The clinical syndrome of far-lateral (extraforaminal) lumbar disc herniation was initially described by Abdullah, et al.,1 in 1974. It is typified by radicular symptoms attributable to involvement of the rostral nerve root exiting at the adjacent neural foramen. Depending on the reported series, far-lateral herniations represent up to 11% of all lumbar herniated discs.1,2,22,24 Foraminal disc herniations are anatomically distinct from far-lateral lesions, yet they present with essentially the same clinical syndrome. In both lesions the posterior root ganglion is frequently involved, resulting in more severe and medically refractory pain syndromes than those usually seen in patients with more common paramedian, intracanalicular disc herniations.

Although awareness of this distinct clinical syndrome has increased substantially, debate continues over the optimum surgical treatment. Surgical access to these lesions can be technically demanding. Numerous approaches have been described. Midline approaches involving partial or complete facetectomy, or complete removal of the pars interarticularis have been described.2,7,8,11,13 However, because these approaches are often associated with substantial bone removal the risk of procedure-relat-

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Transforaminal percutaneous endoscopic discectomy in the treatment of far-lateral and foraminal lumbar disc herniations

SEAN M. LEW, M.D., THOMAS F. MEHALIC, M.D., AND KRISTIN L. FAGONE, R.N.
Division of Neurosurgery, University of Vermont, Burlington, Vermont; and Division of Neurosurgery, Maine Medical Center, Portland, Maine

Object. Far-lateral (extraforaminal) and foraminal disc herniations comprise up to 11% of all herniated intervertebral discs. Operative management can be technically difficult, and the optimum surgical treatment remains controversial. Accessing these lateral disc herniations endoscopically via a percutaneous transforaminal approach offers several theoretical advantages over the more traditional procedures. The object of this study was to assess the safety and efficacy of treating patients with far-lateral and foraminal disc herniations via a percutaneous transforaminal endoscopic approach.

Methods. A retrospective analysis was performed of 47 consecutive patients who underwent surgery via this approach. All procedures were performed after induction of a local anesthetic on an outpatient basis. Outcome was measured with Macnab criteria and by determining a patient’s return-to-work status. The median follow-up period was 18 months (range 4–51 months). Excellent or good outcome was obtained in 40 (85%) of 47 patients. Of the 38 patients working before the onset of symptoms, 34 (90%) returned to work. Five patients (11%) experienced poor outcomes and subsequently underwent open procedures at the same level. Of the 10 recipients of Workers’ Compensation, Macnab criteria indicated a significantly worse outcome (70% excellent or good), but an excellent return-to-work status was maintained (90%). There were no complications.

Conclusions. Transforaminal percutaneous endoscopic discectomy is safe and efficacious in the treatment of far-lateral and foraminal disc herniations.

KEY WORDS • endoscopy • discectomy • intervertebral disc herniation • lumbar spine
Endoscopic discectomy for lateral disc herniations

as that used for discography). In this study, we examine the
efficacy and safety of treating foraminal or extraforaminal
disc herniations in a series of patients in whom transforam-
inal percutaneous endoscopic lumbar discectomies were
performed.

Clinical Material and Methods

Patient Population

Between May 1995 and June 1999, 107 patients under-
went transforaminal percutaneous endoscopic lumbar dis-
cectomies performed by the senior author (T.F.M.). Forty-
seven of these patients were treated for far-lateral or
foraminal lumbar disc herniations. A retrospective analy-
sis of these cases provides the focus of this study. The
patients all met the following criteria: 1) unilateral, single-
level lumbar disc herniations lateral to the dura (foraminal
or extraforaminal) visualized on computerized tomogra-
phy and/or magnetic resonance imaging; 2) signs and
symptoms consistent with symptomatic involvement of
the nerve root exiting the adjacent neural foramen, includ-
ing radicular leg pain; 3) failure of appropriate conserva-
tive therapies; and 4) no history of lumbar surgery. Pa-
tients with L5–S1 herniations were excluded if it was
believed that the lesion was made inaccessible by a rela-
tively high riding iliac crest. Preoperative data including
age, sex, neurological signs, employment status, and ver-
tebreal levels of the herniation are summarized in Table 1.

