Spine

35 Diagnosis, Treatment, and Complications of Adult Lumbar Disk Herniation: Evidence-Based Data for the Healthcare Professional

36 Advances in the Understanding of Cervical Spine Deformity
Diagnosis, Treatment, and Complications of Adult Lumbar Disk Herniation: Evidence-Based Data for the Healthcare Professional

Eric Klineberg, MD
Alexander Ching, MD
Greg Mundis, MD
Douglas Burton, MD
Shay Bess, MD

Abstract

Lumbar disk herniation is a commonly seen disorder that requires care by spinal surgeons and healthcare professionals. Although there has been substantial research on the diagnosis, treatment, complications, and outcomes of lumbar disk herniation, patient management varies. A review and evaluation of the literature (with special regard for high-quality randomized studies) and familiarity with best practices guidelines for the evaluation, management, and treatment of adult lumbar disk herniation will enhance the optimal delivery of health care to affected patients.


Lumbar disk herniation (LDH) is one of the most common diagnoses seen in a clinical spinal practice.1 In his classic 1996 article, McCulloch2 reported that LDH is a disorder affecting approximately 1% of the general population, with 90% of patients improving with nonsurgical treatment. He reported that only 2% to 4% of patients with persistent pain are good surgical candidates, and up to 20% to 30% of patients with evidence of LDH on MRI or a CT myelogram are asymptomatic. McCulloch2 postulated that, although surgical intervention may improve short-term outcomes, surgical treatment is rarely indicated within 6 weeks of the onset of symptoms. He also reported that surgery may not improve long-term outcomes compared with nonsurgical management.

Since the publication of McCulloch’s article, there has been a large volume of
Herniation is defined as localized disk material that protrudes beyond the margins of the disk space (Table 1). It may be further classified as a protrusion with mild compression or as an extrusion when the amount of disk compression is larger in any dimension than the disk space itself. An extruded disk may become sequestered (lose continuity with the disk space). It also may be further defined as contained (if still covered by the anulus fibrosus) or uncontained (if not covered by the anulus fibrosus) (Figure 2). The clinical symptoms of LDH can vary, ranging from back to leg pain. Because the etiology of back pain is unclear, surgical treatment is challenging. In contrast, leg pain is caused by both mechanical and chemical nerve root irritation. When evaluating and treating these patients, the clinician is faced with a variety of conflicting evidence.

**Physical Examination**

Physical examination findings are effective in making the diagnosis of LDH, although the examination is not specific for the exact anatomic location. A proper evaluation should include a history of the illness, including the time of onset and exacerbating and alleviating factors. It also should focus on a patient’s prior history of back or leg pain, previous surgery, and prior interventions. Careful attention must be paid to any warning signs (such as constitutional symptoms, weight gain or loss, renal disease, and cancer) and severe neurologic symptoms (such as loss of bowel or bladder control and saddle anesthesia). A focused examination of the pelvis, back, and legs should be performed. The neurologic examination should evaluate strength, sensation, and reflexes, and it should be followed by

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**Table 1**

<table>
<thead>
<tr>
<th>Herniation Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>Localized disk material</td>
<td>Disk material that protrudes beyond the margins</td>
</tr>
<tr>
<td>Contained</td>
<td>Disk material still covered by the anulus fibrosus</td>
</tr>
<tr>
<td>Uncontained</td>
<td>Disk material not covered by the anulus fibrosus</td>
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**Figure 1** Illustrations showing the development of the intervertebral disk. A, Early development with the notochord and paraxial somites with sclerotome cells. B, Sclerotome cells migrate and condense around the notochord. C, The notochord contracts within the developing vertebral bodies and expands within the future nucleus pulposus. D, The mature intervertebral disk is formed and composed of the cartilage end plate (EP) and the lamellar structures of the anulus fibrosus. IAF = inner anulus fibrosus. NP = nucleus pulposus, OAF = outer anulus fibrosus; VB = vertebral body. (Reproduced with permission from Chan WC, Sze KL, Samartzis D, Leung VY, Chan D: Structure and biology of the intervertebral disk in health and disease. *Orthop Clin North Am* 2011;42[4]:447-464.)

