Lateral disk herniation into the lumbar intervertebral foramen: differential diagnosis.

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Lateral Disk Herniation into the Lumbar Intervertebral Foramen: Differential Diagnosis

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Lateral disk herniation into the intervertebral foramen if not recognized may result in a negative surgical exploration. The condition is readily recognized by computed tomography (CT), which demonstrates a soft-tissue mass in the intervertebral foramen, focal protrusion of the posterolateral margin of the disk into the foramen, absence of dural sac deformity, and occasionally the presence of calcium or gas in the intervertebral foramen. The differential diagnosis includes metastatic neoplasm, primary neoplasm, and conjoined root sheath anomaly. Features that enable CT differentiation of these conditions from lateral disk herniation are described. Myelography is useful in the identification of a conjoined root sheath.

Lateral disk herniation into a lumbar intervertebral foramen is a pathologic entity that has been responsible for negative surgical exploration and negative radiologic investigations [1, 2]. The purpose of this communication is to describe the CT findings in this condition and the differential diagnostic features that distinguish it from other lesions in the lumbar intervertebral foramen.

Materials and Methods

Eighteen patients were evaluated. They fall into four groups:

Group 1 comprised nine patients with lateral disk rupture into a lumbar intervertebral foramen. In each case there were symptoms and/or signs of unilateral radiculopathy. All nine had surgery confirming the diagnosis. Compression of the nerve root by the disk herniation was verified in every case by surgery.

Group 2 comprised five patients with malignant neoplasm (metastatic carcinoma or lymphoma) involving the lumbar intervertebral foramen. In three cases the histologic diagnosis of the primary condition had been established before lumbar spinal involvement. In the other two cases, biopsy of the spinal lesion was performed.

Group 3 comprised two patients with primary schwannoma in the lumbar intervertebral foramen. In one case the tumor was histologically confirmed by surgery. The other case involved Recklinghausen disease with bilateral foraminal lesions presumed to be schwannomas.

Group 4 comprised two patients with conjoined root sheath anomaly, in each case verified by myelography.

All patients were examined with a Somatom 2 scanner using a zoom factor of 4.5, 460 mAs, and 125 kVp. The images were processed and displayed on a 256 × 256 matrix. Two patients were examined on a Somatom DR scanner with a display matrix of 512 × 512.

Results

Group 1: Lateral Disk Herniation into the Intervertebral Foramen

Eight of the nine patients in this group were examined by myelography as well as CT. The results are shown in table 1. In each case the lesion appeared as a soft-tissue mass in the foramen. A component of the lesion also protruded into the spinal canal in two cases. Only in these two cases was the dural sac deformed by the disk herniation. In two other patients in this group, the main bulk of the lesion appeared lateral to the intervertebral foramen (fig. 1A). Myelography was negative in three patients (fig. 1B), equivocal in one, and positive in four. Of these four cases, two patients with the large component in the bony spinal canal showed the typical myelographic manifestations of a large disk herniation. The other two showed asymmetric filling of the root sheath with apparent widening of the nerve root on the side of the lesion. One showed a minimal indentation on the lateral aspect of the contrast column.

The CT images were analyzed by measuring the density of the lesion in the foramen and comparing it with the density of the dural sac and the nucleus pulposus within the disk space. These measurements are included in table 1. In eight of the nine patients, the density of the mass in the intervertebral foramen was higher than that of the dural sac (figs. 1 and 2); in two of these, the density of the mass was higher than that of the nucleus pulposus in the disk space. In these two patients the herniated fragment appeared on the CT image to be partly calcified. The ninth patient showed low density similar to that of air (fig. 3) because of the presence of gas within the herniated fragment. In the other six cases, the density of the lesion, though higher than that of the dural sac, was lower than that of the nucleus pulposus.

