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Intradural Lumbar Disc Herniation with Intradural Gas: Report of Three Cases[1]

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This paper reports on three cases of an intradural lumbar disc herniation (IDLDH) that were diagnosed by a radiological examination. In all cases, an intradural vacuum (IDV) was detected on the CT scans, and the IDLDH showed iso- or lower signal intensity on the T2-weighted images. Enhanced MRI of one case revealed a small amount of air, but this was without enhancement. All the cases showed definite IDV on the CT scans, and this was an important clue for diagnosing IDLDH.

Index words : Intradural disc herniation
Dural vacuum
Spine

Intradural disc herniation is a very rare condition with an incidence that ranges from 0.26% to 0.30% of all herniated discs (1). Myelography, computed tomography (CT) and magnetic resonance imaging (MRI) are generally used to diagnose intradural lumbar disc herniation (IDLDH), but there can be some differences according to each case. Several studies have reported of a potential association between intradural disc herniation and gas within the spinal canal. However, to our knowledge, there are no reports of IDLDH together with intradural vacuum (IDV). This report presents three cases of IDLDH that were diagnosed by a radiological examination with a review of the relevant literature.

Case Reports

Case 1

A 54-year-old man with a 15-year history of chronic back pain was admitted with complains of severe back pain and right radiculopathy of a three-day duration. A physical examination showed no reflex in the right knee. The CT scan revealed a right paracentral soft tissue lesion that contained intradural gas at the L3 - 4 level (Fig. 1A). The sagittal T2-weighted image showed an intradural iso-intensity mass at the L3 - 4 level with a peripheral lower-intensity rim signal (Fig. 1B). The axial T2-weighted image demonstrated that the Rt. intradural herniated disc material contained gas that had passed through a Rt. posterior annular tear (Fig. 1C). The patient was preoperatively diagnosed with Rt. intradural herniated disc material that contained gas at the L3 - 4 level, and he underwent an open lumbar microdiscectomy. On the surgical field, the right L4 nerve root was severely compressed by the transligamentously-extruding disc, and there were dense adhesions between the PLL and the dura. A longitudinal incision was made in the dura mater and the intradural disc fragment was removed. He showed a marked improvement in his symptoms on the follow-up examinations.

Case 2

A 62-year-old female with a 10-year history of right buttock and leg pain was admitted to the hospital due to

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the sudden exacerbation of symptoms one month before her admission. The physical examination showed that both the ankle dorsiflexion and ankle plantar flexion were 4/4. The dorsiflexion strength of the great toes had decreased to 3/4 with a hallux flexion of 3/4 (Rt/Lt). In addition, her reflexes showed as 2+ at the knees, and 3+ and 2+ at the right and left ankle, respectively. The CT scan revealed a lesion of the left paracentral soft tissue with an encircling gas density (CT number; -250~ -350 HU) (Fig. 2A). The sagittal T2-weighted MR images showed a Lt. anterior iso- intensity lesion, as compared with the spinal cord, behind the posterior longitudinal ligament at the L4 - 5 disc level (Fig. 2C). She was preoperatively diagnosed with a left intradural disc herniation that contained gas, and she underwent an open lumbar microdiscectomy at the left L4 - 5 level. The dural opening was not found on the surgical field. However, the sequestrated disc material was removed after incising the dura. Postoperatively, the pain in her right buttock and leg were relieved.

Case 3

A 59-year-old female with 20-year history of lumbar discomfort complained of a one month duration of back