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**Figure 2**

specific provocative tests in the lower extremities, with attention to the myotomal and dermatomal distributions.

Jensen\textsuperscript{10} evaluated 52 patients with surgically confirmed LDH. The author reported that the clinical examination had a positive predictive value of 50\% to 76\% for a sensory defect and 69\% to 76\% for a motor defect. Jensen\textsuperscript{10} concluded that an accurate examination could result in a correct diagnosis of LDH, but confirmation of the diagnosis with MRI would best determine the exact level of the disk herniation. Interestingly, the Lasègue root tension test, also known as the straight leg raise test, was positive in 94\% of the patients with LDH. Although this test was sensitive, it did not predict the exact anatomic level of the herniated disk.

Poiraudeau et al\textsuperscript{11} determined the sensitivity and specificity of several nerve root tension tests, including the Lasègue sign, the crossed Lasègue sign, the Bell test (having the patient stand and apply pressure at the L4-L5 or L5-S1 level induces radicular pain), and the hyperextension test (passive extension causes radicular pain). The authors reported a sensitivity of 0.77 to 0.83 for the Lasègue sign and the best specificity for the crossed Lasègue sign (0.74 to 0.89). The Bell and the hyperextension tests also produced similar measures of sensitivity and specificity. Rabin et al\textsuperscript{12} compared the sensitivity of seated versus supine straight leg raises (Figure 3) and found higher sensitivity if the examination was performed with the patient supine (0.67 versus 0.41; \(P < 0.05\)). These tests, along with the physical examination findings, are critically important in making the initial diagnosis of LDH. However, confirmation of the exact anatomic location of LDH requires additional noninvasive testing. The NASS consensus statement recommends that manual muscle testing, sensory testing, supine straight leg raises, the Lasègue sign, and the crossed Lasègue sign be used in diagnosing LDH with radiculopathy.

### Confirmatory Tests

Initial spinal imaging is not always required for patients with sciatica, with the exception of patients with “red flags” or acute, severe neurologic deficits. Radiography is appropriate for any patient who will be taken to the operating room to verify the herniation level or any patient with red flags, such as nocturnal pain, loss of height, or fever,

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Disk Herniation Classification System\textsuperscript{a}</th>
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<tr>
<td>Disk Herniation Type</td>
<td>Presence of Extruded or Subannular Fragments</td>
</tr>
<tr>
<td>Fragment fissure</td>
<td>Yes</td>
</tr>
<tr>
<td>Fragment defect</td>
<td>Yes</td>
</tr>
<tr>
<td>Fragment contained</td>
<td>Yes</td>
</tr>
<tr>
<td>No fragment contained</td>
<td>No</td>
</tr>
</tbody>
</table>

\textsuperscript{a}The disk herniation type is classified by the presence of subannular fragments, the annular integrity, and the resultant surgical management. (Reproduced with permission from Carragee EJ, Han MY, Suen PW, Kim D: Clinical outcomes after lumbar discectomy for sciatica: The effects of fragment type and anular competence. J Bone Joint Surg Am 2003;85[1]:102-108.)
or if stability is in question. If the symptoms of LDH have been present for 6 weeks and a diagnosis has been made using clinical findings, confirmation with a noninvasive test may be desirable. Jackson et al.\(^1\) compared MRI, myelography, and CT myelography to determine the sensitivity and specificity of each test. The authors found that MRI was the most accurate modality, with the highest specificity and the lowest false-positive rate (Figure 4). A CT myelogram also was helpful in confirming the diagnosis and had the greatest sensitivity. NASS made a grade A recommendation to use MRI when possible to diagnose LDH; a CT myelogram was recommended if MRI was not available or was contraindicated.\(^3\)

