Original Article

Fibrous adhesive entrapment of lumbosacral nerve roots as a cause of sciatica

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Study design: Report of seven patients with fibrous adhesive entrapment of lumbosacral nerve roots as a cause of sciatica, whose radiographic findings were negative and who experienced relief from sciatica immediately after the entrapment was released.

Objectives: To describe a new clinical entity of fibrous adhesive entrapment of lumbosacral nerve roots with negative radiographic findings.

Setting: Orthopaedic department, Japan.

Methods: Clinical evaluation and post-operative outcome in seven patients with entrapment of lumbosacral nerve roots because of fibrous adhesion confirmed intraoperatively.

Results: Radiographic examinations by magnetic resonance imaging (MRI), myelography, and computed tomographic (CT) myelography demonstrated neither disc herniations nor spinal stenosis in all seven patients, and differential nerve root block was effective for relieving sciatica and low back pain. We confirmed, intraoperatively, entrapment of the nerve root by fibrous adhesion, and all seven patients were relieved from sciatica and low back pain postoperatively.

Conclusion: This study presented seven patients with sciatica caused by fibrous adhesive entrapment of lumbosacral nerve roots who underwent decompression and release of fibrous adhesion. Radiographic examinations, such as MRI, myelography and CT myelography, showed no compressive shadows and also differential nerve root block was effective for its diagnosis. This study seems to be the first report of patients with entrapment of lumbosacral nerve roots caused by fibrous adhesion, whose radiographic findings were negative.

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Introduction

Compression of lumbosacral nerve roots in association with intervertebral disc herniation and spinal stenosis usually causes sciatic pain.^{1,2} Radiographic examinations, such as magnetic resonance imaging (MRI), myelography, and computed tomographic (CT) myelography, usually reveal findings of compression in patients with disc herniations and/or spinal stenosis. However, we sometimes encounter patients with sciatic pain whose radiographic examinations reveal neither lumbar disc herniations nor spinal stenosis.

In this study, we describe the surgical management of a series of patients with sciatica whose lumbosacral nerve roots were entrapped because of fibrous

adhesion. The aim of this study was to determine the effectiveness of differential nerve root block for the diagnosis and to emphasize the necessity of surgical decompression and release of fibrous adhesive entrapment of the lumbosacral nerve roots.

Methods

In our unit, between 1985 and 1998, 1841 patients with sciatica and low back pain required surgical intervention. In seven patients, entrapment of lumbosacral nerve roots because of fibrous adhesion was confirmed intraoperatively and decompressive surgery was required. The clinical data of the patients are summarized in Table 1. They comprised four women and three men, their average age at the time of operation was 43 years, and the average follow-up period was 7 years and 2 months.

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Table 1 The summary of clinical data

Case	Age	Sex	Follow-up	Cause	Interval from onset to surgery	Low back pain	SLR	Affected nerve root	Root block no.	Outcome	Myelography	CTM	MRI	JOA score Pre	JOA score Post
1	20	M	14Y8Mo	Sports	5Mo	(+)	10° (+)	left S1	1	effective	n.p.	n.p.	n.p.	10	24
2	50	F	8Y11Mo	(-)	4Mo	(+)	45° (+)	left L5	1	effective	n.p.	n.p.	n.p.	12	24
3	39	F	8Y	(-)	7Mo	(+)	(-)	right L6	1	effective	n.p.	n.p.	n.p.	16	24
4	44	F	7Y11Mo	(-)	4Mo	(+)	50° (+)	right L5	1	effective	n.p.	n.p.	n.p.	14	22
5	58	M	5Y9Mo	(-)	1Y	(+)	70° (+)	right L5	2	effective	n.p.	n.p.	n.p.	8	19
6	43	M	2Y11Mo	Labor	1Y1Mo	(+)	(-)	left L5	1	effective	irregular	n.p.	n.p.	12	18
7	50	F	2Y	(-)	5Mo	(+)	40° (+)	left L5	2	effective	n.p.	n.p.	n.p.	15	27

M: male; F: female; Y: year; Mo: month; SLR: straight leg raising

Radiographic examinations

Initially, MRI was performed for all patients. Patients with negative findings on MRI underwent myelography and CT myelography in order to look for slight compressive shadows caused by intervertebral disc herniations which could not be detected by MRI, myelography and CT myelography. Differential nerve root block using lidocaine was attempted at suspicious levels of neurological symptoms to identify which nerve root was affected and also to confirm whether or not pain relief was obtained. In the patients without remarkable findings in MRI, myelography and CT myelography, the level of this nerve root block was determined according to physical examination data, such as pain, sensory deficit, and motor weakness.