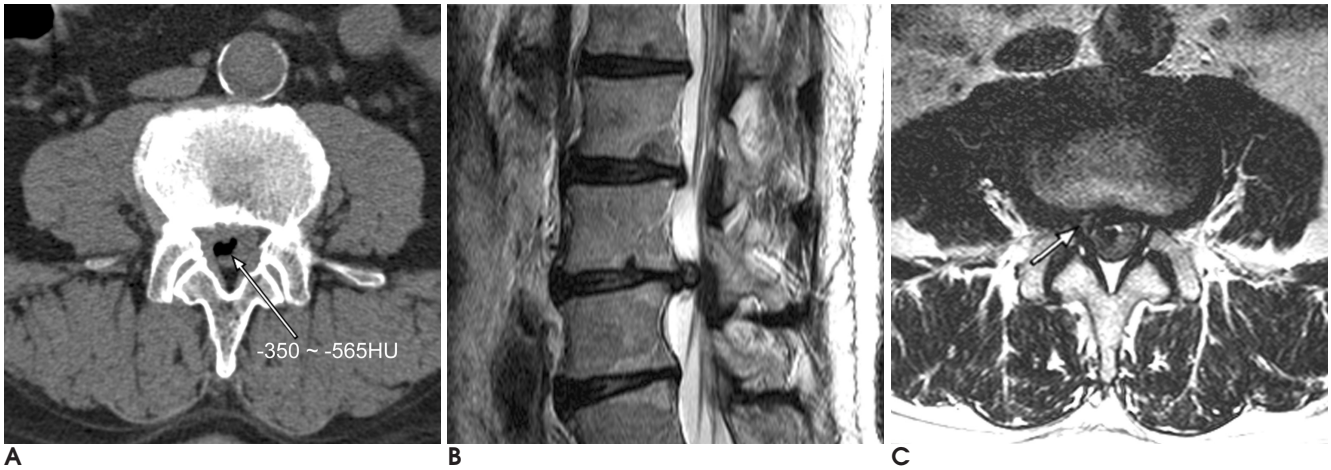

Fig. 1. L3-4 intradural disc herniation.
A. The CT image showed a Rt. anterior intradural mass-like lesion that contained gas (arrow, CT number; -350~ -565 HU).
B. The sagittal T2-weighted MR image demonstrated an isointense intradural lesion with a peripheral lower signal rim.
C. The axial T2-weighted image showed the Rt. intradural herniated disc material containing gas that had passed through the Rt. posterior annular tear (arrow).

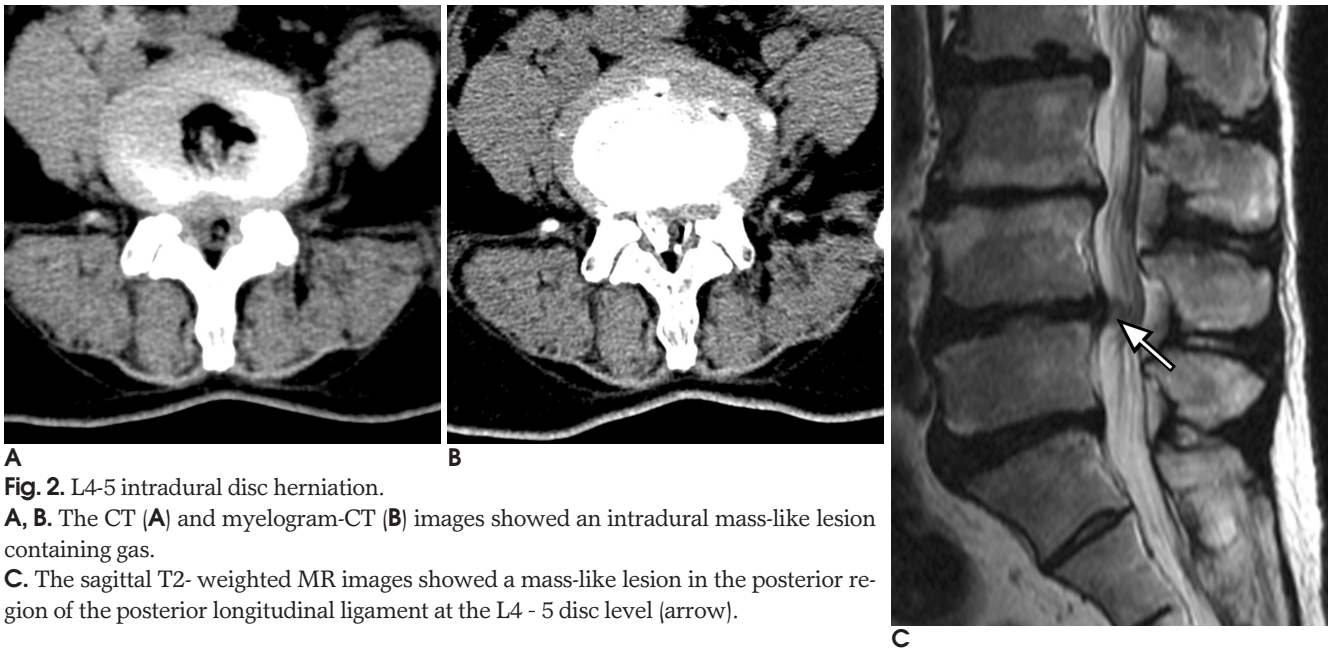

Fig. 2. L4-5 intradural disc herniation.
A, B. The CT (**A**) and myelogram-CT (**B**) images showed an intradural mass-like lesion containing gas.
C. The sagittal T2- weighted MR images showed a mass-like lesion in the posterior region of the posterior longitudinal ligament at the L4 - 5 disc level (arrow).

