

Natural history of lumbar disc hernia with radicular leg pain: Spontaneous MRI changes of the herniated mass and correlation with clinical outcome

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ABSTRACT

A prospective sequential MRI study was done to investigate the morphologic changes of the lumbar disc hernia (LDH). We also studied the relationship between the MRI changes and the type of LDH and the clinical outcome.

MRI was performed every 3 months from the onset for a maximum of 24 months in 42 patients with radicular leg pain and symptoms definitely diagnosed as caused by LDH. The size of the herniated mass was determined by the ratio of the anteroposterior diameter of the spinal canal to the maximum diameter of the LDH mass on T2-weighted axial images.

The clinical outcome was evaluated as excellent, good, or poor depending on leg pain and physical findings. The JOA (Japanese Orthopaedic Association) score for LDH was also used to assess the outcome. Thirty-seven (88%) of the 42 patients showed >50% reduction of the hernia on MRI 3-12 months after onset,

and the morphologic changes of the herniated mass were well correlated with the clinical outcome.

Key words: lumbar disc hernia, MRI, natural history

INTRODUCTION

Lumbar disc hernia (LDH) is a common cause of low back pain and radicular leg pain. It is well known that the majority of LDH patients recover spontaneously.^{5,19,21} Since the advent of MRI, a spontaneous decrease in the size of LDH masses has been reported.^{1,6,11} Saal reported more than 50% reduction in 82% of patients.²⁰ Matsubara wrote about clinical symptoms and signs.¹⁴ However, there is little in the literature on prospective sequential morphologic changes on MRI correlated with clinical outcomes. The purpose of the present study was to investigate the natural history of the morphologic changes of LDH

on MRI and to assess correlations with the type of LDH and the clinical outcome.

PATIENTS AND METHODS

We investigated 42 patients (28 men and 14 women) with a mean age of 42 years (range 16–64 years) who presented with unilateral leg pain and low back pain that was definitely diagnosed as being caused by LDH. All of these patients were treated conservatively (bed rest, oral non-steroidal, anti-inflammatory drugs, pelvic traction and caudal epidural block) and followed up by serial MRI. The symptomatic disc level was L2-L3 in 8 cases, L3-L4 in 6 cases, L4-L5 in 15 cases and L5-S1 in 13 cases.

All patients underwent MRI examinations every three months for a period of 3–24 months (mean 10.3 months). Images were obtained using a 1.5 tesla superconducting MR scanner with a surface coil (Signa advanced version 4.8; GE Medical Systems, Milwaukee USA).

LDH was classified into three types: protrusion (n=7), extrusion (n=17) and sequestration (n=18), using T2-weighted sagittal MR images (Fig. 1).

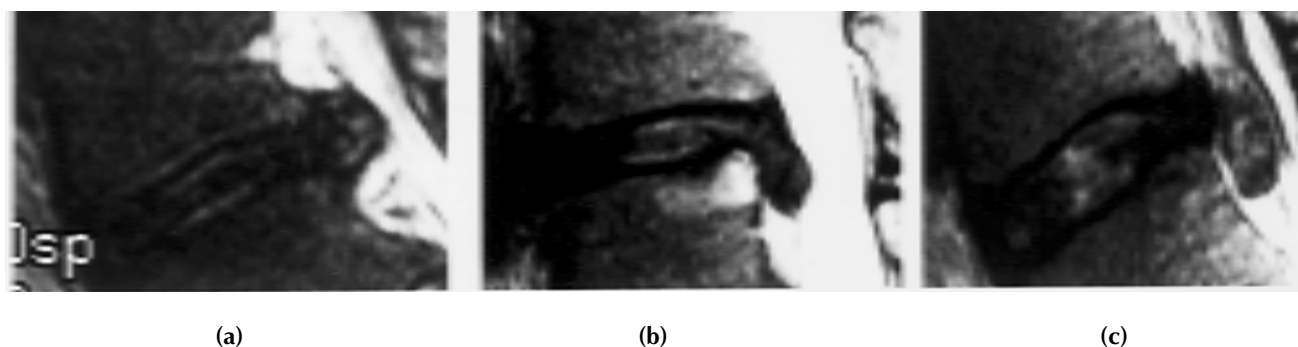
The size of the herniated mass was determined from the ratio of the anterior-posterior diameter of the spinal canal to the maximum diameter of the mass on T2-weighted axial images. This parameter was designated the canal-hernia mass ratio (C-H ratio) (Fig. 2).¹⁴