Electromyography is another option to help a physician with diagnosis and localization of the level of neural compression caused by LDH. Electromyography can determine the severity of nerve compression and injury but is unable to determine the difference between LDH and other causes of nerve root compression.\(^15\) Electromyography may be helpful in determining the influence of other confounding conditions, including diabetic peripheral neuropathy, compressive peripheral neuropathy, and chronic neural injury.\(^15\)

Although somatosensory-evoked potentials can determine neural compression, they are not specific regarding the level of root compression or the final diagnosis of LDH. Other noninvasive tests are available, including thermal qualitative sensory testing. Samuelsson and Lundin\(^16\) examined this new technology, which determines the difference in the thermal threshold between different dermatomes. Unfortunately, a poor correlation was found between thermal testing results and the ability to determine the level of a LDH. There is insufficient evidence to recommend for or against this modality to determine the dermatomal distribution of LDH and confirm its anatomic location.

### Nonsurgical Treatment

Nonsurgical management remains the foundation of initial treatment of most adult patients with LDH, with the exception of patients with a progressive neurologic deficit and/or patients with cauda equina syndrome.\(^7\) Weber\(^18\) prospectively randomized 126 adult patients with LDH to either surgical or nonsurgical treatment. Two-thirds of the nonsurgical patients reported good to fair outcomes at 1-, 4-, and 10-year follow-ups. Subsequent prospective studies have shown up to 96% good to excellent results at 12-month follow-up for patients with LDH who were treated nonsurgically and similar outcomes for patients who received surgical treatment.\(^19\)–\(^21\) One potential reason for resolution of symptoms associated with LDH is that the LDH often resorbs. Multiple studies have demonstrated
resolution of the LDH on diagnostic imaging. The spontaneous resolution of LDH is often independent of size. Cribb et al reported that 93% of the patients with an LDH that occupied greater than 66% of the canal diameter had radiographic and clinical resolution without substantial neurologic deterioration. Notable risk factors for disk herniation include performing manual labor, prolonged driving, and working in positions that require sustained lumbar flexion or rotation. Despite the initial resolution of symptoms, 30% of patients continue to report low back pain, and 20% do not work for a period of 3 to 12 months. The initial nonsurgical management of symptoms associated with LDH can be classified into three categories: pharmacologic, epidural steroid injections, and manipulative or physical therapies.

Pharmacologic Management
The historical options for pharmacologic treatment of back and leg pain caused by LDH include NSAIDs, corticosteroids, narcotics, and muscle relaxants. Several studies have reported that orally administered NSAIDs are more effective compared with a placebo in the acute, early time points of LDH. However, a meta-analysis of the efficacy of NSAIDs demonstrated that the treatment effect was modest and occurred only in the earliest time points. Corticosteroids are commonly prescribed for a limited duration to reduce the inflammation associated with LDH. Studies have demonstrated that corticosteroids decrease inflammation and acute pain caused by LDH; however, the pain relief is of limited duration. Despite the routine use of muscle relaxants to relieve pain associated with LDH, there are no randomized controlled trials to establish efficacy for their use.

Nerve modulation medications, including gabapentin and pregabalin, are increasingly being used to treat neuropathic pain. Gabapentin, an analog of the neurotransmitter gamma-aminobutyric acid, has both antiseizure and analgesic properties. Gabapentin is thought to bind to the calcium channel in the central nervous system; however, its exact mechanism of action is unknown. Few studies have investigated the use of these medications for the treatment of radiculopathy in association with LDH. Kasimcan and Kaplan reported substantial improvement for back and leg pain and walking distance in 33 patients with LDH treated with gabapentin monotherapy. However, three patients (9%) had adverse side effects (including somnolence, dizziness, and drowsiness) that necessitated discontinuation of the medication. Because several studies suggested that tumor necrosis factor (TNF)-α plays a role in the inflammatory process associated with LDH, a pharmacologic TNF-α blockade was considered as a therapeutic option to relieve radicular pain. However, the results of several prospective, randomized controlled trials reported that a TNF-α blockade is no more effective than placebo in relieving leg pain secondary to LDH. Although the authors reported a trend in favor of TNF-α inhibitors for symptom relief, there was no statistical difference measured by the visual analog scale (VAS), the Oswestry Disability Index, and the Medical Outcomes Study 12-Item Short Form.