and posterior thigh pain (the pain on the right side was greater) in both legs. The neurological examination revealed weakness in her lower extremities and a decreased right ankle jerk. The CT scan demonstrated an intradural mass-like lesion surrounded by a small amount of gas (Fig. 3A). The T2-weighted sagittal MRI demonstrated an anterior intradural mass-like lesion at the L2 - 3 disc level with an iso- or slightly lower signal intensity, and this intensity appeared similar to that of the intervertebral disc (Fig. 3B). The post-contrast T1 sagittal and axial scans showed a peripherally enhanced transligamentous lesion, but there was no definitely enhanced intradural lesion at the L2 - 3 disc level (Fig. 3C, D). The preoperative diagnosis was a transligamentous disc herniation with an associated intradural disc herniation at the L2 - 3 level. Therefore, the patient underwent an open lumbar microdiscectomy at the L2 - 3 level. A small extradural disc herniation was revealed during surgery. The dural opening could not be found on the surgical field, but a disc rupture was observed after making an incision into the dura. The subsequent histopathological examination confirmed the diagnosis of a herniated nucleus pulposus. The patient totally recovered after surgery with no recurrence of her preoperative symptoms.

Discussion

Dandy first reported on IDLDH in 1942 (2). Kataoka et al. reported that intradural disc herniation are most commonly found in the lumbar area, and the incidence of this condition ranges from 0.04% to 0.33% in lumbar herniated disc patients (3). The authors experienced three cases of IDLDH out of 9285 lumbar spine disc herniations, which is a 0.032% incidence.

The pathogenesis of intradural disc herniation is unclear. However, several theories have been proposed (4).

1. There is adhesion formation between the dura and the posterior longitudinal ligament secondary to chronic inflammation, with the resulting spontaneous perforation, although not through propulsion

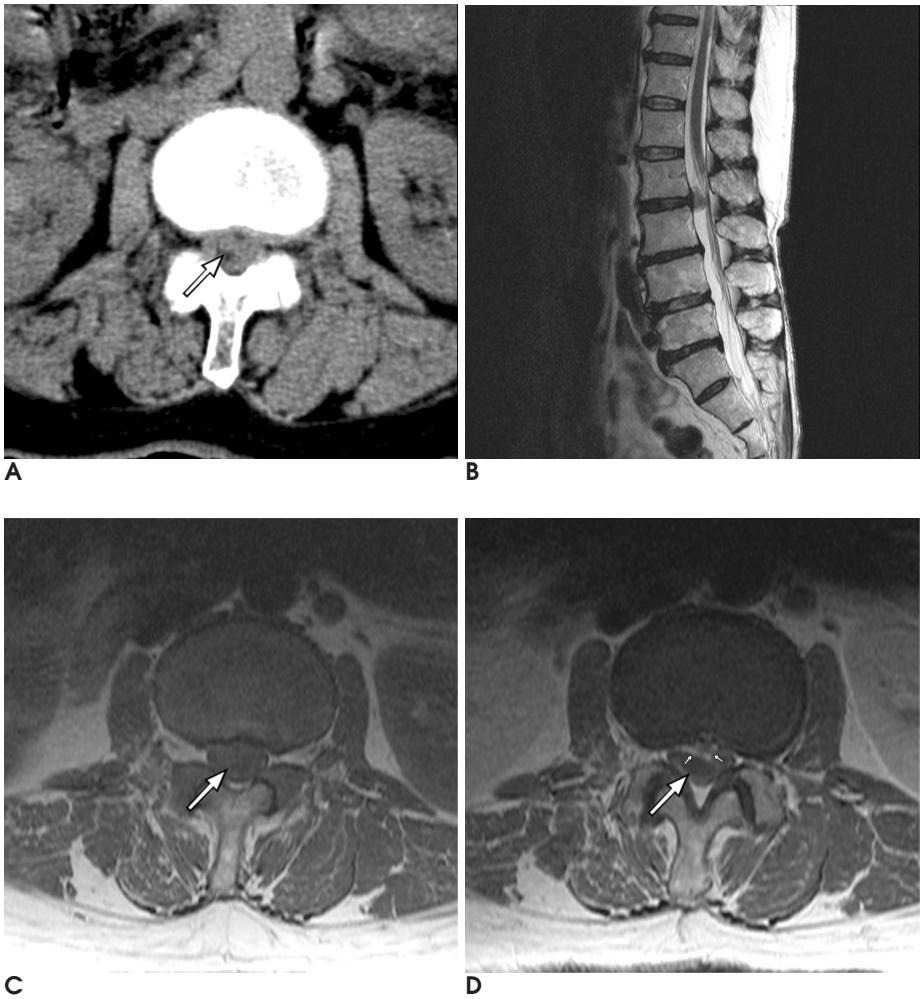

Fig. 3. L2 - 3 intradural disc herniation.
A. The CT image showed an intradural mass-like lesion (large arrow) surrounded by a subtle small amount of gas.
B. The T2-weighted sagittal MRI showed an anterior intradural mass-like lesion at the L2 - 3 disc level.
C, D. The T1-weighted axial image without contrast (**C**), and the post-contrast T1 axial image (**D**). The enhanced T1 axial image showed the marginated enhancing extradural lesion (small arrows), but not the enhanced intradural lesion (large arrow).

of the disc material.
2. There is a congenital union between the dura mater and the common posterior vertebral ligament.
3. There are secondary changes resulting from a previous surgery.