Surgical Technique

The posterolateral approach involves accessing the tri-
gle working zone originally described by Kambin and
Gellman.16 This zone provides safe access to both the fora-
men and the intradiscal space. The zone is bounded su-
periorly and anteriorly by the nerve root, inferiorly by the
transverse process, and medially by the superior facet
(Fig. 1).

The procedure is performed in an operating suite after
the patient has received a local anesthetic. Intravenous
sedation is provided as an adjunct to minimize agitation
and discomfort while still allowing for continual feedback
from the patient regarding the radicular pain experienced
during the procedure. Feedback is believed to decrease
the likelihood that a neural element injury will occur.

The patient is positioned prone on a Wilson frame. Pre-
operative imaging studies, in addition to intraoperative
fluoroscopy, are conducted to ascertain the entry site, typi-
cally 8 to 12 cm off midline at the level of the pathologi-
cal disc. The AP angle of the disc space is visualized with
a lateral projection. The patient is then prepared and
sealed, and the C-arm fluoroscope is included within the
sterile field. The predetermined entry site is then infil-
trated with local anesthetic (procainamide 0.25% with
1:200,000 epinephrine). Under direct fluoroscopic visual-
ization, a 20-gauge spinal needle is used to infiltrate the
local anesthetic to the level of the facet root, anteriorly by the
nerve root, inferiorly by the transverse process, and medially by the superior facet
(Fig. 1).

Table 1

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. of Patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>male/female</td>
<td>2.9:1 (75/25)</td>
</tr>
<tr>
<td>employed prior to symptom onset</td>
<td>38 (81)</td>
</tr>
<tr>
<td>Workers’ Compensation recipients</td>
<td>10 (21)</td>
</tr>
<tr>
<td>motor deficit</td>
<td>10 (21)</td>
</tr>
<tr>
<td>sensory deficit</td>
<td>16 (34)</td>
</tr>
<tr>
<td>nerve root tension sign†</td>
<td>25 (53)</td>
</tr>
<tr>
<td>level</td>
<td></td>
</tr>
<tr>
<td>L1–2</td>
<td>2 (4)</td>
</tr>
<tr>
<td>L2–3</td>
<td>4 (9)</td>
</tr>
<tr>
<td>L3–4</td>
<td>19 (40)</td>
</tr>
<tr>
<td>L4–5</td>
<td>21 (45)</td>
</tr>
<tr>
<td>L5–S1</td>
<td>1 (2)</td>
</tr>
</tbody>
</table>

* The patients ranged in age from 30 to 70 years (mean age 50.5 ± 10.5[
standard deviation]).
† According to femoral stretch or straight leg raise test.

FIG. 1. Photograph of a model depicting the triangular working
zone, which is bounded superiorly and anteriorly by the nerve root,
inferiorly by the transverse process, and medially by the superior facet.
mated probe (3.5 or 4.7 mm in diameter [Surgical Dynamics]) is used for quick evacuation of the intradiscal space to create a central cavity.

A fiberoptic scope (30,000 pixel Working Channel Scope; Surgical Dynamics) is then introduced down the cannula through the neural foramen. Various manual instruments, including steerable probes, spatulas, flexible cup graspers, scissors, and hooks, are passed and utilized in the working channel to complete the discectomy and decompress the nerve root (Fig. 2). The automated probe is also needed to decompress the intradiscal space. In the final significant stage extradiscal dissection is performed in which the extruded disc material is removed and the exiting and traversing nerve roots are visualized. The photograph in Fig. 3 shows a disc fragment removed via the cannula. When all disc material has been removed, the scope is withdrawn and a sterile dressing is applied. Skin suturing is typically not required.

