

Lumbar-spine disorders rank fifth among disease categories in the cost of hospital care and account for higher costs resulting from absenteeism from work and disability than any other category. The natural history of sciatica is favorable, with resolution of leg pain within 8 weeks from onset in the majority of patients. Although relief of symptoms was twice as fast among patients with sciatica who were treated with early surgery as among those who were treated conservatively, this multicenter, randomized trial demonstrated that this strategy did not result in a better overall 1-year functional recovery rate than did a policy of prolonged conservative treatment with an offer of subsequent surgery. The benefits of surgery for speed of recovery and relief of pain were consistent among patients in all predefined subgroups, except for patients whose sciatica was not provoked by sitting.

Wilco C. Peul, M.D., Hans C. van Houwelingen, Ph.D., Wilbert B. van den Hout, Ph.D., **Surgery versus Prolonged Conservative Treatment for Sciatica.** *n engl j med* 356;22 www.nejm.org may 31, 2007 2245

In patients with a herniated disc confirmed by imaging and leg symptoms persisting for at least 6 weeks, surgery was superior to non-operative treatment in relieving symptoms and improving function. In the as-treated analysis, the treatment effect for surgery was seen as early as 6 weeks, appeared to reach a maximum by 6 months and persisted over 8 years; it is notable that the non-operative group also improved significantly and this improvement persisted with little to no degradation of outcomes in either group (operative and nonoperative) between 4 and 8 years. The persistent small benefit in the surgery group over time has made the overall intention-to-treat comparison more statistically significant over time despite high levels of cross-over.

Jon D. Lurie¹, Tor D. Tosteson¹, Anna N. A. Tosteson¹, Wenyan Zhao¹, et. Al. **Surgical versus Non-Operative Treatment for Lumbar Disc Herniation: Eight-Year Results for the Spine Patient Outcomes Research Trial (SPORT).** *Spine (Phila Pa 1976)*. 2014 January 1; 39(1): 3–16.

There is fair evidence that conservative discectomy will result in shorter operative times and a quicker return to work. There is fair quality evidence that conservative discectomy will result in a higher incidence of recurrent disc herniation.

Spine J. 2009 Mar;9(3):240-57. doi: 10.1016/j.spinee.2008.08.005. Epub 2008 Sep 21. **An evidence-based review of the literature on the consequences of conservative versus aggressive discectomy for the treatment of primary disc herniation with radiculopathy.** Watters WC 3rd¹, McGirt MJ.

Surgically treated patients with a herniated lumbar disc had more complete relief of leg pain and improved function and satisfaction compared with nonsurgically treated patients over 10 years. Nevertheless, improvement in the patient's predominant symptom and work and disability outcomes were similar regardless of treatment received.

Spine (Phila Pa 1976). 2005 Apr 15;30(8):927-35. **Long-term outcomes of surgical and nonsurgical management of sciatica secondary to a lumbar disc herniation: 10 year results from the maine lumbar spine study.** Atlas SJ¹, Keller RB, Wu YA, Deyo RA, Singer DE.

A total of 46 patients with lumbar disc herniation treated by microendoscopic discectomy were reviewed. Early surgical intervention (for ≤ 3 months) did not result in greater improvement of clinical outcomes for patients with lumbar disc herniation. Later surgical intervention (> 3 months) resulted in significant improvement of psychological disorders.

J Orthop Sci. 2010 May;15(3):294-8. doi: 10.1007/s00776-010-1457-1. Epub 2010 Jun 18. **Comparison of early and late surgical intervention for lumbar disc herniation: is earlier better?** Akagi R¹, Aoki Y, Ikeda Y, Nakajima F, Ohtori S, Takahashi K, Yamagata M.

Purpose: We wanted to examine the clinical and radiological prognostic factors affecting the postoperative clinical outcome of patients with lumbar disc herniation and who underwent open discectomy. In the current study, the clinical outcomes were significantly poorer in the revision cases as compared with those of the primary surgery cases. In the current study, the clinical outcomes were significantly poorer in the revision cases. In regard to the types of disc herniation, the degree of residual low back pain was significantly lower at a final follow-up in the extruded cases as compared with that of the protruded or sequestered case, compared with those of the primary surgery cases.

Jae Chul Lee, Min-Soo Kim, Byung-Joon Shin. **An Analysis of the Prognostic Factors Affecting the Clinical Outcomes of Conventional Lumbar Open Discectomy : Clinical and Radiological Prognostic Factors.** Asian Spine Journal Vol. 4, No. 1, pp 23~31, 2010.

