Elsevier Editorial System(tm) for Surgical Neurology

Manuscript Draft

Manuscript Number:

Title: Characteristics of L3 nerve root radiculopathy

Article Type: Original Article

Keywords: Clinical characteristics; Joint disease; L3 radiculopathy; Selective nerve root injection; Surgery

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Abstract: Background. In degenerative lumbar spinal disease with nerve root compression, the L5 and S1 nerve roots are the most often affected and the L3 nerve root is involved infrequently. The purpose of this study was to investigate the characteristics and of L3 nerve root radiculopathy.
Methods. Seventeen consecutive patients with L3 radiculopathy were treated. The symptomatic nerve roots were determined by the pain distribution, the neurological findings and selective nerve root injection. The clinical characteristics and outcomes of these patients were assessed retrospectively.
Results. The average age was 76 years. The spinal diseases that were associated with L3 radiculopathy were lumbar canal stenosis (LCS) in 6 patients, lumbar extraforaminal stenosis and lumbar disc herniation in 5 each, and LCS with degenerative scoliosis in 1. The patients' symptoms were thigh pain in 12 patients, and hip or knee pain in 5. Four patients were non-ambulatory because of severe pain. Although a sensory disturbance was reported in 9 patients, motor weakness was present in 2. Selective nerve root injection was completely effective in 10 patients. Six had decompressive surgery and/or fusion followed by a favorable outcome. Four patients were misdiagnosed and received conservative treatment for hip and/or knee joint diseases.
Conclusions. L3 radiculopathy was characterized by various lower limb pain and neurological deficit. Selective nerve root injection was effective for most patients. In elderly patients who do not respond to treatment for hip and/or knee joint diseases, L3 nerve root radiculopathy should be considered as the cause of lower limb pain.

August 1, 2008.

James I. Ausman MD, PhD

Editor-in-chief

Surgical Neurology Editorial Office

Dear Dr. Ausman:

Enclosed is a clinical article titled, “Characteristics of L3 nerve root radiculopathy” for consideration in *Surgical Neurology*. This work has not been previously published or submitted elsewhere for review.

Midlumbar radiculopathies that affect the L3 nerve root account for less than 5% of cases of unilateral lumbar radiculopathy requiring surgery. This work is the report of a characteristics and clinical outcome of L3 radiculopathy. This report should be of interest to spinal surgeons since the “unique” characteristics of L3 radiculopathy is not well known.

I look forward to hearing from you.

Sincerely,

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Abbreviations list

LCS: Lumbar Canal Stenosis

MRI: Magnetic Resonance Imaging

Characteristics of L3 nerve root radiculopathy

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Background. In degenerative lumbar spinal disease with nerve root compression, the L5 and S1 nerve roots are the most often affected and the L3 nerve root is involved infrequently. The purpose of this study was to investigate the characteristics and of L3 nerve root radiculopathy.

Methods. Seventeen consecutive patients with L3 radiculopathy were treated. The symptomatic nerve roots were determined by the pain distribution, the neurological findings and selective nerve root injection. The clinical characteristics and outcomes of these patients were assessed retrospectively.

Results. The average age was 76 years. The spinal diseases that were associated with L3 radiculopathy were lumbar canal stenosis (LCS) in 6 patients, lumbar extraforaminal stenosis and lumbar disc herniation in 5 each, and LCS with degenerative scoliosis in 1. The patients' symptoms were thigh pain in 12 patients, and hip or knee pain in 5. Four patients were non-ambulatory because of severe pain. Although a sensory disturbance was reported in 9 patients, motor weakness was present in 2. Selective nerve root injection was completely effective in 10 patients. Six had decompressive surgery and/or fusion followed by a favorable outcome. Four patients were misdiagnosed and received conservative treatment for hip and/or knee joint diseases.

Conclusions. L3 radiculopathy was characterized by various lower limb pain and neurological deficit. Selective nerve root injection was effective for most patients. In elderly patients who do not respond to treatment for hip and/or knee joint diseases, L3 nerve root radiculopathy should be considered as the cause of lower limb pain.