All patients were re-examined and their MRI findings were re-evaluated by the same physician during follow-up. The clinical outcome was evaluated using the JOA (Japanese Orthopaedic Association) score for LDH⁹ and recovery rate.⁸ Radicular leg pain was rated as follows:

Excellent — no pain (recovery rate 100%),

Good — slight pain but bearable during daily activity (recovery rate 80%),

Poor — sometimes unable to perform daily activities due to pain (recovery rate < 50%).



Figures 1 Classification of lumbar disc herniation (LDH) using T2-weighted sagittal MRI. (a) Protrusion: The hernia is at the same level as the disc. (b) Extrusion: The mass migrates cephalad or caudal from disc level, but still maintains continuity with the disc. (c) Sequestration type: The herniated mass is not connected to the disc.

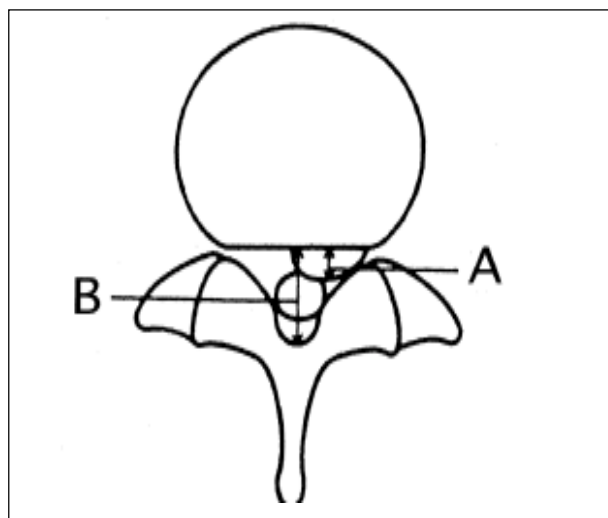


Figure 2 Canal-Hernia mass Ratio: C/H ratio (%) = A/B × 100.

RESULTS

Spontaneous Involution of LDH and Correlation with the Type of Hernia

The time taken for spontaneous involution of the herniated mass by >50% (classified as effective regression) was 3 months in 8 cases, 6 months in 15 cases, 9 months in 12 cases and 12 months in two cases. No marked reduction of the herniated mass was recognized in 5 patients in the final MRI study of up to 24 months.

Two patients with protruded LDH showed spontaneous involution of the herniated mass by >50% 12 months after the onset of symptoms. The other 5 patients with this type of LDH showed no morphologic changes at the time of the final MRI study.

Among patients with extruded LDH, there was a decrease of the herniated mass by >50% in 7 patients 6 months after the onset. In another 10 patients with this type of LDH, the majority showed a significant reduction of size after 9 months.

Among patients with sequestered type, 10 showed over 50% involution of their herniated mass after 3 months, and 6 others after 6 months. Among these 16 patients, 8 showed complete disappearance of their hernia. Two patients showed a significant reduction of hernia size 12 months after the onset of symptoms (Fig. 3).

CORRELATIONS BETWEEN CLINICAL OUTCOME, SYMPTOM DURATION AND MRI FEATURES OF THE HERNIATED MASS

Generally speaking, the involution of the LDH on MRI corresponded well with the clinical outcome. However, among five patients with protruded LDH who showed no morphological changes on MRI, no clinical improvement was found in four cases, as would be expected, but one patient had a good recovery (Table 1).

