A posterolateral microsurgical approach to extreme-lateral lumbar disc herniation

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Extreme-lateral lumbar disc herniations present a surgical challenge because the conventional posterior approach requires bone resection for complete visualization of the pathology. The authors have identified constant anatomical landmarks in cadaveric dissections that facilitate access to the intervertebral foramen when combined with a posterolateral approach, as described by Watkins, for lumbar spinal fusion. The authors describe a technique that allows rapid localization and safe excision of these extreme-lateral lumbar disc herniations without the need for bone resection.

KEY WORDS • lumbar disc herniation • extreme-lateral lumbar disc herniation • posterior primary ramus • posterolateral approach

Clinical Material and Methods

Anatomical Dissections

Bilateral dissections were performed on the lumbar spines of 10 cadavers, and particular note was made of the relationships between the neurovascular structures close to the pedicles and the intravertebral disc. Later surgical procedures entailed the same general approach as used for these dissections.

Illustrative Cases

Ten patients (nine males and one female) with extreme-lateral lumbar disc herniations identified at L1–2 (one patient), L2–3 (one patient), L3–4 (three patients), L4–5 (three patients), and L5–S1 (two patients) were operated on using this approach. The operating microscope was routinely used. All reported improvement; there were no complications, and no recurrent symptoms.

The patients were anesthetized and placed prone with hips flexed to 90°. The relevant spinal level was confirmed fluoroscopically. A vertical incision was made 10 cm from the midline through skin, fat, and then investing deep fascia (Fig. 2 center). Having palpated the transverse process with the index finger, surgical access was gained in a 30° line to the horizontal by longitudinally splitting fibers of the iliacostalis (Fig. 2 left and right). As the split muscle was separated by hand-held retraction, the taut neurovascular bands could be easily felt by the experienced surgeon’s finger obliquely crossing the vertical muscle fibers. Once palpated and before being over-stretched by retraction, the operating microscope was brought in and the neurovascular bundle was carefully followed ventromedially to the pedicle–transverse process junction. Careful dissection allowed this approach to be relatively avascular and to expose the detailed microanatomy of the area. The lateral neurovascular branches related to the disc level in question crossed the transverse
process of the caudal level and, as the exposure proceeded medially, the most medial branch around the facet was noted. Adjacent to the intravertebral foramen there was often a “plug” of fat, which when removed exposes the origin of the posterior primary ramus, the ganglion, and the ventral root (Fig. 2 left, Fig. 3 upper and lower). With a far-lateral disc, this portion of the nerve was displaced dorsally and laterally, often above the intertransverse fascia; great care was taken to avoid injuring this neural “knuckle.” Most of the far-lateral discs, in our experience, have been sequestered fragments. These fragments usually displaced the nerves as described and separated them from the associated intersegmental artery, which is cephalad. Careful microdissection of the tissue planes separated the neurovascular structures from the disc fragment and allowed its easy removal without resection of any bone. When there was a diffuse disc bulge, the annulus was incised and fine rongeurs were used to evacuate some of the nucleus. It is emphasized, however, that this approach was aimed primarily at decompression of the relevant root canal. More extensive surgery may require some pedicle and facet excision, which might lead to local instability.

After decompression of the nerve root, closure was simple: the split muscle came together and sutures were confined to the deep fascia and superficial layers. A vacuum drain was removed 12 hours after the procedure and the patient was mobilized. We have been impressed by how little postoperative discomfort occurs in comparison to a laminectomy at the same level; apart from the local ache, patients report an immediate cessation of root pain.

