# CT/MR spectrum of far lateral and anterior lumbosacral disk herniations.

A G Osborn, R S Hood, R G Sherry, W R Smoker and H R Harnsberger

*AJNR Am J Neuroradiol* 1988, 9 (4) 775-778
http://www.ajnr.org/content/9/4/775

# CT/MR Spectrum of Far Lateral and Anterior Lumbosacral Disk Herniations

Anne G. Osborn[1]
Robert S. Hood
Richard G. Sherry[2]
Wendy R. K. Smoker
H. Ric Harnsberger

**Forty-eight patients had 50 extraforaminal disk herniations (EFDHs) demonstrated on CT and/or MR by (1) presence of disk density or disk signal material lateral to the neural foramen, (2) displacement or obliteration of paravertebral fat, and (3) nerve root or ganglion compression or displacement. Forty-one of 50 EFDHs had a coexisting intraforaminal component; nine of 50 had an isolated far lateral herniated nucleus pulposus. EFDHs typically occurred in the absence of a coexisting intraspinal disk herniation. Migratory fragments were seen in 50% of all cases and were at or cephalad to the interspace of origin in all cases. Forty-six percent of EFDHs were at L2–L3 or L3–L4, although the most commonly affected level was L4–L5 (38%). EFDHs, which were often overlooked (15/50 scans reviewed), are an important preventable cause of failed intraspinal diskectomy. EFDHs can be readily identified on both CT and MR if appropriate scans are obtained from L2 through S1 and if the neural foramina and paravertebral spaces are carefully examined.**

The CT and MR findings of intraspinal cervical and lumbar disk herniations have been well documented [1–4]. Lateral extrusion of disk material into a neural foramen is also a well-recognized phenomenon [5]. Only a few scattered cases of far lateral or true extraforaminal disk herniation (EFDH) and anterior disk herniation have been described in the radiologic literature [5–7]. These types of disk herniation are often overlooked on lumbosacral CT or MR studies, and their clinical significance is insufficiently appreciated. The radiographic findings in 50 cases of true lateral disk herniation are presented. The CT/MR imaging spectrum of EFDH is delineated, and common diagnostic pitfalls are discussed.

## Materials and Methods

Forty-two surgically documented and eight presumed (by radiographic findings and clinical course) cases of far lateral lumbosacral disk herniation (herniated nucleus pulposus [HNP]) occurred in 48 patients (two patients each had coexisting EFDHs at two separate interspaces). Cases were either referred to neurosurgery directly from a wide variety of institutions or were initially diagnosed in radiology and confirmed with the referring physician. Ages ranged from 18–80 years with an average of 54. Males exceeded females by a ratio of 3.5:1. Clinical history and presenting symptoms, CT and/or MR abnormalities, and surgical findings were noted in each case. Twelve of the patients had MR imaging; 46 of 50 had CT. Multiplanar 1.5-T MR scans were obtained on a GE Signa scanner with 5-in. surface coils using both T1- and T2-weighted sequences.

## Results

All patients had lateral herniation of disk density or disk signal material beyond the osseous confines of the neural foramina as demonstrated on CT or MR. Forty-one (82%) of 50 EFDHs had a coexisting foraminal component while nine (18%) of 50 had an isolated far lateral herniation without intraforaminal extension (Fig. 1).

Received June 29, 1987; accepted after revision January 1, 1988.

Presented at the annual meeting of the American Society of Neuroradiology, New York, May 1987.

[1] All authors: Department of Radiology and Division of Neurosurgery, University of Utah School of Medicine, 50 N. Medical Dr., Salt Lake City, UT 84132. Address reprint requests to A. G. Osborn.

[2] Department of Radiology, House of the Good Samaritan Hospital, Watertown, NY 13601.

*AJNR* **9:775–778, July/August 1988**
0195–6108/88/0904–0775

Only 13 (26%) of 50 had an associated intraspinal HNP; 14 (28%) of 50 had a minimal disk bulge; 24 (48%) of 50 had no intraspinal abnormalities at all. Nine of 50 cases had an associated anterior herniation (Fig. 2). Migratory fragments were identified in 25 (50%) of 50. In all cases migration was at or cephalad to the interspace of origin.