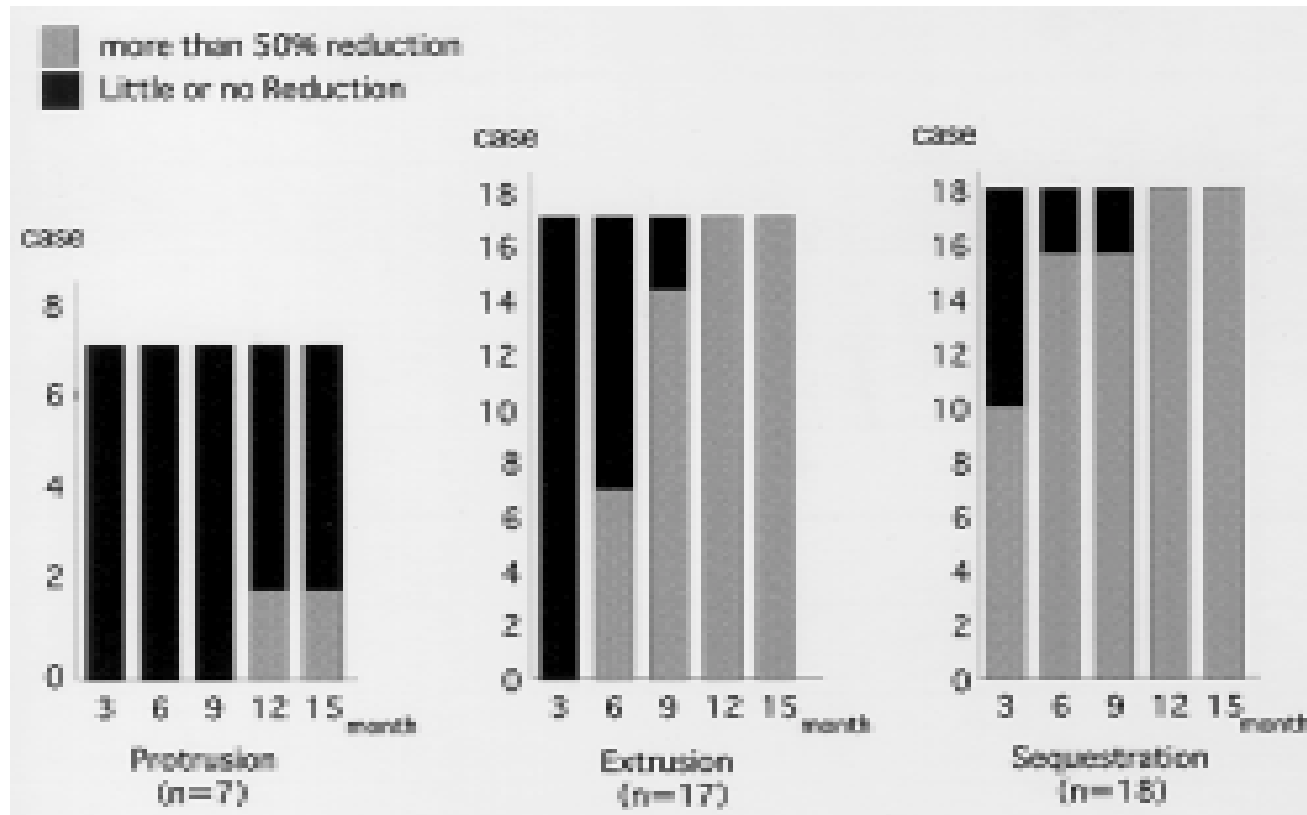


Figure 3 Time taken for spontaneous reduction of the hernia correlated with the type of LDH.

Table 1
Correlation between the clinical outcome and spontaneous changes of the herniated mass on MRI

MRI change	Clinical outcome			
	Excellent	Good	Poor	Total %
Disappearance (n=8)	6	2	0	19
More than 50% reduction (n=29)	11	18	0	69
Little or no reduction (n=5)	0	1	4	12
Total %	40	50	10	100

The recovery of symptoms, especially radicular leg pain, preceded the involution of the herniated mass on MRI. In the patients with sequestered LDH, severe radicular leg pain was the initial symptom and the pain improved 1–5 weeks after the onset, leaving sensory changes or a motor deficit, while a permanent severe motor deficit (MMT ≤ 3) was observed in six cases. In the patients with extruded LDH, radicular leg pain was not so severe compared to the patients with sequestration and leg pain lessened 4–8 weeks after the onset. Patients with the protruded LDH usually complained of leg pain on walking and improved after 3–14 weeks. Four patients with this type of hernia showed no MRI changes and had no decrease of their leg pain (Table 2).