Lumbar disc herniation (LDH) finally resolved in all of the patients with the signal intensity of types 1 and 5. In contrast, LDH remained in all of the patients with the signal intensity of types 2,3 and 4. Type 1 might indicate that LDH mostly involves the nucleus pulposus. Types 2 and 5 might indicate that LDH mostly involves the annulus fibrosus. The annulus fibrosus might tend to remain in comparison with the nucleus pulposus. Therefore, the resorption of LDH might rarely occur in Types 2 and 5. Types 3 and 4 might indicate that the structure of LDH has changed, such as in the granulation of myxoid change.

There were significantly more patients with migration in the group that resolved than in the group that didn't resolve. LDH tends to be in contact with epidural tissue during migration. Therefore, the resorption of LDH might easily occur in the patients in association with migration. Two patients of Type 5 with migration exhibited resorption of LDH, indication that resorption of LDH might easily occur in the patients with migration even if they are type 5.

Fukushima J Med Sci. 2010 Dec;56(2):91-7. **The predictive factors for the resorption of a lumbar disc herniation on plain MRI.** Iwabuchi M¹, Murakami K, Ara F, Otani K, Kikuchi S.

OBJECTIVE: To evaluate and systematize the reasons for persistent pain syndromes following surgical nerve root decompression. **RESULTS:** Group 1 showed a considerable rate of pain syndromes related to tissue damage during the intervention; the rates of radicular pain caused by epidural scar and myofascial pain were 12.3% and 26.1% respectively. Facet joint pain was found in 23.1% of the cases. Group 2 showed a significant rate of facet joint pain (16.9%) despite the minimally invasive intervention. The specificity of Group 3 was the very high rate of unresolved or recurred nerve root compression (63.0%); in other words, in the majority of cases, the aim of the intervention was not achieved.

Pain Physician. 2011 Nov-Dec;14(6):545-57. **An analysis of reasons for failed back surgery syndrome and partial results after different types of surgical lumbar nerve root decompression.** Bokov A¹, Isrelov A, Skorodumov A, Aleynik A, Simonov A, Mlyavykh S.

By 2 years after discectomy, 25 (23.1%) patients had demonstrated radiographic evidence of recurrent disc herniation at the level of prior discectomy on serial imaging. Radiographic disc herniation was asymptomatic in 14 (13%) patients and symptomatic in 11 (10.2%) patients. Clinically silent recurrent disc herniation is common after lumbar discectomy. When obtaining MRI evaluation within the first 2 years of discectomy, providers should expect that radiographic evidence of reherniation may be encountered and that treatment should be considered only when correlating radicular symptoms exist.

Spine (Phila Pa 1976). 2011 Dec 1;36(25):2147-51. doi: 10.1097/BRS.0b013e3182054595. **Asymptomatic same-site recurrent disc herniation after lumbar discectomy: results of a prospective longitudinal study with 2-year serial imaging.** Lebow RL¹, Adogwa O, Parker SL, Sharma A, Cheng J, McGirt MJ.

The major problems with using posterior MED (microendoscopic discectomy) for recurrent lumbar disc herniation are the limited surgical field, the adhesion caused by surgical scarring and complications, such as potential dural tearing and nerve root injury. However, the clinical observations of the patients in this study showed that MED for recurrent lumbar disc herniation in situ still has a good effect if appropriate patients are strictly selected. Most recurrent disc herniation in situ cases are of the disc prolapse type, especially those recurrences that occur a short time after MED, most of which are caused by omission of the free nucleus pulposus within the intervertebral space and its repeated dislocation into the spinal canal. In this study, 12 cases had excellent outcomes (48%), 12 cases had good outcomes (48%), 1 case had a fair outcome (4%) and no patients had poor outcomes. However, for patients with severe lower back pain, lumbar instability and a severe degenerative intervertebral disc with clear end-plate osteochondritis, we do not recommend this therapy because it may aggravate the symptoms of lower back pain after surgery or induce severe back pain instead of relief. Based on our inclusion criteria, the outcomes of this study showed that most patients possessed good lumbar function based on postoperative ODI scoring, suggesting that our inclusion criteria were available.

Clinics (Sao Paulo). 2015 Feb;70(2):120-5. doi: 10.6061/clinics/2015(02)09. **Repeated microendoscopic discectomy for recurrent lumbar disk herniation.** Hou T¹, Zhou Q¹, Dai F¹, Luo F¹, He Q¹, Zhang J¹, Xu J¹.