Outcome Evaluation

All patients underwent outpatient evaluation 3 to 6 weeks postoperatively. Thereafter, follow-up information was obtained by telephone interview or office visit, depending on the needs of the patient. Outcome was categorized using the Macnab criteria: excellent, no pain and no restriction of activity; good, occasional back or leg pain of sufficient severity to interfere with normal work or leisure; fair, handicapped by intermittent pain of sufficient severity to curtail work or leisure activities, but improved functional capacity; and poor, unimproved symptoms, insufficient improvement to allow increased activity, or requirement of reoperation at the same level. Data were collected by a registered nurse employed by the operating surgeon.

Results

On an outpatient basis, all procedures were completed using the aforementioned endoscopic technique. Operative time ranged from 60 to 120 minutes. All patients were discharged to home within 6 hours. There were no complications. The follow-up period ranged from 4 to 51 months, and the median period was 18 months.

Twenty-seven patients had excellent outcomes, 13 had good outcomes, two had fair outcomes, and five had poor outcomes, according to the Macnab criteria (Table 2). Forty of 47 patients had excellent or good outcomes, for an overall success rate of 85%. Of the 38 patients actively employed preoperatively, 34 (90%) returned to work postoperatively. In all five patients with poor outcomes persistent leg pain was present postoperatively, and they underwent subsequent laminectomy/laminotomy at the same level and on the same side.

Ten patients received Workers’ Compensation. When compared with the remaining patients, outcome in the for-
Endoscopic discectomy for lateral disc herniations

Discussion

The optimum treatment of patients with far-lateral (extraforaminal) and foraminal disc herniations remains controversial. Conventional open surgery involving both midline and paramedian approaches has been performed to treat these lesions. Midline approaches involving hemilaminectomy, often with facetectomy, offer the advantage of an approach familiar to all spine surgeons;1,2,8,11,13 however, there are numerous disadvantages. To obtain adequate exposure to extraforaminal herniations, extensive facet or pars interarticularis resection is often required, and the extent of bone resection may lead induce spinal instability. Midline techniques involving laminectomy also make the neural elements within the spinal canal vulnerable to possible injury despite pathological material that is essentially extracanalarical.

Paramedian muscle-splitting approaches are well described and provide excellent exposure for removing foraminal and extraforaminal lesions.4,9,21,26 Compared with midline approaches, a less extensive bone resection is required, thereby preserving motion segment stability. Disadvantages include an often deep and disorienting trajectory to the lesion, as well as diminished exposure when facet hypertrophy or more medial pathological material is present. Nevertheless, the paramedian approach remains an excellent option, although it is unfamiliar and not practiced by many spine surgeons.

Combined approaches involving dissection both medially and laterally to the neural foramen have also been reported.5,10,13 These approaches allow for better exposure and less extensive bone removal; however, these benefits are at the expense of extensive retraction and dissection of paraspinal musculature, as well as generally longer operative time.

Percutaneous techniques for treating far-lateral and foraminal disc herniations have been performed both with and without endoscopy. The reported results have been varied. Automated percutaneous lumbar discectomy appears to be most effective when used to treat contained disc herniations, which is often not the case with more laterally located lesions. Despite initial enthusiasm for this technique, the efficacy of automated percutaneous lumbar discectomy has been questioned.3,15 Percutaneous endoscopic discectomy has shown considerably more promise, as in our series. Early results obtained from series in which transforaminal endoscopic lumbar discectomy was performed are similarly encouraging.5,12,25

The success rate (good and excellent outcomes) in this study was 85%, and 90% of the patients returned to work. These results compare favorably with published outcomes for patients with foraminal and extraforaminal disc herniations treated with conventional surgical approaches.2,4,6,8,10,11,16,18,19,21,22 All of the procedures in this series were performed after application of a local anesthetic (combined with intravenous sedation), allowing us to discharge patients to home the same day in all cases. This result is in stark contrast to that for open approaches to far-lateral and foraminal disc herniations, which often require extensive muscle stripping and retraction. Reported median hospital stays for patients with far-lateral disc herniations treated with conventional open approaches range as high as 3 to 4 days.4,21