Table 2
Correlation between the duration of symptoms and the type of hernia

Type of herniation	Case	Duration of Symptom
Protrusion	3 cases (no improvement: 4 cases)	3–14w (average: 8.0w)
Extrusion	17 cases	4–8w (average: 4.8w)
Sequestration	18 cases (motor deficit: 6 cases)	1–5w (average: 3.2w)

CASE PRESENTATION

Case 1

An 18-year-old man visited our clinic complaining of low back pain, radicular left leg pain and bilateral posterior thigh pain when walking. Severe lumbar

stiffness was observed and SLR was 20° on the left side and 40° on the right side. MRI showed a large central protruding hernia at the L4/5 level. 20 months after the onset, no involution of the herniated mass was observed on MRI and the clinical outcome was poor.

Case 2

A 45-year-old man complained of radicular right leg pain. Lumbar stiffness was observed and SLR was 40° for the right leg. SLR was negative on the left side. No neurological deficits, except sensory changes, were found. MRI showed a caudally migrating extruded hernia at the L4/5 level. His leg pain lessened 6 weeks after the onset. There was over 50% reduction in the size of the herniated mass on MRI at 6 months after the onset (Fig. 4).

Case 3

A 68-year-old man complained of severe radicular left leg pain that prevented him from walking. MRI showed a migrating large sequestered hernia at the L2/3 level. The pain lessened after 3 weeks, but the patient needed a cane for walking because of weakness of the left quadriceps muscle. On MRI conducted 3 months after the initial examination, there was almost complete disappearance of the herniated mass (Fig. 5). He now can walk without a cane, but has permanent atrophy of the left quadriceps muscle (COT; rt 40 cm, lt 35 cm) and occasionally his left leg gives way, 4 years after the onset of symptoms. The patellar tendon reflex was not detected on either side from the onset to the final examination.

DISCUSSION

Although some authors reported that the regression or absorption of herniated masses was detectable on CT scans,^{4,12} the morphologic changes of LDH in association with spontaneous recovery of symptoms was usually unclear. Since the advent of MRI, however, many authors have reported the spontaneous involution of herniated masses.^{1,6,22}

It seems that the time required for involution of the hernia depends largely on the type of LDH. There was >50% involution of the hernia 3 to 6 months after the onset in 16 patients with sequestered LDH and 7 patients with extruded LDH. These 7 patients were presumed to have transligamentous extrusion, although it was difficult to be sure on MRI. The mass almost completely disappeared in 8 patients with sequestered LDH. This type of hernia would be



Figure 4 A 45-year-old man with an extrusion type LDH. **(a)** Initial MRI -C/H ratio 51.6%. **(b)** After 3 months-C/H ratio 43.4%. **(c)** After 6 months -C/H ratio 20.5%.