Key words: Clinical characteristics, Joint disease, L3 radiculopathy, Selective nerve root injection, Surgery

Abbreviations list

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Introduction:

Midlumbar radiculopathies that affect the L3 or L4 nerve roots account for about 5% of cases of unilateral lumbar radiculopathy requiring surgery [10]. Likewise, much less is known about the upper lumbar herniations because disc herniations at the L1-2, L2-3, and L3-4 levels represent <5% of all disc herniations [2]. The frequency of all cases of L3 and L4 radiculopathies managed either surgically or conservatively has not been reported, but is probably low as compared to radiculopathies affecting the L5 or S1 roots [10]. Sunderson et al. reviewed the data of their patients treated for L1-2 and L2-3 disc herniations and described their "unique" characteristics of upper lumbar radiculopathies [12]. The purpose of this study was to investigate the clinical characteristics of L3 nerve root radiculopathy. We retrospectively reviewed our patient data to determine the characteristics of L3 radiculopathy in terms of demography, presenting signs and symptoms, and clinical outcome.

Patients and Methods:

Inclusion and Exclusion Criteria

We retrospectively reviewed the medical records of 17 consecutive patients (7 men and 10 women) who had unilateral L3 radiculopathy managed either conservatively or surgically from January 2002 to January 2006. Our criteria of L3 radiculopathy was based on the inclusion and exclusion criteria defined by Rainville et al. except a nonambulatory status and the inability to read or write English [10]. The patient characteristics are listed in Table 1. Their average age was 76 years (range, 61-90 years). The average length of follow up was 17 months (range, 7-36 months). Informed consent for participation in this study was obtained from all patients. Treatment recommendations were unaffected by study participation.

Nerve root Injections

We defined the diagnosis of L3 radiculopathy from the response to L3 selective nerve root injection. The symptomatic L3 nerve root was determined by the pain distribution, neurological findings and selective L3 nerve root injection using lidocaine and dexamethasone. We performed radiculography and L3 nerve root injection for all patients, and the symptomatic nerve roots were determined. Nerve root infiltration was performed in the oblique position using an image intensifier. With the needle in position, 2 ml of contrast medium (Iotrolan) was injected and confirmed that it provoked the pain. After that, 2 ml of 2% lidocaine and 4 mg of dexamethasone were injected and pain relief was confirmed.

Operative Intervention

The patient was allowed to choose to receive as many as five nerve-root injections at any time during the follow-up period. If one or more additional injections were requested, the patient received the same medication. We considered an operative intervention when L3 selective nerve root injection was not effective and patients' pain relief was not confirmed after three or four additional nerve root injections. Six of 11 patients were treated surgically.

Data collection

The patients' data collected included the spinal diseases associated with the L3 radiculopathy, the patient's symptom, quadriceps motor weakness and sensory disturbance, ambulatory function, and the Prolo scale [8]. All patients were followed clinically until their signs and symptoms improved. No immediate postoperative complications occurred.

Results:

The spinal diseases that were associated with a L3 radiculopathy were lumbar canal stenosis (LCS) in 6 patients, lumbar extraforaminal stenosis and lumbar disc herniation in 5 each, and LCS with degenerative scoliosis in 1. The patients' symptoms were thigh pain in 12 patients, and hip or knee pain in 5 (Table 2). Four patients were not ambulatory because of severe pain. Four patients were misdiagnosed at another institution and received conservative treatment for hip and/or knee joint disease. Although a sensory disturbance was reported in 9 of 17 patients, quadriceps motor weakness was present in only 2 patients (Table 3).

The clinical outcomes for the patients with a L3 monoradiculopathy were generally favorable (Table 4). Eleven patients received conservative management. Nerve root infiltration using lidocaine and steroid was completely effective in 10 patients. The remaining 6 patients (35%) underwent surgery. Of the 6 patients who had surgery, four had a decompression and 2 had a decompression with fusion and instrumentation (Table 5). In patients with advancing age, to avoid repeat spinal surgery for their general health, we performed decompression and/or fusion for spinal stenosis and/or instability in another level which did not affect the L3 radiculopathy.

