Is Microendoscopic Discectomy Effective for Patients With Concomitant Lumbar Disc Herniation and Spondylolysis?

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Abstract

Study Design: A retrospective cohort study.

Objective: Although it is controversial whether to choose only discectomy or fusion surgery in patients with disc herniation and spondylolysis, we expected that aggravation of the spondylolysis may be prevented if posterior supporting muscles can be well-preserved without extensive exploration. The purpose of this study was to investigate the influence of L5 spondylolysis on surgical outcomes following microendoscopic discectomy (MED) in patients with concomitant lumbar disc herniation and spondylolysis.

Methods: We reviewed 811 patients who underwent MED for L4/5 or L5/S1 disc herniation. Patients with spondylolisthesis were excluded. We compared surgical outcomes of patients with and without L5 spondylolysis, whose age, sex, and surgical level were matched.

Results: A total of 655 patients (80.7%) with complete data were considered eligible for the study. MED was performed at L4/5 and L5/S1 in 338 and 317 patients, respectively. A total of 20 patients (3.1%) had concomitant L5 spondylolysis and disc herniation at L4/5 (9 patients) or L5S1 (11 patients). As we compared each outcome of the 20 patients having L5 spondylolysis with 40 matched patients without L5 spondylosis, there were no significant differences in preoperative or postoperative outcomes between the 2 groups, and no patient with spondylolysis had undergone additional surgery during the mean follow-up period of 24 months.

Conclusions: MED demonstrated good surgical results regardless of the presence or absence of spondylolysis. In patients with sciatica with concomitant disc herniation and spondylolysis, but without spondylolisthesis, fusion surgery may not be always necessary.

Keywords

fusion, slip, spondylolisthesis, minimally invasive surgery, disc hernia, endoscope

Introduction

The prognosis for lumbar disc herniation (LDH) is generally considered to be good, and most patients with LDH do not require surgical intervention.[1] However, some may require surgical treatment when conservative treatment fails. Fortunately, surgical outcomes after lumbar discectomy for LDH are excellent.[2,3] Recently, less invasive endoscopic techniques have become popular, and excellent surgical outcomes have been reported.[4-6]

However, when patients present with instability, as evidenced by spondylolisthesis at the same level as disc herniation, fusion surgery must be considered. Conversely, it is

debatable whether fusion surgery as well as discectomy should be performed in patients who have disc herniation and spondylolysis without spondylolisthesis at the same or an adjacent

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lumbar segment. Surgical intervention with decompression alone may damage posterior supporting structures, leading to instability of the affected levels, particularly in patients with spondylolysis. A previous study of patients with disc herniation and spondylolysis at the same or adjacent level demonstrated inferior results after discectomy without fusion compared with decompression and direct repair of the isthmic spondylolysis.[7]

However, considering that most cases of lumbar spondylolysis are asymptomatic[8,9] and that minimally invasive decompression is associated with less slip progression in patients with degenerative spondylolisthesis,[10] we speculated whether surgery to repair spondylolysis may be unnecessary in patients with apparent disc herniation and sciatica. Microendoscopic discectomy (MED) is a minimally invasive technique for LDH that preserves posterior supporting muscles.[11,12] We therefore anticipated that MED would be sufficient to treat such patients if the chief complaint was leg pain (sciatica). The purpose of this study was to determine the effectiveness of MED for the treatment of patients with concomitant LDH and spondylolysis.

Methods

In this retrospective cohort study, we enrolled 811 patients who underwent MED for disc herniation at L4/5 or L5/S between March 2012 and December 2013. Patients who had spondylolisthesis (slip) or age-related lumbar spinal canal stenosis were not included. Among the 811 patients, 156 patients were excluded from the analysis because of incomplete data related to preoperative or postoperative patient-reported outcomes. Written informed consent was obtained from all patients, and the study was approved by an institutional review board at the authors' institution. The presence of spondylolysis at L5 was confirmed using preoperative computed tomography (CT). All patients with LDH underwent MED regardless of the presence of spondylolysis unless they presented with spondylolisthesis. The METRx endoscopic system (Medtronic Sofamor Danek, Memphis, TN, USA) was used for microendoscopic procedures. MED was performed as previously described. [13] Briefly, a skin incision of approximately 18 mm was performed 10 mm from the midline. The endoscopic system was then inserted into the lamina through an intramuscular paramedian approach. If necessary, patients underwent resection of the lamina and ligamentum flavum. The herniation and affected portion of the intervertebral disc were removed, thus completing nerve decompression. In all cases, the surgical procedure was completed without exploration of the isthmic pars defect.

We compared surgical outcomes between patients with and without spondylolysis at L5. Because the number of patients with spondylolysis was lower than those without spondylolysis, we first identified those with spondylolysis and then randomly selected patients matched for age, sex, and surgical level from among those without spondylolysis.