The standard surgical approach for the treatment of recurrent disc herniation uses an open technique with a wide exposure. Many would consider a minimally invasive approach such as microendoscopic discectomy (MED) to be contraindicated in the setting of recurrent disc herniation. MED is a safe and effective surgical approach for the treatment of recurrent lumbar disc herniation. Standardized measures of outcome show that MED for recurrent herniation produces improvement in pain, disability, and functional health that is at least comparable with outcomes reported for conventional open microdiscectomy.

J Spinal Disord Tech. 2010 Feb;23(1):30-4. doi: 10.1097/BSD.0b013e318193c16c. **Clinical outcomes after microendoscopic discectomy for recurrent lumbar disc herniation.** Smith JS¹, Ogden AT, Shafizadeh S, Fessler RG.

Limited quality and amount of evidence were found that microscopic discectomy results in at least an equal clinical outcome compared with open discectomy. Microscopic discectomy results in decreased incision length compared with open discectomy while the surgical duration increased with microscopic discectomy. The choice of open or (type of) microscopic discectomy at present probably depends more on the training and expertise of the surgeon, and the resources available, than on scientific evidence of efficacy. However, it is worth noting that some form of magnification is now used almost universally in major spinal surgical units to facilitate vision. The place for other forms of discectomy is unresolved. Studies of automated percutaneous discectomy and laser discectomy suggest that clinical outcomes following treatment are at best fair and probably worse than after microscopic discectomy. There are no studies examining intradiscal electrotherapy, coblation or fusion as a treatment for sciatica due to disc herniation.

Jacobs WCH, Arts MP, van Tulder MW, Rubinstein SM, van Middelkoop M, Ostelo RW, Verhagen AP, Koes BW, Peul WC. **Surgical techniques for sciatica due to herniated disc, a systematic Review.** *Eur Spine J* (2012) 21:2232–2251.

In our study, the mean intervals until reoperation were 8.1 months after PELD (percutaneous endoscopic lumbar discectomy) and 19.7 months after MED (microendoscopic discectomy). We found shorter intervals after minimally invasive endoscopic discectomy than after open disc surgery, but more research on clinical outcomes after primary surgery are needed to explain this outcome. In this study, real recurrent herniation (true herniation, same level, same side) was the most common cause for lumbar disc reoperations. In particular, more real recurrent herniation was found after minimally invasive endoscopic discectomy than after open disc surgery. By strict definition, patients with recurrent herniation always have a pain-free interval of at least six months between the primary surgery and the recurrence of symptoms [Swartz KR, Trost GR (2003) Recurrent lumbar disc herniation. *Neurosurg Focus* 15(3):E10].

Within 0.5 years after primary surgery, the percentages of reoperations performed at the previously treated site and side were 75.5 % in the PELD group, 39.3 % in the MED group, and only 11.8 % in the open group. It should also be considered that many real recurrent herniations occurred within 0.5 years in the PELD group. A total of 35.1 % (13/37) of these reoperations were performed without a pain-free interval of at least one week. The authors believe that these primary PELD operations did not excise sufficient material. Follow-up should occur more frequently within 0.5 years after PELD and MED. Furthermore, more visits or telephone calls can be made in the one to five-year period after open disc surgery.

Cheng J, Wang H, Zheng W, Li C, Wang J, Zhang Z, Huang B, Zhou Y. **Reoperation after lumbar disc surgery in two hundred and seven patients.** *International Orthopaedics (SICOT)* (2013) 37:1511–1517

The current study documented quantitative analyses of muscle injury, measured by serum CPK and imaging of the multifidus muscle on MRI. No significant differences in CPK ratio and postoperative multifidus atrophy grade were found between tubular discectomy and conventional microdiscectomy although the CSA (cross sectional area) ratio was significantly higher in conventional microdiscectomy. The discrepancy between the results of grading the multifidus atrophy and measuring the CSA of the multifidus could be explained by the fact that replacement of the muscle bulk with fat and fibrous tissue was not taken into account when calculating the CSA.

In our study, we measured the CSA of the multifidus muscle only and found similar results between tubular discectomy and conventional microdiscectomy, indicating no difference in muscle atrophy 1 year postoperatively. The present study has shown significantly longer operation time of tubular discectomy compared with conventional microsurgery.