Surgery

After exploring the spinous process and lamina, laminotomy was performed using an osteotome followed by unroofing of the symptomatic nerve root. As neither disc bulging nor compression of the nerve root and the dura because of spinal stenosis was observed, discectomy was not performed. Entrapment of the nerve root by fibrous adhesion was confirmed and exfoliated. Microsurgical manipulation was often useful for precise observation. These procedures resulted in release of the nerve root and creation of space around it.

Clinical evaluation

Preoperative clinical symptoms and those soon after the operation were assessed using the criteria for the evaluation of low back pain treatment outcome proposed by the Japanese Orthopaedic Association (JOA) (maximum score: 29 points) which is commonly used in Japan (Table 2).

Results

Radiographic examinations by MRI, myelography and CT myelography demonstrated neither disc herniations nor compression of the nerve root and the dura because of spinal canal stenosis in any of the seven patients. In

one patient, however, slightly irregular shadow of the nerve root was observed. All the seven patients complained of sciatica accompanied by low back pain. Five of the patients had no cause for the development of the symptoms. Two patients had a suggestive life-style history: a football player and a manual laborer. None of the seven patients experienced previous medical history of low back pain and sciatica. The average interval between onset of the symptoms and surgical intervention was 7 months, and seemed not to be different from that of lumbar disc herniations or spinal stenosis. The average age at the time of surgery was close to that of lumbar disc herniations, and was somewhat younger than spinal stenotic patients. Differential nerve root block at suspicious symptomatic levels was effective for relieving both sciatic pain and low back pain in all seven patients. Intraoperatively, we confirmed entrapment of the nerve root by fibrous adhesion. All the seven patients experienced complete relief from sciatic pain and low back pain immediately after we released the fibrous adhesion, and the JOA scores improved in all seven patients soon after the operation. During an average follow-up period of 7 years and 2 months, no recurrence of sciatic pain accompanied by low back pain was observed and the JOA scores were unchanged.

Representative case presentation

Case 7: A 51-year-old woman with low back pain and left sciatica was admitted to our hospital. Physical examination on admission demonstrated positive straight leg raising at 45° in the left side and JOA score was 15 points. Differential nerve root block using lidocaine at left L5 nerve root level was effective in relieving both the leg pain and low back pain (Figure 1). MRI and CT myelography showed no disc bulging at L4/5, and myelography demonstrated no abnormal shadow of left L5 nerve root (Figures 2–4). After completing laminotomy at L4/5, fibrous adhesive entrapment was observed. Careful detachment of fibrous adhesion resulted in setting the nerve root free and the patient was relieved from both sciatic pain and low back pain and JOA score increased to 27 points.

Table 2 The criteria for the evaluation of low back pain treatment outcome proposed by the Japanese Orthopaedic Association (JOA)

I. Subjective symptoms				(9 points)
A. Low back pain				
a. none				3
b. occasional mild pain				2
c. frequent mild or occasional severe pain				1
d. frequent or continuous severe pain				0
B. Leg pain and/or tingling				
a. none				3
b. occasional mild symptoms				2
c. frequent mild or occasional severe symptoms				1
d. frequent or continuous severe pain				0
C. Gait				
a. normal				3
b. able to walk farther than 500 m, even though it results in pain, tingling, and/or muscle weakness				2
c. unable to walk farther than 500 m, because of leg pain, tingling, and/or muscle weakness				1
d. unable to walk farther than 100 m, because of leg pain, tingling, and/or muscle weakness				0
II. Clinical signs				(6 points)
A. Straight leg raising test (including tight hamstrings)				
a. normal				2
b. 30° ~ 70°				1
c. less than 30°				0
B. Sensory disturbances				
a. none				2
b. slight disturbances				1
c. marked disturbances				0
C. Motor disturbances				
a. normal (grade 5)				2
b. slight weakness (grade 4)				1
c. marked weakness (grade 3-0)				0
III. Restriction of ADL				(14 points)
ADL	Severe restriction	Moderate restriction	No restriction	
a. turn over while lying	0	1	2	
b. standing	0	1	2	
c. washing	0	1	2	
d. leaning forward	0	1	2	
e. sitting (about 1 h)	0	1	2	
f. lifting or holding heavy objects	0	1	2	
g. walking	0	1	2	
IV. Urinary bladder function				(-6 points)
a. normal				0
b. mild dysuria				-3
c. severe dysuria*				-6

*Incontinence, urinary retention

Figure 1 Differential nerve root block using lidocaine of left L5 nerve root was completely effective