Group 2: Malignant Neoplasm Involving the Lumbar Intervertebral Foramen

The five patients with metastatic neoplasm in the intervertebral foramen had the following histologic diagnoses: adenocarcinoma of unknown origin, metastatic renal cell carcinoma, metastatic breast carcinoma, metastatic adenocarcinoma, and Hodgkin disease. In each case, the soft-tissue mass in the intervertebral foramen diffusely infiltrated the paraspinal soft tissues, causing an increase in their width as compared with the uninvolved side (fig. 4). The CT presentation was easily distinguishable from that of lateral disk herniation. The density pattern, however, was somewhat similar in the two conditions (table 2). The density of the lesions was higher than that of the dural sac but lower than that of the nucleus

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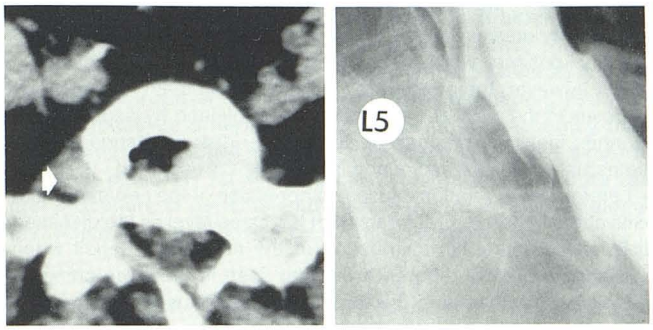
TABLE 1: **CT and Myelographic Findings in Group 1: Lateral Disk Herniation into the Intervertebral Foramen**

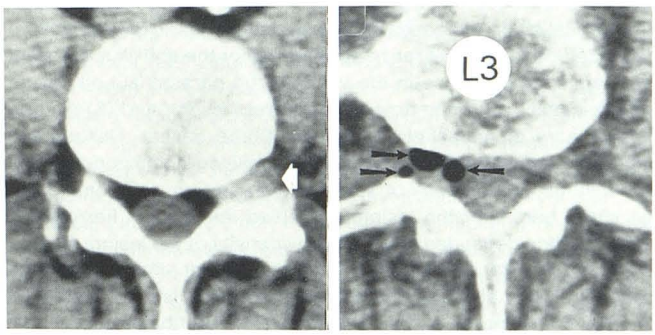
Level of Foramen: Case No. (age, gender)	CT Density (H)			CT Location of Lesion		Myelographic Findings	
	Dural Sac	Lesion	Nucleus Pulposus	Foramen	Spinal Canal	Nonfilling of Root Sheath	Extradural Defect
L3–L4:							
1 (47, F)	23	62	73	+	+	+	+
2 (60, M)	12	55	70	+	0	+*	+*
3 (79, M)	3	−800	−760	+	+	+	+
4 (56, M)	13	76	54	+	0	+	+
L4–L5:							
5 (57, M)	18	46	57	+	0	+	0
6 (63, M)	13	78	85	+	0	0	0
L5–S1:							
7 (65, F)	14	74	97	+	0	0	0
8 (34, M)	8	73	75	+	0	ND	ND
9 (29, M)	16	90	62	+	0	0	0

Note.—H = Hounsfield units; + = present; 0 = absent; ND = data unavailable (myelography not performed).
* This patient demonstrated bilateral nonfilling of the root sheath and a very small extradural defect.



A B

Fig. 1.—Group 1, case 9. Lateral disk herniation at L5–S1. **A**, CT scan. Main bulk of herniated material is lateral to foramen (*arrow*). Although gas may be present within intervertebral disk space as sign of disk degeneration, none was seen in this case. **B**, Myelogram. No sign of disk herniation.



2 3

Fig. 2.—Group 1, case 6. Lateral disk herniation in left intervertebral foramen at L4–L5 (*arrow*). CT density of disk fragment higher than that of dural sac.

Fig. 3.—Group 1, case 3. Gas in lateral disk herniation in right intervertebral foramen at L3–L4 (*arrows*).

pulposus. There was evidence of bone destruction of the adjacent pedicle and/or body of the vertebra in three of the five patients. Myelography was negative in the patient with Hodgkin disease. In two other patients, the appearance on myelography was indistinguishable from that of disk herniation.

The clinical presentation in the four patients with metastatic carcinoma was one of sciatica of short duration (3 weeks–3 months). The patient with Hodgkin disease had a clinical presentation suggesting myelitis, presumably viral in origin or resulting from steroid therapy; the lesion in the foramen was probably not related to the clinical presentation in this patient. The medical history before scanning was negative in two patients (metastatic adenocarcinoma and metastatic renal cell carcinoma) and the histologic diagnosis was established by biopsy after the radiologic examination for suspected sciatica demonstrated bone destruction.

