Diagnosis and microsurgical approach to far-lateral disc herniation in the lumbar spine

JOSEPH C. MAROON, M.D., THOMAS A. KOPITNIK, M.D., LARRY A. SCHULHOF, M.D., ADNAN ABLA, M.D., AND JAMES E. WIEBERGER, M.D.

Department of Neurosurgery, Allegheny General Hospital, Pittsburgh, Pennsylvania; Department of Neurosurgery, West Virginia University Medical Center, Morgantown, West Virginia; and Memorial Mission Hospital, Asheville, North Carolina

Lumbar-disc herniations that occur beneath or far lateral to the intervertebral facet joint are increasingly recognized as a cause of spinal nerve root compression syndromes at the upper lumbar levels. Failure to diagnose and precisely localize these herniations can lead to unsuccessful surgical exploration or exploration of the incorrect interspace. If these herniations are diagnosed, they often cannot be adequately exposed through the typical midline hemilaminectomy approach. Many authors have advocated a partial or complete unilateral facetectomy to expose these herniations, which can lead to vertebral instability or contribute to continued postoperative back pain.

The authors present a series of 25 patients who were diagnosed as having far lateral lumbar disc herniations and underwent paramedian microsurgical lumbar-disc excision. Twelve of these were at the L4–5 level, six at the L5–S1 level, and seven at the L3–4 level. In these cases, myelography is uniformly normal and high-quality magnetic resonance images may not be helpful. High-resolution computerized tomography (CT) appears to be the best study, but even this may be negative unless enhanced by performing CT-discography. Discography with enhanced CT is ideally suited to precisely diagnose and localize these far-lateral herniations. The paramedian muscle splitting microsurgical approach was found to be the most direct and favorable anatomical route to herniations lateral to the neural foramen. With this approach, there is no facet destruction and postoperative pain is minimal. Patients were typically discharged on the 3rd or 4th postoperative day. The clinical and radiographic characteristics of far-lateral lumbar-disc herniations are reviewed and the paramedian microsurgical approach is discussed.

KEY WORDS • intervertebral disc • lateral disc herniation • paramedian approach • discectomy • surgical approach

FAR-LATERAL lumbar-disc herniations beneath or lateral to the facet joint occur with a frequency between 2.6% and 11.7% of all lumbar-disc herniations. Abdullah, et al., reported the clinical characteristics which distinguish them from the typical herniations that occur medial to the facet. Upper lumbar root compression syndromes are four times more likely to be caused by far-lateral disc herniations than by herniation of discs above the L4–5 interspace, which have an average incidence of only 2.5%. Abdullah, et al., have described a paraspinal or lateral exposure which avoids medial facetectomy and possible spinal instability. We advocate a similar technique with emphasis on microsurgical anatomy in the intertransverse process region and precise preoperative localization of the disc herniation using high-resolution computerized tomography (CT), magnetic resonance (MR) imaging, or CT-enhanced discography.

Summary of Cases

Presentation and Diagnosis

In our series, 25 patients presented with far-lateral lumbar-disc herniations confirmed at surgery. Twelve herniations were present at the L4–5 interspace, six...
Paramedian approach to lateral microdiscectomy

patients presented with lateral L5–S1 herniations, and
seven patients had a lateral disc herniation at the L3–4
interspace. Nineteen patients (76%) had a positive Lasègue
sign and often presented with pain radiating into the
ipsilateral hip. Quadriceps weakness or atrophy was
present in 78% of patients with L3–4 herniations and
the patellar reflex was depressed or absent in all but one
patient with herniations at this level. Fifteen disc lesions
were on the left and 10 were on the right. The patients'
mean age at diagnosis was 55 years.

The diagnosis of far-lateral disc herniation was made
using high-resolution CT with and without intrathecal
contrast material, surface-coil MR imaging, or CT-
enhanced discography. The latter method was the most
reliable in confirming the diagnosis and in precisely
localizing the pathology (Fig. 1). All patients were op-
erated on using the paramedian muscle-splitting micro-
surgical approach described below. At surgery, 23 of
the patients (92%) were found to have a free fragment
compressing the affected nerve root, while three had
bulging discs and foraminal stenosis. The only complica-
tion was the development of burning dysesthesias in
the distribution of the regional dorsal root ganglion in
four patients, which persisted only briefly in the post-
operative period.

