

Relationship between ventral lumbar disc protrusion and contrast medium leakage during sympathetic nerve block

Toshiharu Tazawa · Yoshinori Kamiya ·
Mina Takamori · Ken-ichi Ogawa · Takahisa Goto

Received: 6 February 2014 / Accepted: 7 June 2014 / Published online: 1 July 2014
© Japanese Society of Anesthesiologists 2014

Abstract Ventral disc protrusions have been neglected because they are asymptomatic. Lumbar sympathetic nerve block (LSNB) is one of the clinical choices for refractory low back pain treatment. Leakage of the contrast medium may occur and lead to complications, especially when using a neurolytic agent. In this study, we retrospectively reviewed the magnetic resonance images (MRIs) of 52 consecutive patients with refractory low back pain due to lumbar spinal canal stenosis who underwent LSNB, and graded ventral disc protrusion at the L1/2 to L5/S1 vertebral discs on a three-point scale (grade 0 = no protrusion, grade 1 = protrusion without migration, grade 2 = protrusion with migration). We also determined if there was leakage of contrast medium in LSNB. Ventral disc protrusion was observed in all patients, and 75 % (39/52) had grade 2 protrusion in the L1/2–L3/4 vertebral discs. Moreover, the incidence of contrast medium leakage was significantly higher at the vertebrae that had grade 2 protrusion than at those with less protrusion. We revealed a higher incidence of ventral disc protrusion of the lumbar vertebrae than previously reported, and that the incidence

of leakage in LSNB increased when ventral disc protrusion was present. To avoid complications, attention should be paid to ventral disc protrusions before performing LSNB.

Keywords Lumbar spinal canal stenosis · Lumbar sympathetic nerve block · Ventral disc protrusion · Leakage of contrast medium

Introduction

Lumbar spinal canal stenosis (LSCS) is a common cause of refractory pain in the lower back and lower extremities in elderly patients. Lumbar sympathetic nerve block (LSNB) is a frequent treatment choice used in Japan. Intervertebral disc degeneration is a major feature of LSCS that often results in disc protrusion, extending to disc hernia. Protrusion of lumbar vertebral discs occurs not only dorsally (i.e., towards the spinal canal) but also ventrally (i.e., towards the abdominal cavity) and laterally. Ventral disc protrusion is undiagnosed or ignored by most physicians as it is asymptomatic, so literature on the morbidity and clinical importance of ventral disc protrusion [1] is exceedingly rare. However, it may influence drug distribution when LSNB is performed because the lumbar sympathetic nerve trunk is located on the ventrolateral surface of the vertebrae. Leakage of the drug from the ventrolateral surface of the vertebrae (for example, into the lumbar plexus) may induce severe complications, especially when a neurolytic agent is used [2–6].

