins (12) Grane (7) 6
, 6 23 , 19 Takata (31)
, 6 11
55 49
, 6
Jenkins (12) Grane (7)
Grane 1996 (10)

1997

(7)

86%

Yukawa (32) 3 6

가

가

51.7%

78.3%

Grane (10) 가

(39.7%) , 76%가

MRI

6 MRI

가

가 5 4

25

가

6 MRI

가

가

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Clinical Significance of Nerve Root Enhancement in Contrast-Enhanced MR Imaging of the Postoperative Lumbar Spine¹

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Purpose: To determine the significance of nerve root contrast enhancement in patients with residual or recurrent symptomatic postoperative lumbar spine.

Materials and Methods: Eighty-eight patients with 116 postoperative lumbar disc lesions causing radiating back pain underwent enhanced MR imaging. Intradural nerve root enhancement was quantified by pixel measurement, and affected nerve roots were compared before and after contrast administration. Extradural nerve root enhancement was assessed visually, and nerve root enhancement and clinical symptoms were correlated. Associated lesions such as recurrent disc herniation, scar tissue, nerve root thickening and nerve root displacement were also evaluated.

Results: Of 26 cases(22.4%) involving intradural nerve root enhancement, 22 (84.6%) showed significant clinical symptoms ($p=0.002$). and of 59 (50.9%) demonstrating extradural enhancement, clinical symptoms showed significant correlation in 47 (79.7%) ($p=0.001$). Nerve root enhancement, including eleven cases where this was both intra-and extradural, showed highly significant association with clinical symptoms in 74 of the 116 cases (63.8%) ($p=0.000$). Among 33 cases (28.4%) of recurrent disc herniation, nerve root enhancement was observed in 28 (84.8%) and in 24 of these 28 (85.7%), significant correlation with clinical symptoms was observed ($p=0.000$). Where epidural fibrosis was present, correlation between nerve root enhancement and clinical symptoms was not significant ($p>0.05$). Nerve root thickening and displaced nerve root were, however, significantly associated with symptoms(87.2% and 88.6%, respectively).

Conclusion: In patients with postoperative lumbar spine, the association between nerve root enhancement revealed by MRI and clinical symptoms was highly significant.

Index words : Spine, abnormalities

Nerves, roots

Spine, MR

Contrast media, magnetic resonance (MR)

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