The assessment of pre- and postoperative clinical outcomes at 12 months included the use of numerical rating scales for pain in the lower back and leg and numbness in the legs. Patient assessment also involved use of the EuroQol 5 Dimension

Table 1. Demographic Data of Patients.

Total number of patients	655
Age, y, mean (range)	42 (16-69)
Male/female, n	501/154
Surgical level (number of patients)	
L4/5	338
L5/S	317
Number of patients with L5 spondylolysis	20 (3.1%)

(EQ5D), the Oswestry Disability Index (ODI), and the Roland Morris Disability Questionnaire (RDQ).

Statistical Analysis

Continuous variables were compared using the Student *t* test, and categorical variables were compared using Fisher's exact test. The power was calculated as a significance level of .05 using the actual number of samples, the difference between the mean values, and the variance. IBM SPSS Statistics software version 22.0 (IBM Corporation, Armonk, NY, USA) was used for all analyses. All P values were 2-sided, and a *P* value of <.05 was considered statistically significant.

Results

A total of 655 patients (80.7%) with complete data were eligible for the study. MED was performed for L4/5 in 338 patients and for L5/S1 in the remaining 317 patients. The study group comprised 501 men and 154 women. Mean age at surgery was 42 years (range, 15-69 years). Twenty patients (3.1%) had concomitant L5 spondylolysis and disc herniation at L4/5 (9 patients) or L5S1 (11 patients). This group included 18 men and 2 women, with a mean age of 47 years (range 23-67 years) (Table 1). Outcomes were compared between the group of 20 patients with L5 spondylolysis and the 40 patients without L5 spondylolysis, matched in terms of age, sex, and surgical level. Preoperative outcomes with/without spondylolysis were EQ5D, 0.53/0.55; ODI, 45.6/47.8; and RDQ, 13.3/12.6. Postoperative outcomes with/without spondylolysis were EQ5D, 0.86/0.85; ODI, 11.8/13.8; and RDQ, 2.1/3.1. Each group displayed significant improvement after surgery, but there were no significant differences in pre- or postoperative outcomes between the groups (Table 2) although the statistical power of the results ranged from 0.05 to 0.13. No patient with spondylolysis had undergone additional surgery during the mean follow-up period of 24 months (range, 12-60 months).

Case Example

A 47-year-old man presented with right leg pain and lower back pain. Despite conservative treatment for 5 months, the patient's condition had not improved, and he decided to undergo surgical intervention. Magnetic resonance imaging (MRI) revealed right posterolateral lumbar disc hernia at L4/5. CT revealed spondylolysis at L5. He had no instability at L5/S. The patient underwent MED for L4/5. Subsequently,

Table 2. Comparison of Demographic Data and Outcomes Between Patients With and Without L5 Spondylolysis.

Variable	With L5 Spondylolysis	Without L5 Spondylolysis	P
No. of patients	20	40	
Age, y, mean (SD)	47.4 (11.7)	47.5 (11.7)	.96
Sex, male/female, n	18/2	36/4	1.00
BMI, kg/m^2, mean (SD)	23.2 (3.4)	22.9 (2.2)	.71
Surgical level, n			1.00
L4/5	9	18	
L5/S	11	22	
Outcome scores, mean (SD)			
Numerical Rating Scale			
Pain (low back)			
Pre	4.9 (2.9)	4.7 (2.6)	.74
Post	1.8 (2.0)	2.0 (2.3)	.68
Pain (legs)			
Pre	6.8 (2.1)	7.0 (2.3)	.67
Post	1.5 (1.9)	1.6 (2.0)	.79
Dysesthesia (legs)			
Pre	5.1 (2.3)	5.3 (2.9)	.81
Post	1.8 (2.2)	1.9 (2.1)	.86
EQ5D			
Pre	0.53 (0.16)	0.55 (0.16)	.51
Post	0.86 (0.14)	0.85 (0.17)	.84
ODI			
Pre	45.6 (16.7)	47.8 (16.2)	.62
Post	11.8 (13.5)	13.8 (10.4)	.54
RDQ			
Pre	13.3 (4.4)	12.6 (6.1)	.67
Post	2.1 (3.7)	3.1 (4.7)	.45

Abbreviations: SD, standard deviation; BMI, body mass index; EQ5D, EuroQol 5-Dimension; ODI, Oswestry Disability Index; RDQ, Roland Morris Disability Questionnaire; pre, preoperative; post, postoperative.
Continuous variables were compared using the Student *t* test, and categorical variables were compared using Fisher's exact test.

the patient reported that the pain in his lower extremity and lower back significantly decreased postoperatively. Five years after surgery, there was no sign of recurrence of herniation or spondylolisthesis (Figure 1).