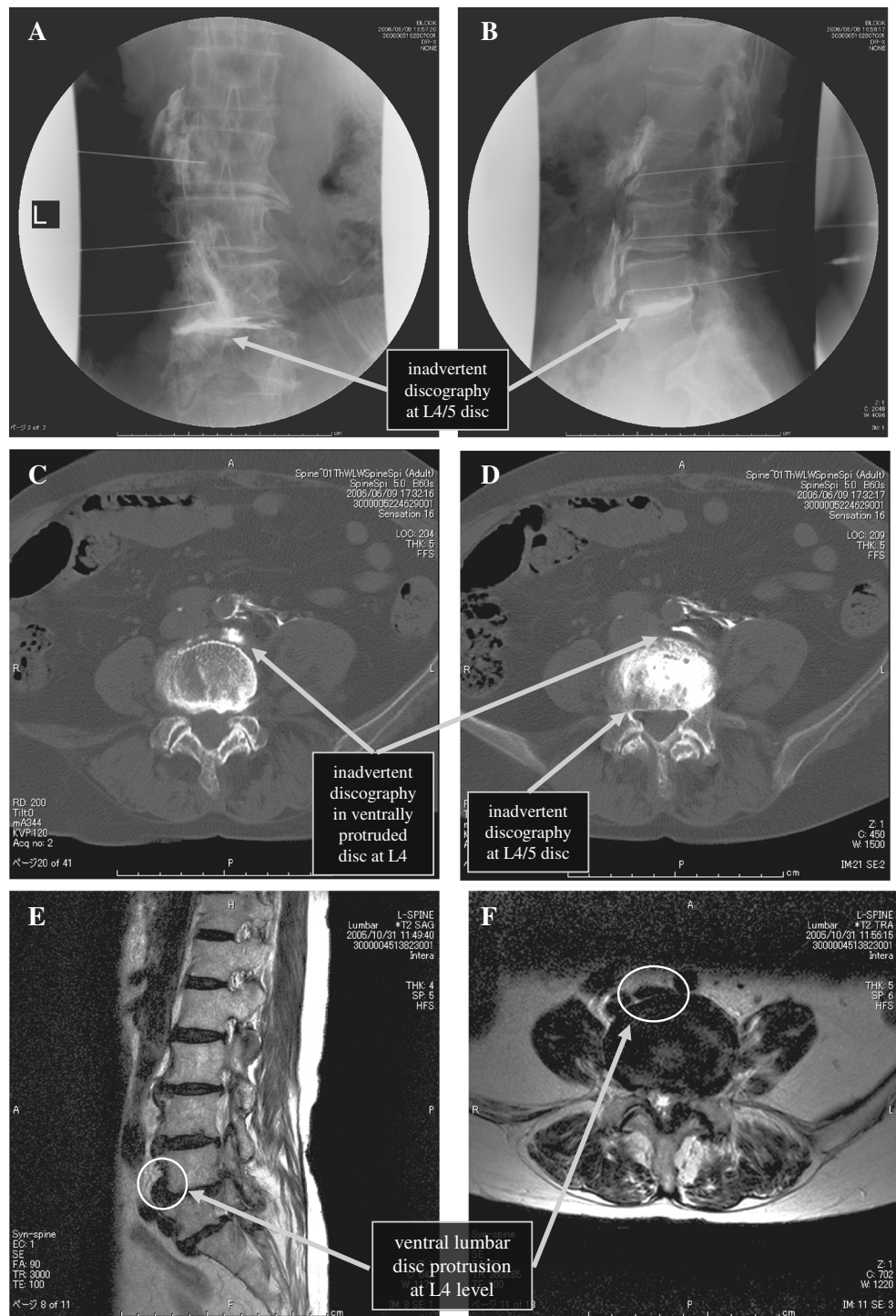
We experienced a case of accidental discography of the L4/5 lumbar disc while performing LSNB. This case prompted us to investigate the relationship between incidence of ventrolateral disc protrusion and leakage of contrast medium in LSNB procedures.

T. Tazawa · M. Takamori · K. Ogawa · T. Goto
Department of Anesthesiology and Critical Care Medicine,
Yokohama City University Graduate School of Medicine,
Yokohama, Japan

Y. Kamiya
Department of Neuroanatomy, Yokohama City University
Graduate School of Medicine, Yokohama, Japan

Present Address:
Y. Kamiya (✉)
Department of Anesthesiology, Niigata University Medical and
Dental Hospital, 1-757 Asahimachidori, Chuo Ward, Niigata,
Niigata Prefecture 951-8510, Japan
e-mail: yoshinori.kamiya@gmail.com

Fig. 1a-f Accidental discography of the L4/L5 disc during lumbar sympathetic nerve block in a lumbar spinal canal stenosis patient. **a** Unexpected discography of the L4/5 lumbar disc was obtained through the L4 needle when the contrast medium (3 ml) was injected through the block needles (*white arrow*). **b** The tip of the L4 block needle was located in the anterior edge of the L4 vertebra, and contrast medium was injected into the ventrally protruded disc. **c** Computed tomography revealed that contrast medium was injected into the ventrally protruded disc at the L4 vertebra. The anterior spread of contrast medium in CT resulted from seeking the appropriate needle position after accidental discography, which was not ultimately achieved. **d** Contrast medium flowed into the L4/5 intervertebral disc from the ventrally protruded disc. **e, f** Magnetic resonance image (MRI) of the ventrally protruded disc at the L4 vertebral level. A ventrally protruded disc was also observed in front of the L2, L3, L5, and S1 vertebral bodies