The Prolo Scale score was used for evaluation of the clinical results [8]. The average Prolo Scale score was 2.5 preoperatively and 7.7 postoperatively (Table 5). All patients were satisfied with their clinical results.

Case Presentation

A 61-year-old woman (Case 2) experienced the sudden onset of right groin pain. Her pain and numbness worsened gradually, and independent ambulation became difficult. She had received

treatment for hip joint disease at another facility. On physical examination, motor examination showed no weakness of her lower extremities bilaterally. Slight hypoesthesia was noted on her right knee (Fig. 1A). Her lower extremity reflexes were normal. MRI revealed L2-3 lumbar disc herniation and L4 degenerative spondylolisthesis (Fig. 1B, 1C). Although she had received L3 nerve root injections 3 times, her pain relief was confirmed temporary. We performed a L2-3 discectomy only and her groin pain decreased markedly and her Prolo score improved from E1F1 (2 points) preoperatively to E5F5 (10) postoperatively.

Discussion:

It has been noted that lumbar radiculopathies involving the L3 or L4 nerve roots become more frequent with advancing age, with the highest incidence occurring in the sixth decade [4]. The median and average age of our patients was 76 years and advanced age may precipitate the development of abnormal spinal dynamics and degeneration that may lead to various spinal diseases that are associated with a L3 monoradiculopathy.

Symptoms associated with midlumbar radiculopathies include lower extremity pain radiating into the lateral hip, the anterior surface of the thigh, and to the anterior knee [10]. Pain in the groin and the anterior thigh is highly suspicious for L2 or L3 root involvement [1]. Several authors have concluded that the presenting symptoms of upper lumbar disc herniations are useless in accurately diagnosing the disease [2, 6, 9]. Our experience was similar. The patients' symptoms varied greatly from thigh pain to hip and/or knee pain. Four patients were not ambulatory because of severe pain. In addition, 4 patients were misdiagnosed elsewhere and received conservative treatment for hip and/or knee joint disease. This information is very important because the mechanism and treatment of radicular pain and arthritic pain are very

different. Fogel et al. reported that the symptoms of midlumbar spinal stenosis, radiculopathy and/or neurogenic claudication may be similar to the pain of an arthritic hip or knee [5]. Therefore, in elderly patients who do not respond to treatment for hip and/or knee joint diseases, L3 nerve root radiculopathy should be considered as a possible cause of the lower limb pain.

The symptoms of L3 radiculopathy could not be as easily categorized as an L5 and/or S1 radiculopathy. The reason for the variable symptoms of L3 radiculopathy is not clear. However, the spinal diseases that were associated with L3 radiculopathy were also variable in our series (LCS, disc herniation, lumbar foraminal stenosis, and LCS with degenerative scoliosis), and may have had some influence on the L3 radicular symptoms because many authors have described the mechanisms of nerve root entrapment in degenerative lumbar spinal diseases and upper disc herniations [1, 7, 12, 13].

Neurological deficits, when present, may be manifested as sensory disturbance, quadriceps weakness and/or a diminished patellar reflex [12]. Aronson et al. reported that sensory deficits to pin prick involving the L3 or L4 dermatomes were noted in 39% and quadriceps weakness was noted in 30% of surgically treated patients with L2-3 disc herniations [3]. A review of the literature disclosed few reports on the neurological features of L3 radiculopathy. In our study, a sensory disturbance was reported in 53% and motor weakness was present in 12% of all patients. The cause of these differences is unclear, but the spinal biomechanics and/ or the patterns of nerve root entrapment may be different in each patient.

Regarding the muscle weakness, as the L3 and L4 nerve roots innervate the quadriceps, quadriceps muscle weakness may not be a consequence of a L3 monoradiculopathy in our series. Therefore, most had ill-defined L3 radiculopathies that could not be clearly categorized

into a typical muscle group weakness or dermatomal sensory deficit, as are seen with radiculopathies of the L5 and S1 roots.