In our cases, the dense adhesions were prominent, but there was no dural opening found on the operative field. Our patients reported that there were no traumatic events or previous surgery. It is believed that the theory pertaining to the adhesions might have led to the IDLDH.

Our patients' clinical histories consisted of chronic low back pain, acute radicular pain and progressive neurological deficits. This type of lesion often presents with cauda equina syndrome, but the symptoms in our patients were not specific.

A diagnosis of intradural disc herniation is difficult, but it can be made by using several imaging techniques. The myelographic findings of intradural disc herniation are not specific. Myelography shows a complete block in approximately 65% of such cases. However, it is not always possible to determine the intra- or extradural origin (4). Hodge et al. reported that myelogram-CT effectively showed the presence of intradural disc material (5). Epstein et al. showed that a myelogram-CT study easily defined an irregular intradural mass that was consistent with a disc fragment, whereas the contrast-enhanced MRI could not readily distinguish a herniated disc fragment from a neurofibroma (6). Hidalgo et al. reported that 2 out of 118 intradural disc herniations contained air in the spinal canal. This percentage of 1.7% is six times higher than that of disc herniations without spinal gas (7). They proposed that the presence of air within the spinal canal and an intradural mass-like lesion on the CT scans and MRI, respectively, were almost certainly evidence of a herniation rather than a tumor. It is believed that the gas is trapped by the herniated disc material, and this might be an important indication of herniated disc fragments. A CT scan can identify gas inside the disc in up to 46% of patients (7). In most cases, the gas consists of nitrogen (90-92%) and carbon dioxide, and this gas can migrate to the spinal canal through ruptures in the annulus, together with the herniated fragments. In our study, CT revealed intradural gas in all three cases, which was the important clue for making a diagnosis of IDLDH.

It is generally easy to differentiate lumbar disc herniation from other conditions with using the current MRI techniques. Holtas et al. reported that the disc was directly connected to the intradural mass, and a diagnosis of an intradural disc herniation can be made from such a finding (8). Wasserstrom et al. reported on IDLDH with a ring enhancement pattern on a contrast MRI study (9). The ring enhancement pattern on the contrast T1-weighted image was attributed to the granulation tissue surrounding the lesion. Our third case showed a low air density lesion in the spinal canal. Therefore, a contrast MRI study was attempted so as to provide a more precise examination. This case had a transligamentous disc herniation with peripheral enhancement and a nonenhancing intradural lesion at the L2-3 disc level. The posterior enhancement of the transligamentous disc herniation might have been the result of the mechanical irritation from the chronic disc herniation against the ventral wall of the dura. Considering that the symptoms had been aggravated one month earlier, the nonenhancing intradural lesion was regarded as an unvascularized disc fragment rather than a tumor. Whittaker et al. reported the homogenous enhancement of the IDLDH in a 66-year-old-man (10). They suggested that the enhancement is likely to depend on the age of the intradural disc herniation. Our cases showed iso- or slightly lower signal intensity on the T1- and T2-weighted images. Almost all the intradural extramedullary tumors were hyperintense on the T2-weighted scan.

IDLDH should be treated by the prompt surgical removal of the ruptured disc fragment because the neurological prognosis is closely linked to the preoperative duration of the neurological symptoms. An IDLDH can often be overlooked during surgery, and this means that a second and possibly difficult surgical procedure will be needed.

In conclusion, our cases showed intradural gas trapped within the herniated disc material on the CT scan with an iso- or slightly lower-signal-intensity intradural lesion being noted on the T2WI. These manifestations might provide an important clue for making the correct preoperative diagnosis of IDLDH.

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경막내 가스를 동반한 요추의 경막내 추간판 탈출증: 증례 보고[1]

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정승은 · 이상호[2] · 김태홍[3] · 조병준

경막내 추간판 탈출증은 드문 질환으로 그 발생기전은 분명치 않다. 저자들은 3예의 요추의 경막내 추간판 탈출증을 경험하였고, 3예 모두 단층촬영에서 경막내 가스(Intra - Dural Vacuum, IDV)을 보였고, T2 강조 시상 자기공명영상에서 저신호강도를 보였다. 저자들은 이러한 영상 소견이 수술전 다른 질환과의 감별진단에 있어 중요한 단서가 될 것으로 생각되어 문헌 고찰과 함께 영상 소견을 보고하는 바이다.