Case presentation

A 67-year-old female (height 146 cm; weight 47 kg) with a complaint of left leg pain and numbness had been diagnosed with LSCS using magnetic resonance imaging (MRI) and was scheduled to undergo LSNB. The left-sided LSNB was performed using the standard paravertebral approach at the L2–L4 vertebral levels under fluoroscopic

monitoring. Guiding needles (14.45 cm length, 21 gauge) were placed 7.0–7.5 cm from the midline. The block needles were placed a little deeper than usual, but abnormal resistance to insertion was not felt. When 3 ml of contrast medium were sequentially injected from the L2 needle, an unexpected discography of the L4/5 lumbar disc was obtained via the L4 needle (Fig. 1a, b) and the LSNB procedure was discontinued. Computed tomography

revealed that contrast medium was injected into the ventrally protruded disc at the L4 level and then flowed into the L4/5 disc (Fig. 1c, d). We speculated that contrast medium was incidentally injected into the ventrolaterally protruded disc. Detailed examination of the MRI revealed that the disc protruded ventrally and covered the front of the L4 vertebra (Fig. 1e, f). This case prompted us to investigate ventrolateral protrusion in patients with LSCS and the relationship between the incidence of ventral disc protrusion and the leakage of contrast medium during an LSNB procedure.

Study methods

Following institutional ethical committee approval, we retrospectively reviewed the MRI films of 52 consecutive patients with LSCS who underwent LSNB at Yokohama City University Hospital between October 2005 and March 2008.

LSNB was performed in a standard paravertebral method at the L2–L4 vertebrae as described above. The guidance needles were advanced tangentially along the lateral aspects of the vertebrae until the tips reached the anterior edges of each vertebra under fluoroscopic view, and then 3 ml of contrast medium were injected through each needle. When the spread of the contrast medium was adequate on bidirectional fluoroscopy, radiofrequency denervation (90 °C, 180 s in each needle) was applied through each needle after confirming sympathetic block using 3 ml of 2 % lidocaine. In 7 cases, 3 ml of 99.5 % ethanol were additionally administered through the needle. The side of the block and the number of points between L2 and L4 at which LSNB was performed were determined by the patients' symptoms and radiographic images. In this study, we investigated leakage of contrast medium in the LSNB procedure on either side of L2–L4 by retrospectively reviewing contrast radiographic images. We judged the contrast medium to have a leakage when it was observed in psoas muscle, psoas compartment, lumbar disc, or on the dorsal side of the vertebra.

For MRI film analysis, we graded ventral disc protrusion on a three-point scale (0 = no protrusion; 1 = anterior bulging only, not covering the ventral aspect of the vertebra; 2 = protruded disc partially covering the ventral aspect of the vertebra, Fig. 2) from lumbar disc L1/2 to L5/S1, and measured (as a percentage) the degree to which each vertebra was covered by protruded ventral discs. Different examiners evaluated leakage of contrast medium (M.T. and K.O.) and ventral disc protrusion (T.T.).

Data were analyzed using StatView for Windows version 5 (SAS Institute Inc, Cary, NC, USA). Statistical analysis was performed using Fischer's exact test and the

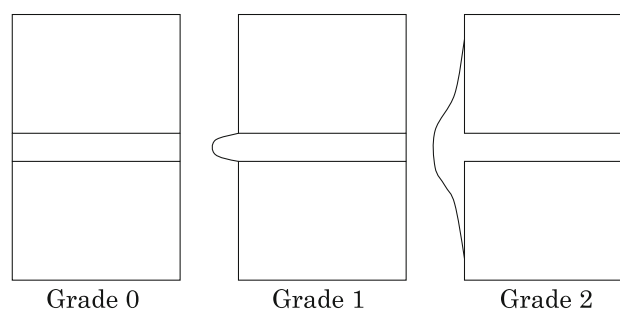


Fig. 2 Schema of ventral lumbar disc herniation. Grade 0 = no herniation; grade 1 = bulging; grade 2 = bulging with migration

Table 1 Patient characteristics

Gender	Male:female	24:28
Age	Mean (range)	73.8 (56–88)
Height (cm)	Mean \pm SD	155.3 \pm 8.6
Body weight (kg)	Mean \pm SD	56.3 \pm 10.9

Data are shown as mean \pm SD

Mantel–Haenszel test. $p < 0.05$ was considered significant.

