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Treatment for Recurrent Lumbar Disc Herniation

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Abstract
Purpose of Review Recurrent lumbar disc herniation (RLDH) is the most common indication for reoperation after a lumbar discectomy. The purpose of this manuscript is to review the incidence, risk factors, and treatment for RLDH.
Recent Findings Patients who require revision surgery for RLDH improved significantly compared to baseline; however, the magnitude of improvement is less than in primary discectomy patients. Treatment with either repeat discectomy or instrumented fusion has comparable clinical outcomes. Repeat discectomy patients, however, have shorter operative times and length of stay. Hospital charges are dramatically lower for repeat discectomy compared to instrumented fusion.
Summary The incidence of RLDH is somewhere between 5 and 18%. Risk factors include younger age, lack of a sensory or motor deficit, and a higher baseline Oswestry Disability Index (ODI) score. Available evidence suggests that some patients may respond to nonoperative interventions and avoid the need for reoperation. For those that fail a trial of conservative management or present with neurologic deficit, both repeat lumbar discectomy and instrumented fusion appear to effectively treat patients with similar complication rates and clinical outcomes.

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Introduction

The surgical treatment of lumbar herniated discs has advantages over nonoperative treatment. Two randomized clinical trials have demonstrated that those receiving operative intervention have faster resolution of pain and regain function more rapidly than those managed nonoperatively [1, 2]. The long-term clinical outcomes of lumbar discectomy remain superior to nonoperative outcomes [3] despite reoperation rates as high as 25% [4]. Leven et al. reported that recurrent lumbar disc herniation was the indication for reoperation after primary discectomy in 62% of cases [5]. Thus, recurrent disc herniation is the primary cause of surgical failure and morbidity in patients treated with a lumbar discectomy. Despite RLDH being a relatively common complication, there is a paucity of high-quality evidence regarding the optimal treatment. The absence of level I evidence to support decision-making has led to a lack of treatment uniformity [6]. The purpose of this manuscript is to review the incidence, risk factors, and treatment for RLDH.

Incidence

Recurrent lumbar disc herniation is defined as the occurrence of herniated disc material at the same level in a patient who has undergone discectomy. The rate of reherniation reported in the literature varies from 5 to 18% [7–9]. This large range may reflect surgical technique, variability in follow-up, and different definitions of RLDH (i.e., including ipsilateral and/or

contralateral reherniations). In regard to timing, nearly half of all recurrent herniations occur within the first year of the index operation [10, 11]. However, reherniation may occur as long as 8 years after the initial discectomy [12•].

Risk Factors

Recent analysis of data from Spine Patient Outcomes Research Trial (SPORT) identified younger age, lack of a sensory or motor deficit, and a higher baseline Oswestry Disability Index (ODI) score as risk factors for recurrent disc herniation [12•]. Thus, the highest risk patients for reherniation are young patients with high disability and without a neurological deficit. Suk et al. found that 32.1% of patients with RLDH described a traumatic event preceding the onset of recurrent symptoms [13]. One possible explanation for this is that the annulotomy performed during disc resection makes the operative level more susceptible to sudden prolapse with high mechanical demand [14]. This may partially explain the higher incidence of RLDH in the young, more active population.

While the SPORT analysis did not find tobacco use to be a significant risk factor [12•], several other studies found a significant correlation of smoking with the incidence of RLDH [13, 15]. Nicotine has been proven to induce intervertebral disc degeneration through a vasoconstrictive process and may inhibit the annular healing process after discectomy [16, 17]. The prolonged time to healing may make the disc more susceptible to reherniation despite the resolution of the original presenting symptoms.

Among radiologic risk factors, Kim et al. found that disc height and range of motion positively correlate with risk of recurrence. They reported that a sagittal range of motion (at the disc level) of more than 10 degrees resulted in a recurrence rate of 26.5% compared to a recurrence rate of 4.1% with a range of motion of less than 10 degrees. Advanced disc degeneration and decreased disc height were significant risk factors for RLDH. The authors hypothesized that this was secondary to an impaired healing process of the annulus in degenerated discs [15]. This study suggests that the preoperative biomechanics of the spine and the intrinsic healing properties of the disc space contribute to the pathogenesis of RLDH.

The importance of operative technique, during the initial discectomy, in mitigating the risk of RLDH was studied by Watters et al. Their meta-analysis of the literature compared aggressive disc removal with large annulotomy and curettage of the disc space to conservative removal of the disc fragment and little disc space invasion (sequestrectomy). The RLDH incidence was greater with the sequestrectomy compared to the aggressive technique [18]. However, this study was published prior to the results of a randomized clinical trial comparing the two techniques. Barth et al. reported results of a prospective study comparing discectomy to sequestrectomy in patients with lumbar disc herniation and radiculopathy. The SF-36, VAS, reherniation rates, self-rated sensory and motor deficit, and impairment in activities of daily living were assessed at 2 years. Forty-two patients were randomized into each group. Patient groups were similar in regard to age, gender, body mass index, preoperative disc desiccation, disc height, and modic changes. No significant difference was found in reherniation rates between the two groups with a 10.5% incidence with discectomy and a 12.5% incidence with sequestrectomy. Sequestrectomy yielded superior results in physical and social functioning, use of analgesics, and overall outcome at 2 years [19–21]. This provides Level II therapeutic evidence that there is no significant difference in reherniation rates after microdiscectomy or sequestrectomy, but long-term functional outcome after sequestrectomy is superior.