The clinical outcomes for the patients with a L3 radiculopathy were generally favorable. Selective nerve root injection was completely effective in 10 patients. Six patients had decompressive surgery and/or fusion followed by a favorable outcome. Concerning the effect of nerve root injections for lumbar radicular pain, Riew et al. suggested that patients who have lumbar radicular pain at one or two levels should be considered for treatment with selective nerve root injections prior to being considered for operative intervention [11]. We also considered nerve root injection as the important part of the conservative treatment. However, it was considered to have failed if the patients' pain relief was not confirmed after three or four additional nerve root injections.

Conclusions:

We conclude that L3 nerve root radiculopathy is characterized by various lower limb pain and sensory disturbances. Selective nerve root injection was effective for most L3 nerve root radiculopathies. Decompressive surgery and/or fusion also were associated with a favorable outcome. In elderly patients whose symptoms do not respond to treatment for hip and/or knee joint diseases, a L3 nerve root radiculopathy should be considered as a possible cause of the lower limb pain.

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Figure Legend:

Figure 1. Dermatome (A) and MRI (B, C) in a representative case of L2-3 disc herniation in a 61-year-old woman (Case 2). Preoperative sagittal T2-weighted MRI (B), and axial T2-weighted MRI (C) show L2-3 disc herniation and coexistent L4 degenerative spondylolisthesis. A L2-3 discectomy was performed, and her pain improved after surgery (see TABLE 1, 5).

Table(s)

Table 1
Summary of study patients

Patient No.	Age(yrs) /Sex	Diagnostic abnormalities Causing L3 monoradiculopathy	Follow up (months)
1	83/F	Lumbar canal stenosis	7
2	61/F	L2-3 Lumbar disc herniation	24
3	76/F	Degenerative scoliosis	27
4	80/F	Lumbar canal stenosis	26
5	90/M	Lumbar canal stenosis	10
6	82/F	Lumbar canal stenosis	7
7	74/M	Lumbar extraforaminal stenosis	9
8	85/F	Lumbar canal stenosis	24
9	62/M	L2-3 Lumbar disc herniation	28
10	74/F	L2-3 Lumbar disc herniation	12
11	72/F	Lumbar extraforaminal stenosis	24
12	76/M	L2-3 Lumbar disc herniation	36
13	68/F	Lumbar canal stenosis	8
14	68/F	Lumbar extraforaminal stenosis	12
15	72/M	Lumbar extraforaminal stenosis	11
16	66/M	Lumbar extraforaminal stenosis	10
17	78/M	L2-3 Lumbar disc herniation	10

Table 2
Patients' symptoms

Patients' symptoms	**N (%)**
Thigh pain	12 (70)
Groin (Hip) pain	3 (18)
Knee pain	2 (12)

Table 3

Neurologic deficits due to L3 monoradiculopathy

Neurologic deficits	N (%)
Sensory disturbance (L3 dermatome)	
Present	9 (53)
Absent	8 (47)
Quadriceps muscle weakness	
Present	2 (12)
Absent	15 (88)

Table 4
Clinical outcomes

	Surgical Treatment N (%)	**Conservative treatment N (%)**
Improved	6 (100)	10 (91)
Worse	0 (0)	0 (0)
Unchanged	0 (0)	1 (9)

Table 5

Surgical procedure and outcome

Patient No.	Surgical Procedure	Prolo Scare (score)	
		Preoperative	Postoperative
2	L2-3 discectomy	E1F1(2)	E5F5(10)
4	L2-3 fenestration	E1F1(2)	E2F3(5)
8	L2-5 decompression and fusion	E1F1(2)	E2F5(7)
9	L2-3 discectomy	E2F2(4)	E5F5(10)
11	L3-4 facetectomy and fusion	E1F1(2)	E2F5(7)
12	L2-3 discectomy	E2F1(3)	E2F5(7)

Figure 1A
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Fig. 1.