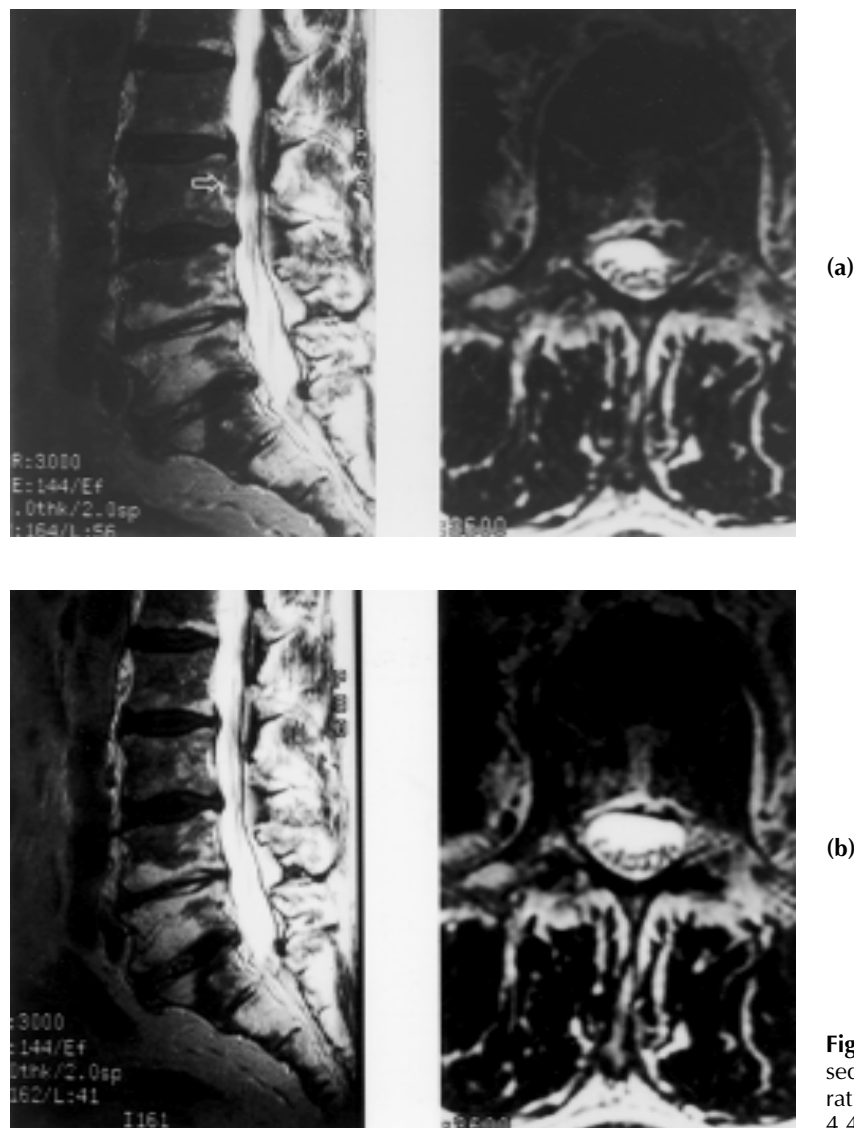


Figure 5 A 68-year-old man with a sequestration type LDH. **(a)** Initial MRI — C/H ratio 47.9%. **(b)** After 3 months — C/H ratio 4.4%.

exposed to the epidural blood supply, resulting in inflammatory and immune reactions that could lead to phagocytosis and resorption of the mass by macrophages.^{7,13,15}

Ten patients with extruded LDH (presumably subligamentous) showed reduction of the herniated mass 9 months after the onset and two cases of protruded LDH did so at 12 months. The mechanism of regression of the mass in these patients was considered to be dehydration and degeneration of the herniated tissue (Fig. 3).^{16,20} Five large central protruding hernias showed little or no reduction of its size after more than 12 months. These were all young

patients and it may take longer to absorb this type of herniated mass because of the rich content of collagen fibres and cartilage cells in the nucleus pulposus at a young age.

The clinical outcome, especially the lessening of radicular leg pain, correlated well with reduction of the herniated mass on MRI (Table 1), although improvement of radicular leg pain preceded the involution of the hernia (Table 2). The causes of radicular pain in patients with LDH are still not clear. However, it is accepted that radicular pain is not only due to mechanical pressure on the sciatic nerve from the hernia itself, but also due to inflammation, edema,

and radicular blood congestion, related to the herniated mass emerging into the extradural space.^{13,18} We consider that the discrepancy between the recovery of symptoms and the morphologic changes of the hernia on MRI is related to improvement of these secondary responses before effective reduction of the herniated mass takes place. The correlation between permanent motor deficits and morphologic changes was not clear in this study.

The indications for surgical treatments are well known.^{10,17} However, our basic concept for LDH is conservative treatment that depends on the facts which have become clear in this study. Nevertheless, we should perform some minimal invasive surgical procedure, such as percutaneous nucleotomy or microsurgical discectomy, for young patients with a large central protruding hernia and little improvement of symptoms or morphologic changes of the herniated mass on MRI. With these concepts, at our institution,

only 34 patients (9%) out of 327 patients with LDH underwent discectomy surgery during the past 3 years.

CONCLUSIONS

1. 37 out of 42 patients (88 %) showed effective (>50%) reduction of the herniated mass on MRI 3–12 months after the onset of symptoms.
2. Sequestered hernia and transligamentous extrusions seem to be more easily and rapidly absorbed.
3. MRI changes and improvement of symptoms are well correlated with MRI changes, but a time lag is observed.
4. The basic treatment of LDH should be conservative according to the results of this study. However, surgery may be necessary for large central protruding hernias and patients who show severe motor deficits.

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