Treatment

The role of nonoperative treatment in the management of symptomatic RLDH remains unclear. Symptomatic patients without neurologic deficit certainly warrant consideration for nonoperative interventions. Ambrossi et al. reported that 6 of 17 (35%) patients with RLDH avoided an operation with conservative treatment. Furthermore, the mean cost was markedly less for patients responding to conservative treatment ($2315) compared with those requiring revision surgery ($39,836) [22•]. As the USA moves towards a value-based health care system, mitigating the costs of treatment will continue to be emphasized. While this study is limited by its small number of patients, it demonstrates that some symptomatic RLDH may avoid surgery with nonoperative measures at a fraction of the financial cost.

Operative interventions are appropriate for those patients with neurologic deficits or symptoms refractory to conservative measures. There are multiple surgical treatment options for RLDH with the main two options consisting of revision lumbar discectomy and instrumented fusion. Determining the optimal surgical intervention is often challenging as there is no level I evidence demonstrating superiority of one approach over another. There are several concerns regarding revision discectomy without fusion. One concern is that there is some inherent instability that led to the RLDH. Another concern is that revision discectomy may lead to more instability. Additional lamina and facet is resected to identify normal tissue plains in an effort to avoid incidental durotomy and neural injury.

The most recent lumbar fusion guidelines state that fusion is reasonable for treatment of RLDH in the setting of instability, spinal deformity, or chronic low-back pain [23]. However,

for patients without those indications, the decision to perform a recurrent discectomy versus instrumented fusion is a complicated one.

A recent study by Guan and colleagues compared the clinical outcomes of repeat discectomy versus instrumented fusion in patients with RLDH without radiographic instability. Both groups had similar ODI scores, visual analog scale (VAS) scores, and quality-adjusted life years (QALY) measures at 3 and 12-month follow-up. There were no significant differences in rates of complications between the discectomy and the fusion groups. The instrumented fusion group, however, required significantly longer hospitalizations (3.7 vs 1 day), longer operative times (229.6 vs 82.7 min), and were more likely to be discharged to inpatient rehab. Furthermore, financial costs were found to be drastically higher in the fusion group ($54,458.29 vs $11,567.05) [24•]. Thus, repeat discectomy may offer the same short-term clinical outcomes as instrumented fusion with quicker recovery and less financial strain on the patient and healthcare system.

Fu et al. performed a retrospective study comparing the long-term outcomes of repeat discectomy versus instrumented fusion for the treatment of RLDH. Short-term findings were similar to the study by Guan [24•], with intraoperative blood loss, length of surgery, and length of hospitalization significantly less in patients undergoing discectomy alone. There was no difference in complication rates between the two techniques with a 13% durotomy rate in the repeat discectomy group and an 11% rate in the fusion group. Clinical symptoms were assessed based on the Japanese Orthopedic Association Back Scores with a mean follow-up of 88.7 months. No significant difference was found with excellent or good clinical outcomes at last follow-up in 78.3% of patients undergoing discectomy alone and 83.3% of patients with instrumented fusion [25].

While these studies show similar clinical outcomes between the repeat discectomy vs instrumented fusion groups, they do not compare how patients requiring revision surgery compare in the long term to those that did not have reherniated discs. Abdu et al. performed an analysis of the SPORT data to compare outcomes of those requiring revision surgery to those without RLDH. The primary outcomes they measured included ODI, the sciatica bothersomeness index (SBI), and Short Form 36 (SF-36) at 6 weeks, 3 months, 6 months, and yearly to 4 years. The results of the study were that time-adjusted mean improvement from baseline to 4-year follow-up was significantly less for the reherniation group on all outcome measures. At 4 years, the only significant difference between the two groups was less improvement on the SBI for the reherniation group [12•]. Patients may therefore be counseled that they will improve significantly with revision surgery but perhaps not as much as with primary surgery.

In the above-mentioned studies, instrumented fusion for the treatment of RLDH was performed predominantly via a transforaminal interbody fusion (TLIF) or posterior lumbar interbody fusion (PLIF) [13, 24•, 25]. This is largely due to the perceived need for direct decompression via discectomy. Anterior lumbar interbody fusion (ALIF) may be a viable fusion alternative in the setting of RLDH and allows for both direct and indirect decompression without having to traverse the dense scar tissue and adhesions via a posterior discectomy. Mamuti et al. reported their series of 35 patients with RLDH that were treated via an ALIF. They found that radicular pain improved significantly compared with pre-operation in all the patients and none of them required reoperation for decompression [26]. Further studies are needed to compare this technique to the traditional posterior discectomy and fusion in the setting of RLDH. The lateral lumbar interbody fusion (LLIF) is a technique that may also be utilized for RLDH. However, direct decompression is not possible with this technique alone and there are no studies in the literature that evaluate the efficacy of indirect decompression for RLDH.

Conclusion

There is no high-quality evidence to provide optimal management guidelines for patients with RLDH. Available evidence suggests that some patients may respond to nonoperative interventions and avoid the need for reoperation. For those that fail a trial of conservative management or present with neurologic deficit, both repeat lumbar discectomy or instrumented fusion appear to effectively treat patients with similar complication rates and clinical outcomes. However, patients with repeat discectomy appear to have a quicker recovery with drastically lower financial costs as compared to patients that undergo instrumented fusion. Regardless of the treatment method, patients undergoing revision surgery for RLDH improve significantly compared to baseline.

Compliance with ethical standards

Conflict of Interest Randall J. Hlubek declares that he has no conflict of interest.

Gregory M. Mundis Jr. reports personal fees from Nuvasive, K2M and Allosource, a patent Nuvasive with royalties paid, and a patent K2M with royalties paid.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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