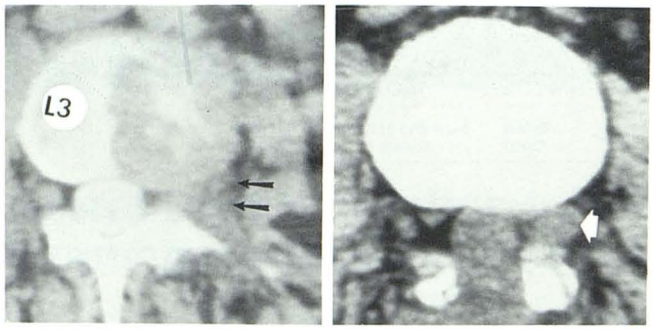
TABLE 2: **CT Density and Pathologic Findings in Groups 2–4**

Group No.: Case No. (age, gender)	Pathology	CT Density (H)		
		Dural Sac	Lesion	Nucleus Pulposus
2:				
1 (74, M)	Metastatic adenocarcinoma	16	26	44
2 (64, F)	Metastatic renal cell carcinoma	10	44	70
3 (39, F)	Metastatic breast carcinoma	25	55	75
4 (41, M)	Hodgkin lymphoma	24	39	66
5 (48, F)	Metastatic adenocarcinoma	...	55	82
3:				
1 (64, M)	Schwannoma	12	12	72
2 (13, M)	Neurofibromatosis	16	20	60
4:				
1 (26, M)	Conjoined root sheath	14	17	55
2 (44, M)	Conjoined root sheath	21	22	65

Note.—H = Hounsfield units.

Group 3: Primary Schwannoma in the Lumbar Intervertebral Foramen

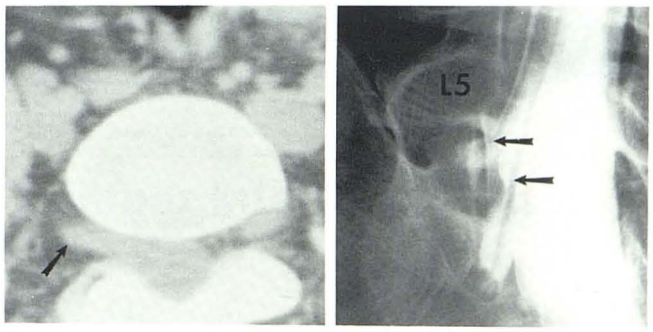
The two patients with schwannoma also presented with sciatica of recent onset. One patient had removal of an intradural tumor 1 month earlier. The other patient had had a diagnosis of neurofibromatosis 5 years earlier. The density of the lesion in both cases was very similar to that of the dural sac (table 2). In the patient with histologically confirmed schwannoma, marked contrast enhancement was seen after intravenous injection of iodinated contrast material. The lesion was unilateral in this case (fig. 5) and bilateral in the neurofibromatosis case. In both cases the lesion had a sharp



4 5

Fig. 4.—Group 2, case 5. Metastatic adenocarcinoma causing bone destruction of vertebral body of L3. Soft-tissue mass occupies left intervertebral foramen and infiltrates paravertebral soft tissue, which appears thicker than normal (*arrows*).

Fig. 5.—Group 3, case 1. Primary schwannoma in left intervertebral foramen (*arrow*).



A B

Fig. 6.—Group 4, case 1. Conjoined root sheath. **A**, CT scan. Anomaly of L5–S1 roots on right (*arrow*). **B**, Myelogram. Two roots (*arrows*) originate within same sheath.

border. However, intervertebral foramen was dilated because of bone erosion in the patient with neurofibromatosis. Myelography was not performed in these two patients.