Discussion

We sought to clarify the effect of lumbar spondylolysis on surgical outcomes following MED. The use of MED was associated with good surgical results, regardless of the presence of spondylolysis. The incidence of L5 spondylolysis was 3.1% among patients with disc herniation at the same or adjacent levels, which was similar to levels reported for the general population.[14-16]

Only one report published to date has investigated the effect of spondylolysis on surgical outcomes after lumbar discectomy.[7] In that study, 48 patients underwent open discectomy alone, and 41 patients underwent open discectomy in combination with direct repair of a pars defect associated with spondylolysis. Among patients who underwent discectomy alone, the gap distance of the pars defect worsened postoperatively

and surgical outcomes were inferior. The authors speculated that muscle detachment from the posterior bony arch and bony resection of the posterior arch may have destabilized the affected lumbar segment and concluded that treatment of such patients should include direct repair, although the fusion rate after direct repair was only 59%. However, the patients included in the study were recruited from an armed force hospital and were males aged 20 to 40 years, indicating that daily activity levels differed from those observed in the general population. Furthermore, the method of surgical intervention used was not considered to be minimally invasive. The skin incision was 7.1 cm, similar to that used in the direct repair group (7.4 cm). We speculate that the use of invasive surgery was the reason why surgical outcomes gradually worsened during the follow-up period, which lasted 12 months. If the authors had used less invasive techniques of lumbar discectomy and caused less damage to the posterior supporting structure, superior surgical results may have been obtained. Indeed, it has been reported that minimally invasive decompression is associated with less slip progression in patients with lumbar canal stenosis and degenerative spondylolisthesis.[10]

MED, which was first reported in the late 1990s as a minimally invasive treatment for LDH, utilizes a 16-mm tubular retractor.[11,13] This technique is now used in cases of lumbar spinal canal stenosis, cervical radiculopathy, or myelopathy.[17-20] A previous report demonstrated that MED was associated with decreased incidence of surgical site infection and major complications,[6] probably because of decreased invasiveness. Recently, a less invasive, percutaneous full-endoscopic technique, which causes less trauma to the muscle, has attracted attention for the treatment of LDH.[21,22] However, because successful use of the microendoscopic technique requires a steep learning curve, microscopic (rather than microendoscopic) discectomy using a similar tubular retractor is more popular approach among spine surgeons. Nevertheless, any minimally invasive technique requires less extensive dissection of muscles and less exploration of the posterior bony arch than conventional open surgery. Although the extent of muscle detachment may lead to progressive instability in patients with spondylolysis, use of MED may minimize the incidence of postoperative instability. Indeed, the surgical procedure was completed in all cases without exploration of the isthmic pars defect. During the postoperative follow-up period, no patient showed enlargement of the pars defect gap distance. However, similar studies performed in the future should include a longer follow-up period.