Results

The demographic data on the subjects are summarized in Table 1. All patients included in this survey had ventral disc protrusion in at least at one interspace. Moreover, 75 % (39/52) of these patients had grade 2 ventral disc protrusion(s). The incidence of ventral protrusion at each intervertebral disc ranged from 46.2 % (L1/L2) to 71.2 % (L4/L5). The incidence of dorsal hernia ranged from 46.2 % (L1/L2) to 90.1 % (L4/L5); among the patients who had dorsal hernias, 91.3 % had simultaneous ventral protrusion (total ventral protrusions of intervertebral disc: 151; simultaneous dorsal hernia and ventral protrusion: 138; Table 2). Additionally, the ventral aspects of the L2–L4 vertebrae that were partially covered by grade 2 protrusions ranged from 32.7 % (L4) to 46.2 % (L3), and the ventral aspects that were fully covered ranged from 3.8 % (L2) to 13.5 % (L3, L4) (Table 3).

The overall rate of leakage of contrast medium was significantly higher when a grade 2 protrusion covered the ventral aspect of the vertebra at L2–L4, though the rate of LSNB with leakage at each vertebra (L2–L4) varied (total block: 51.6 vs. 22.7 %, $p < 0.001$, L2 block: 57.9 vs. 26.8 %, $p = 0.015$, L3 block: 35.7 vs. 28.3 %, $p = 0.62$, L4 block: 73.3 vs. 13.9 %, $p < 0.001$ with the Mantel–Haenszel test and Fisher's exact test, Table 4). Leakage of contrast medium occurred mostly into the psoas muscle or psoas compartment (L2: 23/30 (76.7 %), L3: 21/27

Table 2 Incidence and severity of ventral protrusions, dorsal hernias, and simultaneous dorsal hernias, and ventral protrusions at each intervertebral disc (*n* = 52)

	L1/L2	%	L2/L3	%	L3/L4	%	L4/L5	%	L5/S1	%
Ventral protrusion (+)	24	46.2	29	55.8	34	65.4	37	71.2	27	51.9
Grade 1	15	28.8	11	21.2	12	23.1	14	26.9	9	17.3
Grade 2	9	17.3	18	34.6	22	42.3	23	44.2	18	34.6
Dorsal only	24	46.2	29	55.8	41	78.8	47	90.1	42	80.8
Simultaneous	18	34.6	25	48.1	31	59.6	37	71.2	27	51.9

Table 3 Incidence and severity of ventral protrusions at each vertebra (*n* = 52)

	L2 vertebra	%	L3 vertebra	%	L4 vertebra	%
Partially covered	19	36.5	24	46.2	17	32.7
Fully covered	2	3.8	7	13.5	7	13.5

Table 4 Rate of leakage of contrast medium in the LSNB procedure

	Without leakage	With leakage	Rate of leakage (%)	<i>P</i> value
Total blocks				
Protrusion (+)	30	32	51.6	<0.001 [§]
Protrusion (–)	157	46	22.7	
Blocks at L2 vertebra				
Protrusion (+)	8	11	57.9	0.015*
Protrusion (–)	52	19	26.8	
Blocks at L3 vertebra				
Protrusion (+)	18	10	35.7	0.62
Protrusion (–)	43	17	28.3	
Blocks at L4 vertebra				
Protrusion (+)	4	11	73.3	<0.001*
Protrusion (–)	62	10	13.9	

[§] With the Mantel–Haenszel test

* With Fischer’s exact test. The numbers in the table are the total number of lumbar sympathetic blocks for each vertebra

(77.8 %), L4: 16/21 (76.2 %), compared to all leakage). In the remaining cases, contrast medium was distributed into the dorsal side of the vertebrae. Incidental discography occurred in one patient, as described in the “Case presentation” section. None of the patients experienced severe adverse effects after LSNB in this survey.

Discussion

In this investigation, we revealed that the incidence of ventral protrusion of the nucleus pulposus of the lumbar disc was surprisingly high in LSCS patients, and the rate of leakage of contrast medium in LSNB was

significantly higher where ventral disc protrusion was present.