Results

Neuroanatomy

The dorsal root ganglion was found within the intervertebral foramen just medial to the lateral border of the pars interarticularis. The posterior primary ramus and the ventral nerve root separated immediately distal to the dorsal root ganglion. The ventral nerve root crossed the disc space obliquely in a caudal and ventral direction in proximity to the rostral aspect of the caudal pedicle. The posterior primary ramus coursed in a caudal and dorsal direction. Just before penetrating into the posterior compartment between the pars interarticularis and the intertransverse muscle and ligaments, the posterior primary ramus divided into a medial, lateral, and small muscular branch. Accompanied by a vascular bundle, the muscular branch entered the intermuscular plane between the multifidus and the longissimus. The medial branch was closely applied to the lateral aspect of the superior facet of the caudal vertebrae and most often entered the multifidus. The lateral branch crossed the transverse process of the next caudal vertebrae in the space between the intertransverse muscle and ligament ventrally and the longissimus and iliocostalis dorsally.

Vascular Anatomy

The segmental vessels were identified at the inferior edge of the rostral pedicle, lateral to the existing nerve root. These consistently divided into five easily identifi-
Extreme-lateral lumbar disc herniation more commonly occurs in the upper lumbar spine and in patients between 50 and 60 years of age. It often presents with anterior thigh and groin pain, quadriiceps weakness, and may be accompanied by a positive femoral stretch test. Curiously, there is often little back pain and the Lasègue’s sign is usually negative.

Perhaps the most unique symptomatology reported has been a unilateral paralysis of the transverse abdominal muscle secondary to, and L-2 nerve root compression caused by, an L2–3 lateral herniation.

When considering surgical alternatives, percutaneous techniques are not an option because extreme-lateral lumbar disc herniation often involves sequestered and migrated fragments. These fragments cannot be removed using percutaneous techniques, and they distort the neurovascular structures and place them at risk. An anterolateral approach has been advocated; however, we believe there are simpler solutions.

Mixter and Barr described disc excision via a posterior midline approach, and this remains the most popular approach for classic posterolateral disc herniations. When combined with a complete or partial facetectomy, this approach has been advocated by many authors for the treatment of extreme-lateral lumbar disc herniation. Advocates of this approach have denied a significant problem with postoperative spinal instability, although examples of spinal instability do exist.

Biomechanical studies by Haher and his colleagues suggest that significant acute instability should not be a problem with unilateral facet resection; however, the altered paths of loading that are created, when coupled with the increased forces experienced in the anterior and middle column, may precipitate early degeneration in adjacent discoligamentous structures. This may offer an explanation for the significant postoperative back pain experienced by some patients who have been treated with facetectomy.

To counter the need for extensive medial bone resection and possible facetectomy the paramedian muscle-splitting approach has been advocated by some. It takes advantage of the interfacial plane between the multifidus and longissimus. This provides direct access to the posterior osseous elements adjacent to the facet joints with less soft-tissue retraction laterally. Because it provides the same orientation for viewing the intervertebral foramen as the midline approach, however, it may also require significant bone resection to allow visualization of the pathology.

The midline and paramedian routes are advocated by many because of their supposed ease of approach and surgeons’ familiarity with that anatomy. However, they provide limited access to the intervertebral foramen and the lateral aspect of the vertebral bodies, and may require significant bone resection to visualize the pathology.
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in question. Various combinations of osteotomies and laminoplasties used in these two approaches have been detailed by Kunogi and Hasue.28

We advocate the more lateral approach, as described by Watkins,30,51 in conjunction with identification of the anatomical landmarks described here. Localization of the lateral branch of the posterior primary ramus and the terminal branch of the segmental artery facilitates a safe and rapid approach to the extreme-lateral lumbar disc herniation without bone resection. We find that this approach when combined with microsurgical techniques provides good visualization of the lateral spinal structures, intervertebral foramen, and its contents. In addition, the minimal soft-tissue and bone dissection associated with this approach facilitates rapid postoperative mobilization of the patient. Although this anatomy is less familiar to many spinal surgeons, we consider that it is well worth acquiring the relevant anatomical knowledge. We would recommend this approach as a safe and effective alternative to the midline approaches for the treatment of these unique disc herniations.

References

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