Epidural Steroid Injections
Epidural steroid injections are commonly used to treat LDH radiculopathy. There is sufficient evidence that these injections should be performed using fluoroscopic guidance and contrast to ensure the correct placement of the needle. Lumbar interlaminar epidural injections performed without fluoroscopic guidance have a rate of inaccurate placement ranging from 17% to 30%. The benefit of lumbar epidural steroid injections is both diagnostic (determining the nerve root responsible for the pain) and therapeutic. Lumbar epidural steroid injections can be administered using transforaminal, interlaminar, or caudal anatomic approaches. There is no evidence to suggest that one anatomic approach for lumbar epidural steroid injections is more efficacious than another.

Three randomized controlled clinical trials have been conducted to determine the efficacy of transforaminal lumbar epidural steroid injections compared with anesthetic or saline injections. Approximately 54% of the transforaminal steroid group achieved greater than 50% reduction in pain at 1 month after the injection, whereas only 21% of the intramuscular steroid group reported improvement. Although there was improvement at the 4-week time point, the data lacked sufficient power for the 1-year time point. Vad et al evaluated patients at 12 months, using the VAS and the Roland-Morris Disability Questionnaire for patients treated with transforaminal lumbar epidural steroid injections or saline trigger point injections. The authors reported a significantly better success rate in the epidural steroid injection group compared with the trigger point injection group.

Other interventional procedures include intradiskal electrothermal annuloplasty (IDET) or automated...
percutaneous discectomy. The rationale for these procedures is to shrink the disk material through thermal injury or perform partial disk removal; however, there is insufficient evidence for or against the use of these procedures. One randomized controlled trial compared lumbar epidural steroid injection to IDET.68 At 6 months, the patients receiving IDET had greater improvement in leg and back pain compared with the patients treated with lumbar epidural steroid injections; however, this study was limited by the small sample size and poor follow-up. In two randomized controlled clinical trials for the Dekompressor (Stryker) percutaneous discectomy device, the authors reported more favorable results with discectomy versus epidural discectomy and chemonucleolysis; however, only 40% of the patients had favorable outcomes at 6- to 12-month follow-ups.69,70 There is insufficient evidence to recommend the use of IDET or the Dekompressor device based on currently available data.

**Manipulation and Physical Therapy**

Physical therapy is often prescribed to assist with core strengthening and flexibility in both the preoperative and postoperative periods. Physical therapy may include stabilization exercises, traction, manipulation, laser therapy, and mechanical physiotherapy. Hahne et al71 suggested that stabilization exercises and manipulation have some benefit over no treatment. Sixty patients enrolled in a randomized controlled trial to study the effects of stabilization exercises versus no exercise had statistical improvement in their VAS measure, straight leg test results, and ability to perform activities of daily living 4 weeks after stabilization exercises.62 In a study by Unlu et al,63 patients were randomized to three forms of therapy: laser, traction, and ultrasound. All of the patients had improvement in outcomes and MRI findings at 1 and 3 months; however, without a control group, these findings are difficult to compare with outcomes with no treatment. Mechanical physiotherapy includes assessment, treatment, prevention, and a focus on patient-centric stability and extension exercises.64 This type of therapy is typically used for back pain. Although no randomized control trials are available to evaluate this method for LDH, one prospective study found improvement in pain, weakness, and sensory function at a mean follow-up of 55 weeks in patients with lumbar disk prolapse.65 Because this study had no control group or validated outcome scores, the efficacy of mechanical physiotherapy remains unclear.