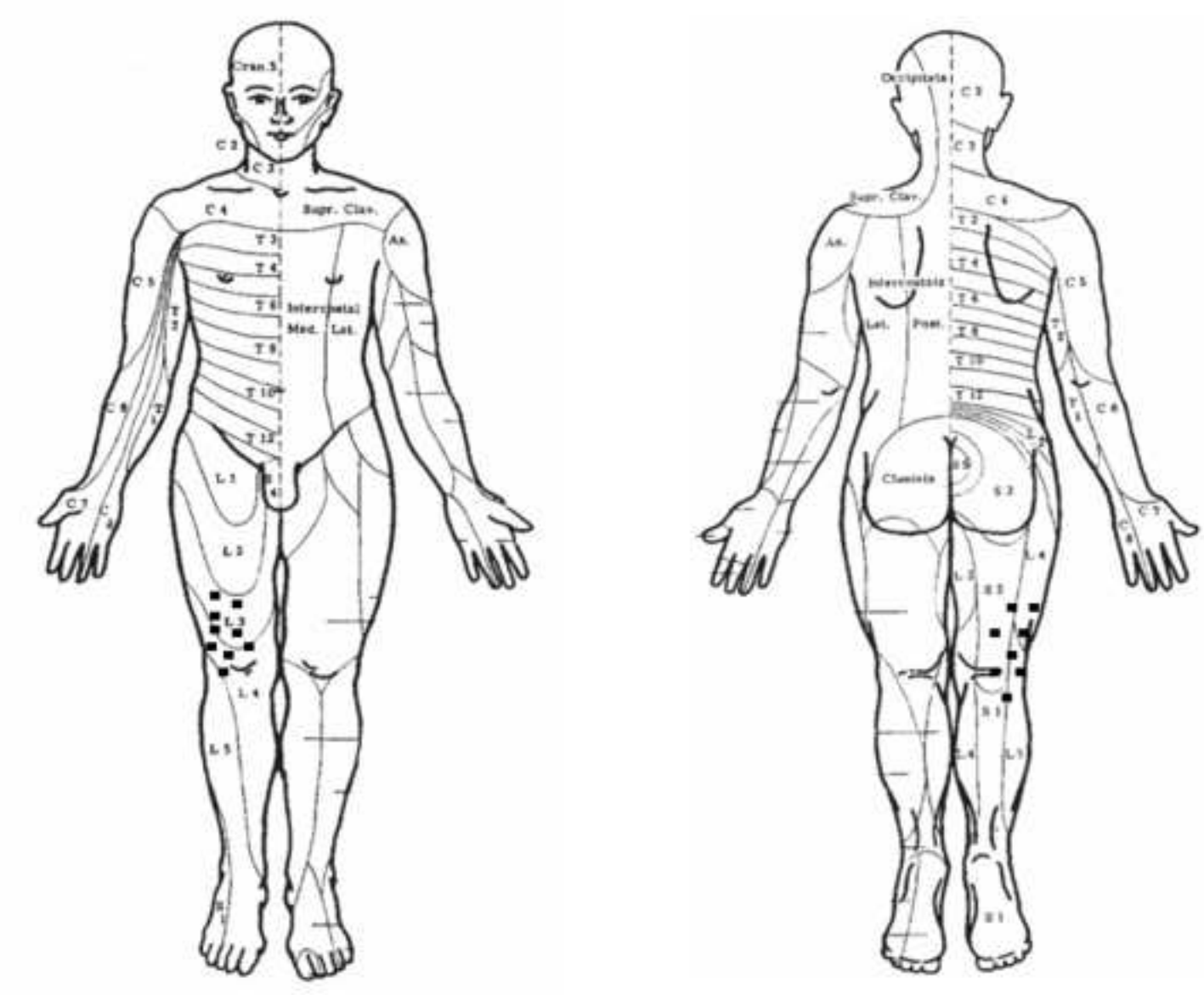

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Figure 1B, 1C