Workers’ Compensation recipients experienced significantly worse outcomes than the other patients in this study, with three of 10 patients having poor outcomes. This was not surprising, as it is well established that this subset of patients undergoing lumbar discectomy fares worse. In two recent studies in which the authors examined outcomes after conventional lumbar microdiscectomy, 29% of patients receiving Workers’ Compensation had successful outcomes as compared with 81% and 86% in those not receiving compensation.7,22 Nevertheless, despite the worse outcome amongst Workers’ compensation recipients in this study, a high return-to-work rate was maintained (90%).

Conclusions

In this study we have demonstrated the safety and efficacy of transforminal percutaneous endoscopic discectomy in the treatment of patients with far-lateral and foraminal disc herniations. There were no complications. Our success rate is comparable with that seen after conventional open surgical procedures. It may be performed on a purely outpatient basis. Furthermore, the basic procedure

<table>
<thead>
<tr>
<th>Chance</th>
<th>0.45</th>
<th>0.12</th>
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<tbody>
<tr>
<td>3 (30)</td>
<td>2 (5.4)</td>
<td>0.05</td>
</tr>
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</table>

TABLE 2
Outcome after endoscopic discectomy

<table>
<thead>
<tr>
<th>Macnab criteria</th>
<th>No. of Patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>excellent</td>
<td>27 (57)</td>
</tr>
<tr>
<td>good</td>
<td>13 (28)</td>
</tr>
<tr>
<td>fair</td>
<td>2 (4)</td>
</tr>
<tr>
<td>poor</td>
<td>5 (11)</td>
</tr>
<tr>
<td>returned to work*</td>
<td>34 (90)</td>
</tr>
</tbody>
</table>

* Thirty-eight were patients employed prior to symptom onset.

TABLE 3
Comparison of outcomes between those receiving and not receiving Workers’ Compensation

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Workers’ Compensation</th>
<th>Non-Workers’ Compensation</th>
<th>p Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>age</td>
<td>49.7 ± 9.8</td>
<td>50.7 ± 10.8</td>
<td>0.30</td>
</tr>
<tr>
<td>male/female</td>
<td>4:0:1</td>
<td>2:7:1</td>
<td>0.45</td>
</tr>
<tr>
<td>Macnab outcome criteria (%)</td>
<td>7 (70)</td>
<td>33 (89)</td>
<td>0.12</td>
</tr>
<tr>
<td>excellent</td>
<td>5 (50)</td>
<td>22 (60)</td>
<td>0.24</td>
</tr>
<tr>
<td>good</td>
<td>2 (20)</td>
<td>11 (30)</td>
<td>0.27</td>
</tr>
<tr>
<td>fair</td>
<td>0 (0)</td>
<td>2 (5.4)</td>
<td>0.62</td>
</tr>
<tr>
<td>poor</td>
<td>3 (30)</td>
<td>2 (5.4)</td>
<td>0.05</td>
</tr>
<tr>
<td>returned to work/</td>
<td>9 (90)</td>
<td>26 (95)</td>
<td>0.45</td>
</tr>
<tr>
<td>previously employed (%)</td>
<td>28</td>
<td>0.24</td>
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involves an approach familiar to those surgeons who perform lumbar discography. Based on these results, transforaminal percutaneous endoscopic discectomy should be viewed as a reasonable alternative to conventional therapies for the treatment of patients with far-lateral and foraminal lumbar disc herniations.

Disclosure

The authors have no financial interest in the endoscopic equipment used in this study, nor was funding provided by any commercial source.

References


S. M. Lew, T. F. Mehalic, and K. L. Fagone


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