Six of 50 EFDHs occurred at the L2–L3 level, 17 at L3–L4, 19 at L4–L5, and eight at L5–S1. Lateralization was almost evenly divided between right (24/50) and left (26/50) sides.

The presence of EFDH was initially overlooked in 15 cases; in one instance (Fig. 3), four CT scans and three intraspinal operations were performed before far lateral disk herniation was recognized and corrected. Forty-two EFDHs were removed, with postoperative relief of symptoms in 40 of these cases. The remaining six patients either improved spontaneously (two cases) or were lost to follow-up (four cases).

EFDHs were demonstrated equally well on CT and MR in all cases in which both methods were used.

### Discussion

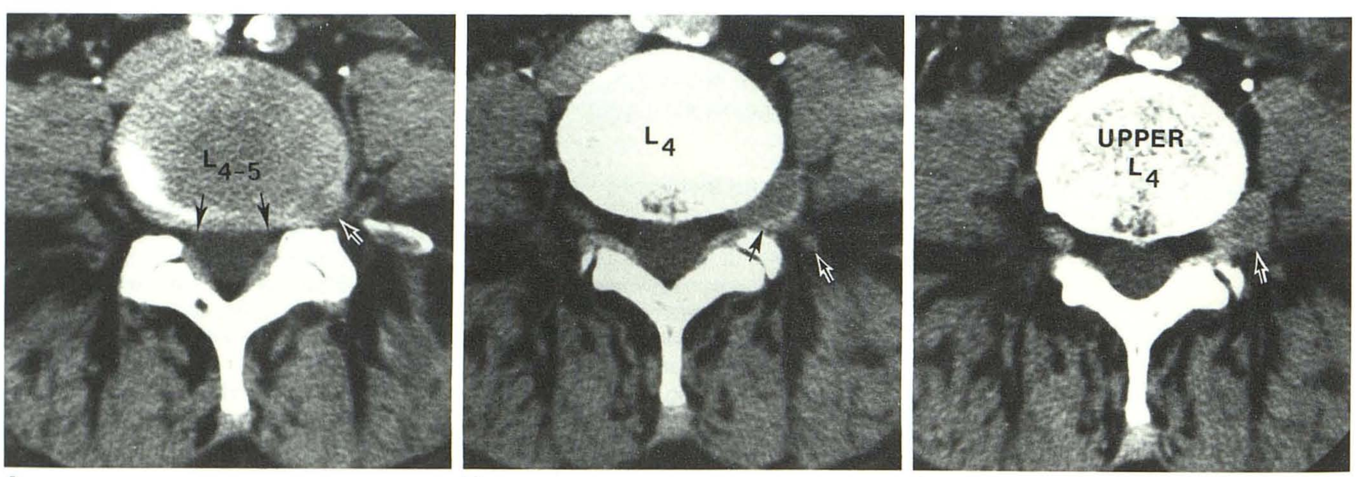
Nucleus pulposus bulge or herniation may occur circumferentially or focally in any direction. Because the anulus fibrosus is thinnest posteriorly, posterior rupture with central or central-lateral intraspinal extrusion of nuclear material is by far the most common occurrence. True lateral and extraforaminal disk herniations have been estimated as constituting from 1–11% of all lumbosacral HNPs [5, 8–10]. Anterior intervertebral disk herniations are even less commonly reported [7].

Lateral disk herniations with root compression outside the neural foramen are usually undetected at myelography and are frequently overlooked even on high-resolution CT and surface-coil MR studies of the lumbosacral spine. Nearly one-third of our cases had an initial misdiagnosis. Failure to identify extruded fragments beyond the confines of the spinal canal and neural foramen may result in inappropriate surgical approach and poor postoperative results. Several of our cases had one or more explorations for persisting root compression before the presence of EFDH was identified and subsequently removed via an extralaminar approach (Fig. 3).