Discussion

The nerve roots in the lumbosacral region may be easily compressed by intervertebral disc herniations and/or spinal stenosis. Such mechanical compressions of the nerve root may induce functional changes, such as sensory deficit, motor weakness, and pain.^{1,3} Rydevik reported that compression of the nerve root caused structural damage to the nerve fibers, and impairment of intraneural blood flow; i.e. ischemia, and formation of intraneural edema.^{1,3} He also suggested that long-standing intraneural edema may progress to fibrosis around the nerve root.^{1,3} Lundborg reported that nerve root compression injury caused local myelin changes and that increased endoneurial fluid pressure interfered with intrafascicular capillary flow and constituted a pathophysiological mechanism in nerve compression injuries.⁴ Howe suggested that acute nerve root compression neuropathies were usually painless, whereas chronic injury of the nerve root produced a marked increase in mechanical sensitivity.⁵ Smyth also reported that repeated or continued pressure on the nerve root made the root hypersensitive and caused sciatica.⁶ Furthermore, he suggested that postoperative reactionary fibrosis around the nerve root seemed to be sufficient to cause persistent acute sciatica.⁶

Figure 2 MRI showed no disc bulging at L4/5

Figure 3 Postero-anterior myelogram demonstrated no abnormality of left L5 nerve root

Malcolm reported that degenerative disc disease and protrusion might lead to compression of epidural veins and suggested a significant relationship between the evidence for venous obstruction and perineural fibrosis.⁷

On the other hand, several investigators have suggested that chemical inflammation or irritation can cause sciatic pain, and that these are important factors rather than mechanical compression. In experiments using dogs, McCarron proved that homogenized autogenous nucleus pulposus injected into the lumbar epidural space caused chemical or immunologic inflammation of the neural sac.⁸ Marshall suggested that chemical irritation of the nerve root in association with disc prolapse and subsequent endoneurial edema caused was responsible for acute sciatic pain.⁹

In the light of all these previous reports, we suggest that mechanical compression and/or chemical irritation cause not only a decrease of blood supply and endoneurial edema, but also subsequent nerve root constriction and entrapment of the nerve root by circumferential fibrous adhesion.

Here, we should discuss the potential reasons for negative findings on MRI, myelography and CT myelography. In six patients without remarkable radiographic findings, severe nerve root compression

due to fibrous adhesive entrapment which reflected radiographic findings was not detected, but adhesion of the nerve root and restriction on nerve root movement were observed. In a patient with slightly irregular shadow of the nerve root, nerve root compression which was observed intraoperatively was more severe than the other six patients. We considered that the grade of adhesive fibrous entrapment was not correlated with compressive findings on MRI, myelography and CT myelography. Furthermore, several investigators reported that gadolinium enhanced MRI was useful and quite effective for the diagnosis of postoperative perineural fibrosis.^{10,11} However, this technique has not been widely used for preoperative screening of perineural fibrosis. We consider that gadolinium enhanced MRI might be necessary in the investigation of fibrous adhesive entrapment of the nerve root. Differential nerve root block is effective and necessary for the diagnosis of fibrous adhesive entrapment² in patients with negative radiographic findings on MRI, myelography and CT myelography. With regard to surgical procedure, laminotomy and unroofing of the symptomatic nerve root seemed to be a fairly invasive and an over-indicated surgery. However, we selected this procedure because we felt that a simple epidural

Figure 4 Lateral myelogram demonstrated no abnormality of left L5 nerve root

exploration was insufficient for obtaining a good visual operation field.

Differential nerve root block at the suspicious symptomatic level was effective for relieving both sciatica and low back pain in all seven patients. As mentioned above, chemical irritation and mechanical compression seem to relate to the development of fibrous adhesive entrapment around the nerve root and posterior longitudinal ligament, which caused both sciatica and low back pain in this condition. Furthermore, we speculate that some chemical substance derived from the intervertebral disc may be one of the causes for the formation of fibrous adhesive entrapment around the nerve root and posterior longitudinal ligament. However, further investigation will be required to clarify the accurate mechanism.

On encountering a patient with definite sciatic pain accompanied by low back pain whose radiographic examinations by MRI, myelography and CT myelography reveal neither disc herniations nor spinal stenosis, differential nerve root block using lidocaine is essential for the diagnosis of fibrous adhesive entrapment of the nerve root. Surgical decompression and release of the fibrous adhesion may be the best way to treat this condition.

Conclusions

This study presented seven patients with sciatica accompanied by low back pain caused by fibrous adhesive entrapment of lumbosacral nerve roots who underwent decompression and release of fibrous adhesion. MRI, myelography and CT myelography revealed neither disc herniations nor nerve root compression except for an irregular shadow in myelography detected in a patient. Differential nerve root block using lidocaine was effective in identifying the symptomatic level and relieving both the sciatic pain and low back pain in all the seven patients. This is the first report of patients with fibrous adhesive entrapment of lumbosacral nerve roots whose MRI, myelography and CT myelography showed negative findings. We would like to emphasize that surgical decompression and release of the fibrous adhesion is necessary for the treatment of this condition and differential nerve root block and gadolinium enhanced MRI are essential for its diagnosis.

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