Thackeray et al66 reported no benefit for physical therapy and selective nerve root blocks compared with only selective nerve root blocks. Three randomized controlled trials assessed the role of spinal manipulation for LDH and reported improved outcomes with manipulation and improved VAS and Medical Outcomes Study 36-Item Short Form (SF-36) scores for both short- and long-term (12-month) time points.67-69

**Surgical Management**

Despite consistent reports demonstrating good results for nonsurgical treatment of LDH, surgical discectomy remains an important treatment option for patients when nonsurgical treatment fails.

**Surgical Versus Nonsurgical Treatment**

Surgical management may have a benefit in the early management of LDH. The classic study by Weber68 of the randomized treatment of LDH in which 60 patients were treated with discectomy and 66 patients with continued conservative measures found that conservative treatment was successful, but those treated surgically had significantly better results at 1 year postoperatively (P < 0.05). The advantage of surgical treatment faded over time. At 4 years, the surgically treated patients had a trend toward better results, but this difference was no longer present at 10 years.69 The Maine Lumbar Spine Study compared the 10-year results of surgical and nonsurgical treatment of 507 patients with LDH.1 During the 10-year period, 56% of the surgically treated patients reported that their low back pain and leg pain had greatly decreased or was completely gone compared with 40% of the nonsurgical group. The greatest improvement in the surgically treated group occurred in the first 2 years postoperatively; however, both groups had continued improvement throughout the 10-year period.

In a retrospective study, Gahrterman et al70 evaluated recovery from ankle dorsiflexion weakness after lumbar discectomy to identify factors indicative of a better outcome. The authors reviewed 56 consecutive patients with ankle dorsiflexion weakness that was treated with surgical decompression. The diagnosis of LDH was confirmed in 49 of the 56 patients (88%), with L4-L5 being the most common level of involvement (41 of the 56 patients). The mean power grade was 1.8 on presentation, with 66% of the patients having a grade of less than 3. The mean power
grade improved to 3.2 at 6 weeks and 3.5 at the most recent follow-up. The authors concluded that there was no statistical difference in motor recovery as a function of the duration of preoperative weakness; however, patients younger than 40 years had a better recovery in the first 6 weeks postoperatively.

The Spine Patient Outcomes Research Trial (SPORT) assessed outcomes for patients with LDH treated surgically and nonsurgically. The surgically treated patients had significantly improved postoperative Oswestry Disability Index scores, body pain, and physical function compared with the nonsurgical cohort. At the 4-year follow-up, the surgically treated group had improvement in all primary outcome measures and maintained greater improvement in all primary outcome measures compared with those who received only nonsurgical treatment. The only exception was in the area of likelihood to return to work, which was similar between the two groups. Because the SPORT study had a crossover rate approaching 30% of the patients and a follow-up rate of less than 80%, the intention-to-treat analysis was difficult to interpret.

In a randomized study of patients with symptomatic LDHs, Osterman et al evaluated 28 patients treated with diskectomy and 28 nonsurgically treated patients. At 2 years, the authors found no significant difference in outcomes, with modest short-term gains in the diskectomy group.

Psychosocial Factors
Psychosocial factors can contribute to favorable outcomes after lumbar diskectomy and may guide the decision-making process for or against surgery. Chaichana et al evaluated a cohort of 67 patients and correlated preoperative depression and somatic perception with postoperative disability and quality of life after lumbar diskectomy. The patients with preoperative depression and somatization had similar improvements in leg pain compared with those without psychosocial factors but had overall worse outcome scores as measured by the Oswestry Disability Index and the SF-36. In a prospective cohort study, Kohlboeck et al assessed depression and the prognosis for lumbar diskectomy in 48 patients. The authors concluded that preoperative depression is a negative predictor for a good outcome, whereas a positive straight leg raise test was a positive predictor for a good outcome. In addition, the absence of a work-related injury, the absence of back pain, a radicular pattern of pain, and reflex asymmetry were all positive predictors for good outcomes after lumbar diskectomy.