The CT and MR findings of EFDH in our series included (1) presence of disk density (Fig. 1) or disk attenuation (Fig. 4) material lateral to the neural foramen alone or in contiguity with the intervertebral disk margin; (2) displacement or obliteration of paraspinal fat (Figs. 4 and 5); and (3) compression or displacement of the adjacent ganglion or nerve root (Fig. 4A). Because the pedicle forms an anatomic barrier inferiorly just below each interspace, cephalad migration of disk fragments was common (Figs. 1 and 3) and was seen in half the cases. Lateral or anterior disk herniation in the absence of intraspinal disk herniation was also relatively common. While isolated anterior disk herniations can occur, they are usually asymptomatic. All nine of our cases had coexisting lateral or posterior components (Fig. 2).

Clinical presentation of EFDH varies somewhat from its typical intraspinal counterpart [8, 9]. Patients with EFDH tend to be male (3.5:1), older (average age, 54), and often have a history of undiagnosed or inadequately treated lumbosacral root compression. Because far lateral disk herniations are located above the pedicle and often migrate cephalad, root irritation is typically of the segment above each interspace (not below, as with intraspinal HNPs). Nearly half our cases occurred at L2–L3 or L3–L4, while approximately 90% of classic lumbosacral intraspinal HNPs are found at the L4–L5 or L5–S1 levels.

Pitfalls in the diagnosis of far lateral herniation include both




A B C

**Fig. 1.—54-year-old man with left hip and knee pain.**

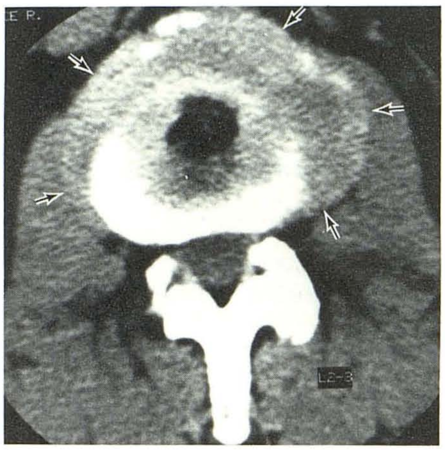
***A***, **Axial CT scan through L4–L5 disk space shows only minimal flattening of posterior disk margin (*black arrows*) without intraspinal abnormality. Left lateral aspect of disk appears slightly irregular and indistinct (*outlined arrow*).**

***B***, **Scan 6 mm above *A* shows left paraspinal extraforaminal disk density material (*black arrow*) displacing the adjacent ganglion and nerve root posterolaterally (*outlined arrow*) compared with the opposite, normal side. Note completely normal-appearing epidural fat within neural foramen.**