Operative Technique

Following induction of general endotracheal anes-
thesia, the patient is placed in the prone position on a
lumbar frame. The operative site is prepared in the
usual fashion. A paramedian skin incision, approxi-
mately 4 cm from the midline and 4 to 5 cm long, is
used for a direct paramedian muscle-splitting approach
to the far-lateral herniated disc (Fig. 2). The subcuta-
aneous tissue is dissected free from the underlying fascia
and the groove between the multifidus and longissimus
muscles is palpated (Fig. 3 left). A fascial incision is
made at this point and blunt dissection is used to
palpate and expose the lateral aspect of the zygapophy-
sial facet joint and the transverse process above and
below the disc level to be explored. One or two deep
Williams microdiscectomy retractors are used to main-
tain exposure. It is essential at this point to obtain a
radiograph with a probe in position to confirm the
correct interspace.

After x-ray confirmation, the operating microscope
is used to continue the exposure and dissection. The
attachment of the multifidus muscle to the mammillary
process of the facet is released and the intertransverse
muscle is identified and divided, thus exposing the
intertransverse fascia. The intertransverse fascia is di-
vided using microsurgical techniques. There is fre-
quently additional fat that must be dissected to identify
the radicular artery and vein, the nerve root, and the
dorsal root ganglion (Fig. 3 right). Often the exposure
is too far lateral and one must continue to work medi-
ally to expose the nerve root but care must be taken to
avoid traumatizing it or transmitting electrical energy
from the coagulation apparatus to the underlying root
and ganglion. Painful postoperative dysesthesias may
occur secondary to the trauma of dissection and/or
coagulation. This occurred in four of our patients, but
fortunately was transient.

The nerve root may be additionally vulnerable be-
because it may be splayed over the underlying herniation
which is usually medial and superior to the disc space.
Caudal migration is prevented by the pedicle in most
cases. With preoperative CT localization, disc fragments
are precisely located and removed using small pituitary
grasping instrumentation. Nerve root manipulation is
avoided with the aid of microsurgical techniques. Ad-
ditional medial exposure may be obtained by removing
the lateral margin of the facet joint with no compromise
of facet integrity. Once the fragment of disc is removed,
the disc space is palpated and additional disc material
is removed from the disc space with down-biting pitui-
tary rongeurs. Complete hemostasis is obtained and the
fascia, subcutaneous tissue, and skin are closed in layers
in the usual manner.
J. C. Maroon, et al.

FIG. 3. Artist's drawings showing the muscle groove with fascial incision (left) and the nerve root stretched over the underlying herniated disc fragment (right).

Discussion

The incidence of far-lateral lumbar-disc herniations is approximately 10% of all lumbar-disc herniations. Inability to recognize these lesions results in failure to diagnose disabling pain. The diagnosis of far-lateral disc herniations has remained elusive because of the atypical clinical presentation and the inconsistent radiographic findings with standard studies normally successful for medial herniations.

Clinical Findings

Diagnosis and treatment of these herniations is problematic in many respects. The clinical diagnosis relies on a high index of suspicion coupled with characteristic findings. The clinical presentation of patients with far-lateral disc herniations has subtleties which may distinguish these entities from medial herniations. Although any adult age group can be affected, most series describe a slightly older population than seen with central herniations, with average ages ranging from 44 to 57 years. These herniations produce pain and radicular symptoms but, unlike medially located fragments, lateral disc herniations compress the nerve root exiting at the same interspace, and produce upper lumbar root compression syndromes. Hip and leg pain are generally present, but groin and anterior thigh pain may dominate the clinical picture and are often reproduced by lateral bending. Severe radicular symptoms more intense than typically seen with central herniations may occur because of direct compression of the posterior spinal root ganglion. This is in contrast to medial disc herniations, which usually compress nerve roots exiting at the next lowest interspace. Laségue sign is negative in many series, although herniations at lower levels may produce a positive straight-leg raising sign. This is likely due to increased movement of the nerve roots at the lower lumbar levels. The most common findings are quadriceps weakness, decreased patellar reflex, and decreased sensation in the L-4 dermatome, since the most common level for these herniations is the L4-5 disc space (Table 1).