Arts M, Brand R, van der Kallen B, Lycklama a` Nijeholt G, Peul W . **Does minimally invasive lumbar disc surgery result in less muscle injury than conventional surgery? A randomized controlled trial.** *Eur Spine J* (2011) 20:51–57

Postoperatively, in both groups there was a substantial decrease in the VAS (visual analogue scale) score with long-term follow-up—to 1.6 points in the MID (minimally invasive discectomy) and OD (open discectomy) cohorts. There was no significant intergroup difference in pain relief with either short-term follow-up or long-term follow-up. There was no statistically significant difference in either short-term or long-term leg pain relief when comparing patients randomized to MID or to OD. Higher, but not statistically significantly different, rates of recurrent herniation were seen in patients randomized to MID. Subsequent reoperation for recurrent disc herniation was more common in patients randomized to MID (8.50%) than OD (5.35%). However, the pooled relative risk was not significantly different. Intraoperative complications were significantly more common in patients randomized to receive MID (6.96%) than OD (3.56%). Total complications did not differ significantly between MID and OD.

Conclusions The total incidence of complications did not differ between the approaches. The current evidence suggests that both open and minimally invasive discectomy lead to a substantial and equivalent degree of short- and long-term improvement in leg pain, the primary symptom of many patients with lumbar radiculopathy.

Dasenbrock HH, Juraschek SP, , Schultz LR, Witham TF, Sciubba DM, Wolinsky J, Gokaslan ZL, and Bydon A. **The efficacy of minimally invasive discectomy compared with open discectomy: a meta-analysis of prospective randomized controlled trials.** J Neurosurg Spine. 2012 May ; 16(5): 452–462.

LDH (lumbar disc herniation) is a common disease in modern society, the incidence of which is second only to upper respiratory tract infections in the USA. The statistical results indicated that the two methods,

minimally invasive discectomy (MID) and standard discectomy (SD), have the same effect in alleviating pain. The MID group was more likely to experience increased disc herniation recurrence. MID had a smaller size of incision, a shorter hospital stay, but more effort should be put into reducing herniation recurrence and surgical time.

Chang X, Chen B, Li HY, Han XB, Zhou Y, Li CQ. **The safety and efficacy of minimally invasive discectomy: a meta-analysis of prospective randomised controlled trials.** International Orthopaedics (SICOT) (2014) 38:1225–1234.

Overall, the evidence suggested higher rates of nerve-root injury, incidental durotomy and reoperation with minimally invasive than with open surgery, but the differences were not statistically significant. We found moderate-quality evidence that failed to show an advantage attributable to minimally invasive surgery for discectomy in terms of short- and long-term function and low-quality evidence that failed to show an advantage in terms of short- and long-term pain. Careful patient selection and adequate nerve-root decompression may be the most important principles to optimize patient outcomes. In experienced hands and in the absence of excessive subcutaneous adipose tissue, conventional open discectomy can be accomplished through small incisions comparable in size to those required for tubular retractors. The current evidence suggests a risk–benefit ratio that does not support the routine use of minimally invasive surgery for cervical and lumbar discectomy.

Evaniew N, Khan M, Drew B, Kwok D, Bhandari M, Ghert M. **Minimally invasive versus open surgery for cervical and lumbar discectomy: a systematic review and meta-analysis.** CMAJ OPEN, 2(4); E295-E305.

Disc herniation and radiculitis are based on a pathophysiologic explanation of inflammatory pathology. Epidural steroids have been recommended to be effective in disc herniation and radiculitis secondary to their antiinflammatory profiles. Emerging evidence shows that local anesthetics with or without steroids are equally effective in many settings.

The objective of this trial was to evaluate the effectiveness of local anesthetic lumbar transforaminal epidural injections with or without steroids for managing chronic low back and lower extremity pain with unilateral radiculitis secondary to disc herniation.

For each nerve root level, 1.5 mL of 1% preservative-free lidocaine followed by 0.5 mL of either sodium chloride solution or betamethasone was injected. with the initial 2 epidural injections including a structured exercise program. All patients continued drug therapy with opioids or nonsteroidal anti-inflammatory drugs, although generally, at a lower level than their initial doses. Medications or dosages were changed based on necessity or discontinued if no longer needed. Protocol also included a structured exercise program. The 2-year follow-up results of this randomized, double-blind, active control trial of transforaminal epidural injections of 120 patients with chronic persistent pain from disc herniation who received treatments with local anesthetic alone or local anesthetic and steroid are positive. At the end of 2 years, significant improvement was seen in 65% of patients administered local anesthetics alone and 57% of patients administered local anesthetic and steroid when all

participants were included. These results indicate that both treatments are effective but that steroids have no superiority.

Manchikanti L¹, Cash KA, Pampati V, Falco FJ. Transforaminal epidural injections in chronic lumbar disc herniation: a randomized, double-blind, active-control trial. Pain Physician. 2014 Jul-Aug;17(4):E489-501.