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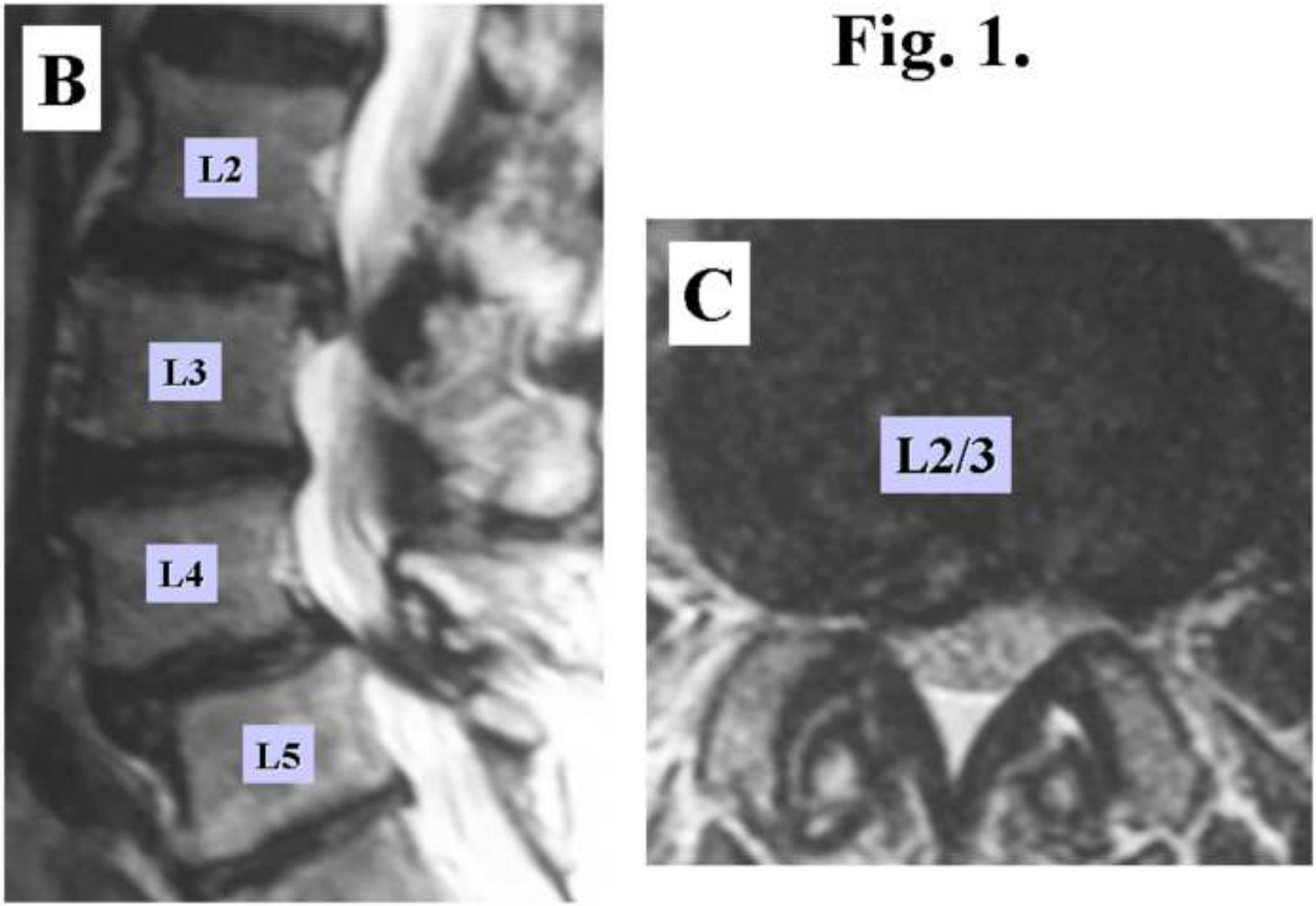

Fig. 1.