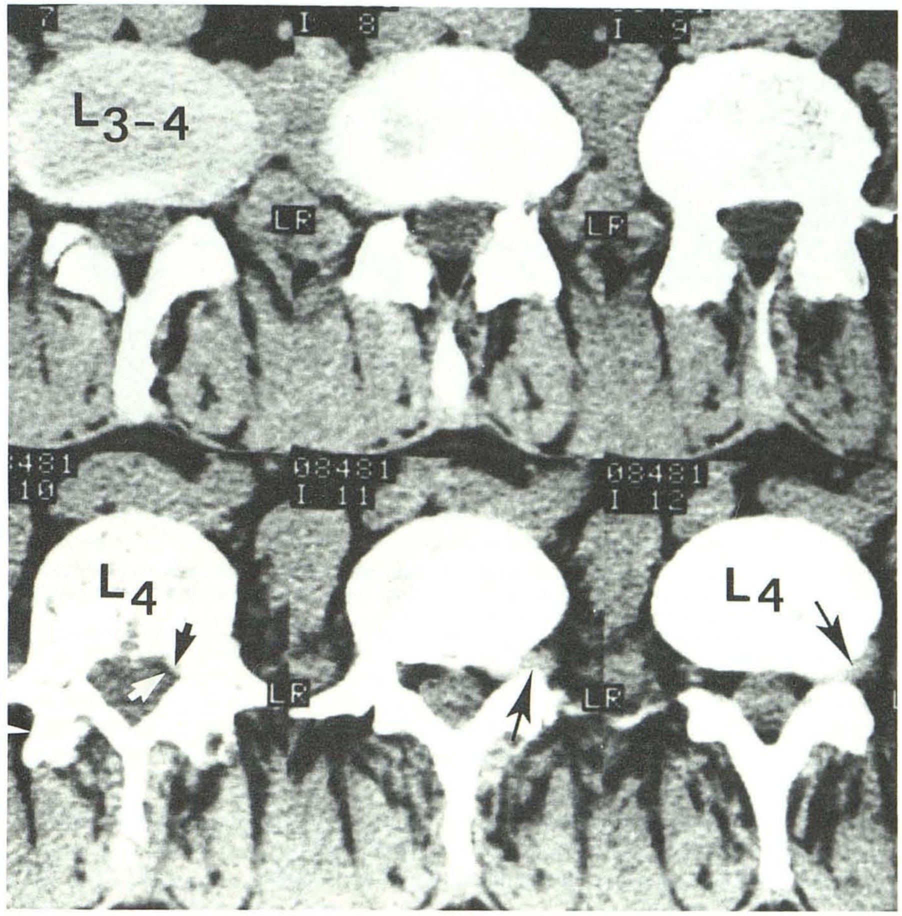
***C***, **Scan through upper L4 vertebral body shows large cephalad extruded disk fragment (*arrow*). Extraforaminal diskectomy disclosed far lateral disk herniation with cephalad migratory fragments.**

Fig. 2.—60-year-old man with multiple hospitalizations for chronic low back and right lower extremity pain and absent ankle jerk. Motor strength was normal. Axial CT scan through L2–L3 shows very large far lateral and anterior disk herniation (*arrows*) without intraspinal abnormality.

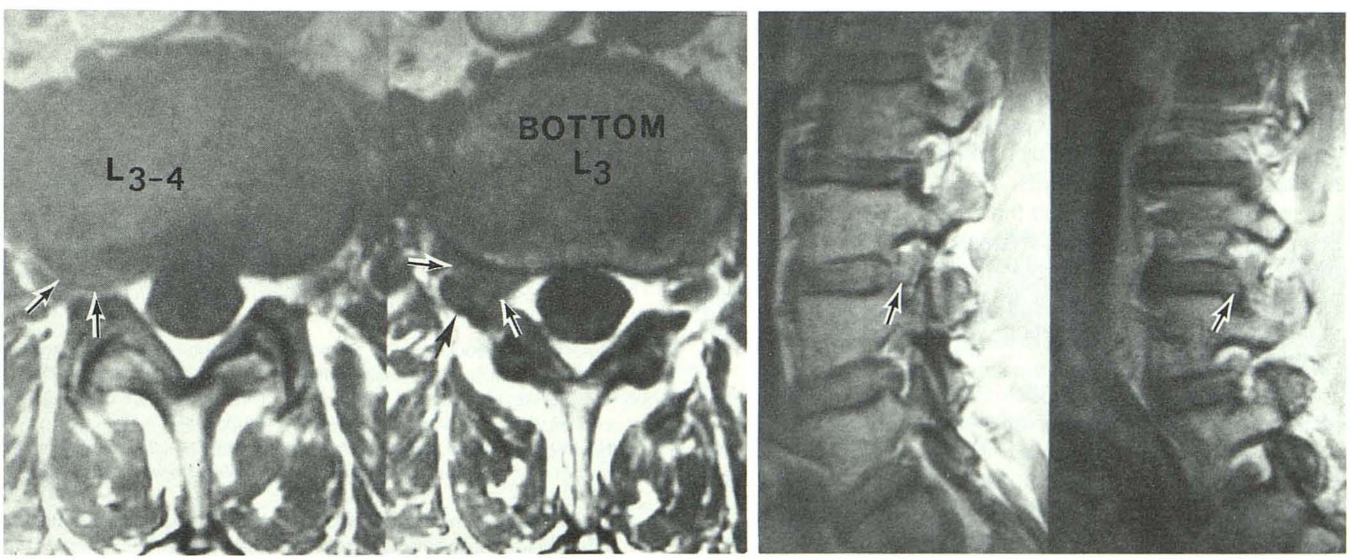
Fig. 3.—57-year-old man who had three previous intraspinal decompressive procedures at L4–L5. Persisting left thigh, hip, and groin pain prompted review of his outside studies. The initial and three subsequent postoperative CT scans all showed foraminal and far lateral disk fragments (*large arrows*) that had been completely overlooked. Note virtually normal intraspinal structures with only minimal medial protrusion (*small arrows*) of disk fragment. Extralaminar removal of foraminal and far lateral herniated disk completely relieved symptoms.