Duration of Symptoms and Time to Surgery
Data suggest that nonsurgical management of LDH is appropriate for most patients and, if a patient requires surgical treatment, short- and long-term improvement are possible. The patients who are likely to do worse are those with preoperative depression; however, this fact raises the important clinical question of how long surgeons should wait before offering surgical intervention.

Ng and Sell assessed the predictive value of the duration of sciatica on the success of diskectomy by comparing patients with symptoms of less than 4 months and greater than 12 months. The authors concluded that the change in a patient’s Oswestry Disability Index score was a function of symptom duration. The cohort who had symptoms for less than 4 months had better outcomes. Fisher et al compared patients with greater than and less than 6 months of symptomatic sciatica before lumbar diskectomy. Patients who had symptoms for less than 6 months also had better postoperative NASS lumbar spine instrument and SF-36 scores than those with symptoms for more than 6 months. Nygaard et al reviewed the duration of leg pain as a predictor of outcome after surgery for LDH. The authors concluded that patients who had leg pain for more than 8 months had inferior outcomes.

Patients who receive early surgical treatment also may have better outcomes compared with patients treated with epidural steroid injections only, particularly those with a large LDH. In a prospective randomized trial, Buttermann evaluated 100 patients with large LDHs (greater than 25% of the canal) for a minimum of 6 weeks’ duration. Fifty patients were randomized to epidural steroid injections and 50 to lumbar diskectomy. The diskectomy group had earlier recovery and decreased pain medication requirements at 1 and 3 months. The author concluded that patients with greater than 25% canal involvement and greater than 6 weeks of symptom duration have better outcomes with surgical intervention.

Technique
Open surgical dissection and muscle injury to remove disk material may impede recovery and increase pain and disability over time (Figure 5). Two level III studies and one level II study evaluated open versus endoscopic or tubular lumbar diskectomies. Hermantin et al compared open versus endoscopic diskectomy procedures and found equivalent results; however, there
was a trend toward increased narcotic use among the group treated with open discectomy. A randomized controlled trial by Arts et al assessed 328 patients treated with either tubular discectomy or conventional microdiscectomy for sciatica. The authors found no difference in the length of the hospital stay, the amount of blood loss, the recovery rate, and the overall outcome between the groups. A similar study by Arts et al questioned whether minimally invasive approaches result in less muscle injury than conventional surgery. The authors evaluated preoperative and 1-day and 1-year postoperative creatine phosphokinase levels and also used MRI to measure the preoperative and 1-year postoperative cross-sectional area of the multifidus muscle. No differences between the two groups were found at 1 year.

The approach for the treatment of a far lateral disk herniation can pose a unique challenge for spinal surgeons. Various surgical approaches have been described, but an ideal approach has not been determined. In one of the only large series to compare surgical techniques, Epstein reviewed 174 patients treated with three different techniques: medial facetectomy, complete facetectomy, and an intertransverse approach. The author reported little difference in the results for the three surgical groups.

**Recurrent Disk Herniation**

The incidence of recurrent disk herniation ranges from 1% to 25%. In a prospective multicenter cohort study, McGirt et al performed follow-up MRI after primary discectomy and found a 13% incidence of asymptomatic recurrence and a 10% incidence of repeat surgery at 2 years. Weinstein et al reported a LDH reoperation rate of 10% at 4 years in the SPORT trial. Fifty percent of the procedures were performed for herniation recurrence. Atlas et al reported a 25% reoperation rate at 10 years in the Maine Lumbar Spine Study, although the reasons for the surgical interventions were not specified.