Peter et al. reported incidental discography during celiac plexus block [7], and they pointed out the possibility of accidental discography during LSNB, because correct insertion of the block needle frequently resulted in the needle tip making contact with the vertebral body during both kinds of nerve block. They thought that incidental discography might occur in the case of direct puncture of a lumbar disc with a block needle. However, in our case, the nerve-block needle punctured the ventrally protruded nucleus pulposus wrapped around the vertebrae and contrast medium was injected into the protruded disc.

Even when the needle is very carefully positioned using fluoroscopic imaging, contrast medium leakage into the psoas muscle may occur during an LSNB via the paravertebral approach. A prospective study revealed that the incidence of psoas spread of contrast medium was 21.3 % of 216 blocks [8]. Genitofemoral neuritis, the most common complication after paravertebral neurolytic LSNB, may occur if the neurolytic agent spreads into the psoas compartment because the genitofemoral nerve passes downwards and emerges from the anterior surface of the psoas muscle. If a ventrolaterally protruded disc is present, the block needle may be deflected from the vertebral body. Such a situation may increase the incidence of injectant leakage into the psoas compartment and/or psoas muscle. This speculation is also applicable to accidental permanent lesion of the lateral cutaneous femoral nerve after LSNB using a neurolytic agent [6].

The incidence of genitofemoral neuritis with LSNB using a neurolytic agent was reported as approximately 5–10 % [3–5]. Our results suggest that the presence of ventral disc protrusion may increase the risk of this complication, so clinicians should be especially careful to check for ventral disc protrusion when they use neurolytic agents.

In this study, our sample size was too small to permit us to draw firm conclusions. Moreover, we only assessed leakage of contrast medium in the LSNB procedure retrospectively without evaluating the physiological (skin temperature, etc.) and symptomatic changes in each patient.

Therefore, we cannot determine the “success rate” of LSNB in this study. However, because radiographic evaluation is very useful for predicting the clinical success of LSNB, we believe that the results of our study may contribute to reducing inadvertent complications of LSNB.

In conclusion, all of the LSCS patients in this survey had ventral disc protrusion, and 75 % of them had grade 2 protrusion at the L2–L4 vertebral level. Moreover, the incidence of contrast medium leakage during the LSNB procedure was significantly higher when the patient had grade 2 ventral disc protrusion. Lumbar sympathetic nerve block with radiofrequency denervation, not with neurolytic agents, is recommended for patients with lumbar spinal canal stenosis in order to avoid complications due to the unexpected spread of neurolytic agents.

Acknowledgments Support was provided solely by institutional and/or departmental sources.

Conflict of interest None.

References

1. Schmidt RC, Poll W. Anterior lumbar disc herniations (author's transl.). *Arch Orthop Trauma Surg.* 1978;92(1):59–62.
2. Dirim A, Kumsar S. Iatrogenic ureteral injury due to lumbar sympathetic block. *Scand J Urol Nephrol.* 2008;42(4):395–6.
3. Bonica J. Neurolytic lumbar sympathetic block. In: *The management of pain.* Philadelphia: Lea and Febiger; 1990. p. 2020–2025.
4. Hatangdi VS, Boas RA. Lumbar sympathectomy: a single needle technique. *Br J Anaesth.* 1985;57(3):285–9.
5. Breivik H, Cousins M, Lofstom J. Sympathetic neural blockade of upper and lower extremity. In: Lofstom J, Cousins M, editors. *Neural blockade in clinical anesthesia and management of pain.* 3rd ed. Philadelphia: Lippincott-Raven; 1988. p. 411–50.
6. Pennekamp W, Krumova EK, Feigl GP, Frombach E, Nicolas V, Schwarzer A, Maier C. Permanent lesion of the lateral femoral cutaneous nerve after low-volume ethanol 96 % application on the lumbar sympathetic chain. *Pain Physician.* 2013;16(4):391–7.
7. Wilson PR. Incidental discography during celiac plexus block. *Anesthesiology.* 1992;76(2):314–6.
8. Hong JH, Kim AR, Lee MY, Kim YC, Oh MJ. A prospective evaluation of psoas muscle and intravascular injection in lumbar sympathetic ganglion block. *Anesth Analg.* 2010;111(3):802–7.