2




3




A B

Fig. 4.—54-year-old man with right thigh pain.

*A*, Axial T1-weighted 1.5-T MR scan through L3–L4 shows disk signal material (*outlined arrows*) obliterating fat within and lateral to the right neural foramen. Note posterolateral displacement of adjacent ganglion (*black arrow*) compared with the opposite, normal side.

*B*, Sagittal proton-density scan nicely shows extruded disk material within neural foramen (*arrows*). Foraminal disk herniation is also present at L4–L5. Surgery confirmed radiologic findings.

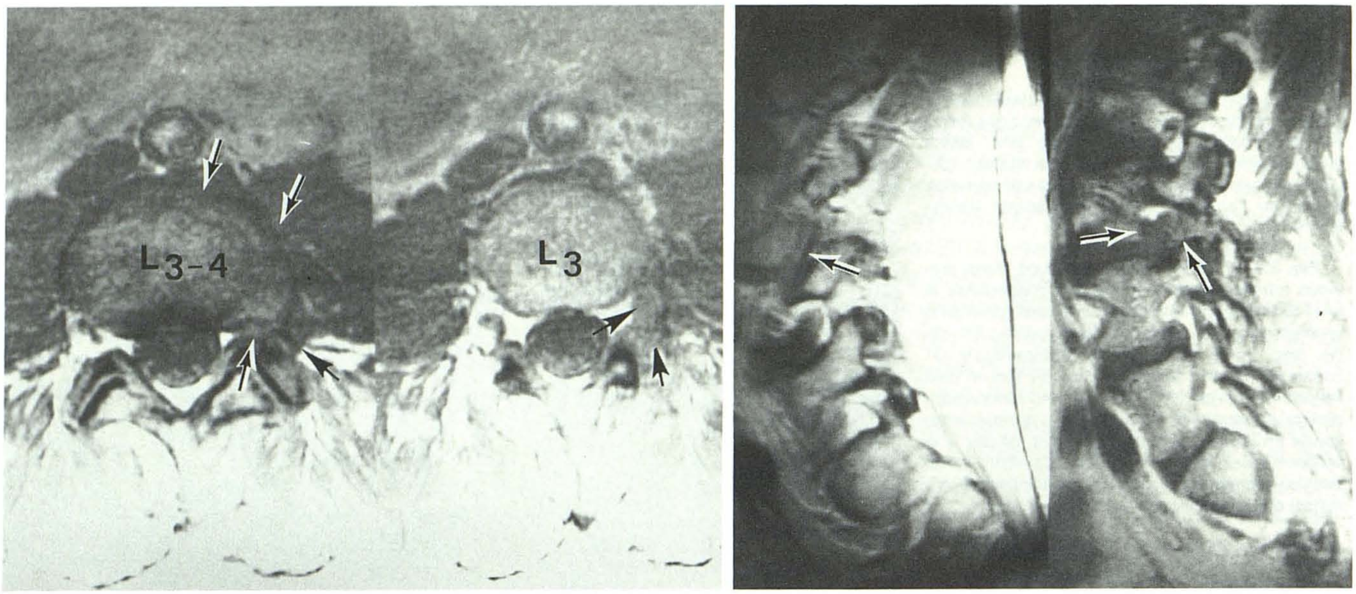



**Fig. 5.—57-year-old man with left anterior leg pain persisting after intraspinal diskectomy.**
***A***, **Axial T1-weighted MR scan shows far left lateral and anterior disk herniation (*outlined arrows*), with lateral and cephalad extension of disk fragments (*black arrows*). Note absence of intracanalicular component.**
***B***, **Sagittal proton-density scan shows disk material within neural foramen and in paraspinal fat (*arrows*). Repeat diskectomy using an extralaminar approach resulted in complete relief of symptoms.**