Several risk factors contribute to the risk of recurrent disk herniation. Carragee et al classified disk herniations into four categories based on intraoperative findings. Type 1 disk herniations have free fragments with a fissure in the anulus fibrosus. Type 2 have free fragments with a defect in the anulus fibrosus. Type 3 have a contained fragment without an annular tear, and type 4 have a contained herniation with no free fragment. The overall reoperation rate for all the groups was 6.1%; however, for the group with an annular fissure (type 2), the reoperation rate was 21.2%. Another notable finding in this study was the high rate (37.5%) of recurrent or persistent sciatica in patients with a type 4 disk herniation, despite a low rate of documented reherniation (12.5%).

Wera et al reported on 259 disk herniations treated with subtotal discectomy at a mean follow-up of 96 months. Comparing the reoperation rate for Carragee types 1, 2, 3, and 4 herniations, the authors reported rates of 1.6%, 3.3%, 9.6%, and 4.6%, respectively. In the study by Carragee et al, the reoperation rates for types 1, 2, 3, and 4 herniations were 1.1%, 21.2%, 4.8%, and 6.3%, respectively. Based on this comparison, there may be an advantage, at least with regard to the risk of recurrent disk herniation, in favor of more aggressive discectomy in patients with a large annular defect found at the time of surgery. In a study of 1,320 patients treated with subtotal discectomy, Wera et al reported a 1% recurrence rate within 1 year of surgery compared with 6.1% in the study by Carragee et al.

Thomé et al randomized 84 patients younger than 60 years to treatment with either subtotal discectomy or sequestrectomy. At 1 year after surgery, the patient satisfaction rate showed a trend toward better outcomes with sequestrectomy. At 2 years after surgery, the reherniation rate was similar in both groups; however, patient-reported satisfaction with the treatment outcome was statistically significant in favor of sequestrectomy. The authors found
high rates of radiographic abnormalities at repeat MRIs 2 years after surgery, although there was a low correlation between these findings and sciatica. There was a correlation between the presence and severity of Modic changes and the presence of low back pain and a correlation between subtotal diskectomy (as opposed to sequestrectomy) and Modic changes. Schick and Elhabony found no difference in recurrence rates or outcome in 200 patients treated with sequestrectomy or diskectomy at 1-year follow-up.

**Primary Fusion**

Some authors advocate primary fusion as a viable treatment option, especially for disk herniations with concomitant axial low back pain. Matsunaga et al retrospectively reviewed manual laborers and athletes with LDHs treated with diskectomy versus diskectomy and fusion. The rates of return to work and sports were the primary outcome measures. The authors concluded that athletes did better with diskectomy in terms of returning to play sooner, whereas laborers did better with primary fusion. However, no validated outcome measures were used. The NASS consensus statement concluded that there were insufficient data to recommend for or against primary fusion for LDH.³

**Surgical Outcomes**

In a retrospective review of the outcomes of 68 patients treated with lumbar diskectomy, Baksh reported that 54 patients (79%) were pain free immediately postoperatively. By 10 years, only 27% patients remained pain free. This finding suggests that the early clinical benefits of lumbar diskectomy are not long lasting. In a retrospective review of 88 patients treated with microdiskectomy, the authors reported that 75% of the patients had an unchanged clinical status, 18% deteriorated, and 7% improved at the 10-year follow-up. Overall, 83% of patients had a successful result at the 10-year follow-up.³⁵

**Summary**

Regardless of the treatment, LDHs tend to improve over time. Refractory radicular pain is the most reliable indication for diskectomy, and it appears that there is no significant difference based on the approach used. Patient selection also is an important factor. Noninvolvement in a workers’ compensation claim, the absence of back pain, and a radicular pattern of pain with reflex asymmetry are all positive predictors for good outcomes after lumbar diskectomy: There are convincing new data that surgical intervention, especially early intervention, may improve clinical outcomes compared with nonsurgical treatment. However, the clinical response to diskectomy may diminish over time. More long-term studies are clearly needed and should include validated outcome measures.

**References**


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