Group 4: Conjoined Root Sheath Anomaly

The two patients in this group also presented with sciatica. The 26-year-old patient had sciatica on the side of the conjoined root sheath. The appearance on CT was therefore very suspicious (fig. 6A). The diagnosis was established by myelography (fig. 6B), which showed the classic appearance of a conjoined root sheath [3]. The density measurements were similar to that of the dural sac (table 2). The conjoined root sheath merged almost imperceptibly with the dural sac by gradual widening, encroaching on the surrounding epidural fat and presenting an asymmetric appearance contralaterally. The diagnosis was made on the basis of a reverse asymmetry at the level below, since the lower root sheath arose from the conjoined sheath and not from the dural sac itself.

Discussion

Lateral disk herniation, when limited to the intervertebral foramen, may cause no deformity of the dural sac. The myelogram therefore may be negative while the herniated fragment compresses the nerve root in the foramen, resulting in the clinical picture of radiculopathy. Awareness of this condition has led to surgical exploration in patients who had the typical signs of nerve root compression, even if myelograms were negative. But because a herniated fragment might lie far lateral in the intervertebral foramen or actually lateral to the foramen, initial surgical exploration may also be negative [1].

Of our eight patients in whom the lateral disk herniation was not associated with a medial component in the bony spinal canal, myelography was performed in seven; results were negative in three and equivocal in one. This should not be surprising in view of the explanation given above. The diagnosis of lateral disk herniation in the intervertebral foramen can be made readily with CT, however, if one is aware of the CT manifestations of this condition. The lesion causes a soft-tissue mass that displaces the fat from the intervertebral foramen. While indistinct from the nerve ganglion, the lesion is larger and higher in density. In two or our patients, the main bulk of the lesion was virtually lateral to the foramen (fig. 1A). Because of its demonstration by CT, particular effort was made at surgery to explore for the lesion in its lateral location.

Another manifestation of this lesion is focal protrusion of the posterolateral border of the intervertebral disk into the lower part of the intervertebral foramen. When the lesion is limited to the foramen with no medial component, the dural sac is not deformed. Finally, the presence of calcium or gas in the foramen (fig. 3) may be a clue to the presence of a lesion.

Our findings are similar to those reported by Williams et al. [2]. The density measurements of the herniated fragments in eight of our nine patients were higher than that of the dural sac. In six cases, however, the density was still lower than that of the nucleus pulposus in the disk space. This can be explained by degenerative changes that may precede or accompany disk herniation and by the partial-volume phenomenon inherent in CT scanning.

Lateral disk herniation causes compression of the nerve root that exits at the intervertebral foramen of the same level as the diseased disk. The topographic distribution of the neurologic deficit when present is therefore different from that seen in the more common disk herniation medial to the foramen, which causes compression of the nerve root that exits in the foramen below the level of the diseased disk. Awareness of this difference helps to explain apparent discrepancies between the spinal level of the clinical signs and the level of the diseased disk.

The differential diagnosis of lateral disk herniation in our series included metastatic tumor, primary schwannoma, and conjoined root sheath. These conditions could be differentiated from lateral disk herniation. In our cases of metastatic neoplasm, differentiation depended on (1) an infiltrative appearance of the soft-tissue lesion that caused an increase in the width of the paraspinal soft tissue (all five cases); (2) bone destruction (three cases); and (3) history of a primary or metastatic carcinoma (three cases). Neither the density pattern of the lesion on CT nor its myelographic appearance was helpful. In the cases of schwannoma and neurofibromatosis, the sharp border of the lesion resembled lateral disk herniation. Differentiation depended on (1) the low density of the lesion, similar to that of the dural sac; (2) contrast enhancement after intravenous injection of iodinated contrast material; and (3) history of removal of a neurofibroma or a clinical history of neurofibromatosis. The conjoined root sheath anomaly could be distinguished from lateral disk herniation by its low density and by the manner in which it joined the dural sac.

REFERENCES

1. McNab I. Negative disc exploration—an analysis of the cause of nerve root involvement in 68 patients. *J Bone & Joint Surg [Am]* **1971**;53:891–903
2. Williams AL, Haughton VM, Daniels DL, Thornton RS. CT recognition of lateral lumbar disk herniation. *AJNR* **1982**;3:211–213, *AJR* **1982**;139:345–347
3. Bernini PM, Wiesel SW, Rothman RH. Metrizamide myelography and the identification of anomalous lumbosacral nerve roots. *J Bone & Joint Surg [Am]* **1980**;62A:1203–1208