Radiographic Studies

Radiographic diagnosis of lateral lumbar-disc herniations has been shown to be unreliable when using typical studies. Herniations outside the neural foramen are usually not detected at myelography and are often overlooked with high-resolution CT or surface-coil MR imaging. Osborn, et al., found that one-third of far-lateral herniations have an initial misdiagnosis. High-resolution CT studies of lateral, foraminal, or extraforaminal herniation is dependent on differential densities of the disc material, nerve roots, epidural fat, and the thecal sac. When the disc is isodense, it is difficult to demonstrate with CT. Jackson and Glah studied a series of patients with foraminal or extraforaminal lumbar disc herniations using metrizamide myelography, CT, discography, and CT-enhanced dis-
Paramedian approach to lateral microdiscectomy

TABLE 1

<table>
<thead>
<tr>
<th>Authors &amp; Year</th>
<th>L1-2</th>
<th>L2-3</th>
<th>L3-4</th>
<th>L4-5</th>
<th>L5-S1</th>
<th>Total Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdullah, et al., 1974</td>
<td>1</td>
<td>11</td>
<td>35</td>
<td>82</td>
<td>9</td>
<td>138</td>
</tr>
<tr>
<td>Nelson &amp; Gold, 1983</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Godersky, et al., 1984</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Epstein, et al., 1986</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Kurobane, et al., 1986</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Jackson &amp; Glah, 1987</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>8</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Zindrick, et al., 1987</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>25</td>
<td>7</td>
<td>39</td>
</tr>
<tr>
<td>Osborn, et al., 1988</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>19</td>
<td>8</td>
<td>50</td>
</tr>
<tr>
<td>Maroon, et al., 1990</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>12</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td>totals</td>
<td>1</td>
<td>17</td>
<td>77</td>
<td>164</td>
<td>54</td>
<td>313</td>
</tr>
</tbody>
</table>

cography. Accurate diagnosis of lateral disc herniations was made with CT-enhanced discography in 94% of cases compared to 38% with discography alone, 50% with CT and/or myelographically enhanced CT, and 13% with myelography alone. Myelographically enhanced CT showed no lesions that were not readily apparent on plain CT; however, discographically enhanced CT may greatly improve the diagnostic accuracy of CT in these cases.

The technique of discography was developed in the early 1940's by Lindblom and applied to CT scanning of the lumbar spine by Angtuaco, et al. This technique is especially helpful as a diagnostic adjunct when myelography is normal or nondiagnostic and/or the clinical picture is misleading. Although Angtuaco, et al., emphasized the lateral oblique approach to discography, Jackson and Glah found that the posterior midline approach is accomplished easily, with less pain, and less radiation to patient and physician. Water-soluble contrast agents such as Amipaque or Conray-60 are superior to oil-based Pantopaque because of the hydrophilic property of nuclear material and the ability of the fragments to rapidly absorb the contrast agents.

After this, CT can be used to precisely localize the enhanced disc material (Fig. 1 right). This procedure is extremely helpful in differentiating the potential lesions that can be seen lateral to the neural foramen from herniated disc material. This differential diagnosis includes conjoined nerve roots, enlarged ganglion, neurofibroma, primary schwannoma, and metastatic neoplasm, as well as herniated disc.

Surgical Approach

Presently, the most common surgical approach is via a midline hemilaminectomy exposure, often necessitating destruction of the ipsilateral facet joint. Instability following facetectomy has been reported to occur with alarming frequency during decompressive laminectomies and is a cause for concern during disc exploration. Several authors have advocated a lateral dissection along the facet through a midline incision, with partial lateral facet resection if necessary. This approach requires adequate lateral retraction to pass anteriorly over the facet joint. The need for this difficult lateral retraction is eliminated by using the paramedian muscle-splitting approach. With this technique, the dissection remains immediately lateral to the facet joint, and retraction is minimized. The spinal nerve and ganglion are directly beneath the intertransverse ligament, and microsurgical technique greatly aids in the dissection when opening the ligament and working near the nerve root. With this approach and microtechnique, there is minimal resection of bone and facet joint and little risk of injury to neural structures. Following removal of the herniated fragments, the disc space can be adequately cleared. This approach can easily be combined with the classic interlaminar exposure if more medial exploration is required.

We believe that microtechnique is essential in the region lateral to the facet joint to avoid manipulation and injury to the neural and vascular structures, especially the dorsal root ganglion. Thermal or mechanical injury to the ganglion may result in postoperative dysesthetic pain. This muscle-splitting approach is the most direct and favorable anatomical route to lumbar-disc herniations lateral to the neural foramen, and is greatly facilitated by the use of appropriate microsurgical techniques.

References


J. C. Maroon, et al.