failure to identify disk material outside the confines of the spinal canal and failure to identify cephalad migratory fragments. Disk bulge with scoliosis can also mimic EFDH. In such cases the disk may appear asymmetric on any given single axial section but the margins are smooth without focal protrusions; symmetric contralateral disk bulge can be identified on adjacent sections.

The differential diagnosis of lateral disk herniation includes enlarged nerve root sleeves (conjoined roots, arachnoid diverticuli, or perineural cysts), neurofibroma, other epidural or extraspinal tumors (primary or metastatic), vertebral osteophytes, and prominent epidural or paraspinal venous plexuses. In most cases, the attenuation of disk material is higher than other soft tissues, and a focal protrusion contiguous with the intervertebral disk can usually be identified. Osteophytes are readily identified by using bone windows on CT or by their signal absence on MR.

Our experience with MR in these cases is relatively limited but suggests that signal differentiation between EFDHs and their mimics may be possible by using both T1- and T2-weighted scans. The sagittal projection is particularly helpful in identifying anterior herniation, while axial scans are most useful for lateral protrusions.

Although some authors have recently advocated the use of CT diskography for the definitive diagnosis of extreme lateral lumbar disk herniations [10], we believe both MR and CT provide highly accurate, noninvasive methods for delineating this clinically important entity.

## Conclusions

1. True far lateral or extraforaminal disk herniations (EFDHs) are often overlooked.
2. The typical patient is a middle-aged male who often has a history of failed intraspinal diskectomy.
3. EFDHs often occur at L2–L3 or L3–L4.
4. EFDHs usually occur without associated intraspinal HNP, although 82% have a coexisting intraforaminal component.
5. Paravertebral, cephalad migratory fragments are common.
6. EFDHs can be readily identified on both CT and MR if appropriate scans are performed from L2 through S1 and if the neural foramina and paravertebral spaces are carefully examined.
7. Since the surgical approach for EFDH is extralaminar, accurate radiologic diagnosis is essential for appropriate treatment.

## REFERENCES


1. Williams AL, Haughton VM, Synertsen A. Computed tomography in the diagnosis of herniated nucleus pulposus. *Radiology* **1980**;135:295–299
2. Chafetz NI, Genant HK, Moon KL, Helms CA, Morris JM. Recognition of lumbar disk herniation with NMR. *AJNR* **1984**;5:23–26
3. Maravilla KR, Lesh P, Weinrieb JK, Selby DK, Mooney V. Magnetic resonance imaging of the lumbar spine with CT correlation. *AJNR* **1985**;6:237–245
4. Edelman RR, Shoukimas GM, Stark DD, et al. High-resolution surface-coil imaging of lumbar disk disease. *AJNR* **1985**;6:479–485
5. Williams AL, Haughton VM, Daniels DL, Thornton RS. CT recognition of lateral lumbar disk herniation. *AJR* **1982**;139:345–347
6. Novetsky GJ, Berlin L, Epstein AJ, Lodo N, Miller SH. The extraforaminal herniated disk. Detection by computed tomography *AJNR* **1982**;3:653–655
7. Johansen JG. Demonstration of anterior intervertebral disc herniation by CT. *Neuroradiology* **1987**;29:214
8. Kurobane Y, Takahashi T, Tajima T, et al. Extraforaminal disc herniation. *Spine* **1986**;11:260–268
9. Abdulla AD, Ditto EW, Byrd EB, et al. Extreme lateral lumbar disc herniations: clinical syndrome and special problems of diagnosis. *J Neurosurg* **1974**;41:229–234
10. Brown LJ. Definitive diagnosis of extreme lateral lumbar disc herniation. *Surg Neurol* **1987**;27:373–376