In this study, the use of MED was associated with good patient-reported outcomes, regardless of the presence of spondylolysis. In other words, the symptoms of patients enrolled in this study were considered to be unrelated to the presence of spondylolysis. Although most patients with spondylolysis are asymptomatic,[8] they may present with low back pain.[23,24] When the origin of the pain is obvious, direct repair of the pars defect is an effective treatment.[25] However, when patients have simultaneous disc herniation and spondylolysis, it may be difficult to determine the true origin of symptoms. For instance,
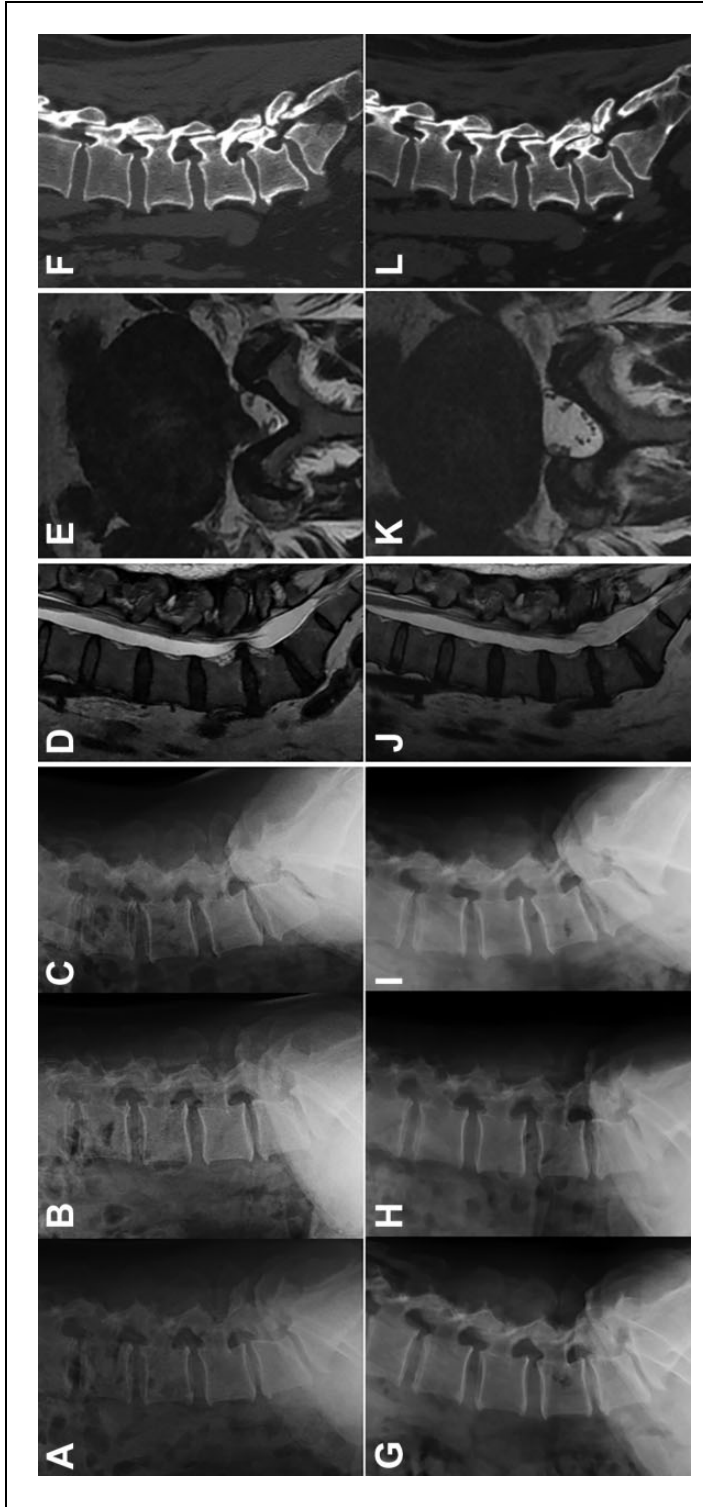
Figure 1. A 47-year-old man who had disc herniation at L4/5 and concomitant L5 spondylolysis underwent microendoscopic discectomy (MED) for L4/5. Five years after surgery, there was no sign of recurrence of herniation or spondylolisthesis. Preoperative lateral X-ray in a neutral (A), flexion (B), and extension (C) position, sagittal (D), and axial (E) images on T2-weighted magnetic resonance imaging (MRI), and sagittal image on computed tomography (CT) (F). Postoperative (5 years) lateral X-ray in a neutral (G), flexion (H), and extension (I) position, sagittal (J) and axial (K) images on T2-weighted MRI, and sagittal image on CT (L).

the symptoms associated with disc herniation at L4/5 may be similar to those associated with L5 spondylolysis because both can cause low back pain and L5 radiculopathy. However, sciatica arising from an entrapment at the isthmic bony defect is extremely rare in patients without spondylolisthesis.[23,26-28] In the present study, 9 patients had disc herniation at L4/5. All had radiating pain in their legs and positive results on the sciatic stretch test, although sciatic nerve stretch test is not always positive in patients with lumbar disc herniation.[29] When these results were evaluated in conjunction with MRI findings, it was possible to determine that disc herniation was the primary cause of the patient's pain, although the possibility that L5 spondylolysis contributed to the pain experienced by the patient could not be ignored. Fortunately, all patients displayed improvement of their symptoms postoperatively.

In this study, the incidence of L5 spondylolysis was 3.1%, which was compatible with past reports for the general population.[14-16] We first expected the incidence of spondylolysis to be higher in patients with disc herniation because the existence of spondylolysis may cause disc degeneration.[30] Considering that patients undergoing fusion surgery for spondylolisthesis at L5/S1 owing to L5 spondylolysis were not included in this study, the number of patients who had disc degeneration, including disc herniation associated with L5 spondylolysis may have been underestimated. Nevertheless, it is not possible to determine whether L5 spondylolysis affected the onset of disc herniation in the patients enrolled in this study. Because the existence of L5 spondylolysis did not significantly affect surgical outcomes, we assume that L5 spondylolysis did not drastically affect the onset of disc herniation in most patients studied. Furthermore, because the incidence of progressive slip in adult patients with spondylolysis is relatively rare,[31,32] the probability that the patients in this study will undergo progressive spondylolisthesis is relatively low if the posterior supporting sculpture is well preserved. However, evidently, in patients whose symptoms are atypical of those caused by disc herniation (ie, only low back pain without tension sign in the leg), spondylolysis may be the primary cause of the patient's symptoms, and fusion surgery should be initially considered.

There are several limitations to this study. First, owing to the retrospective nature of this study, the number of patients with spondylolysis was relatively small, the results might have been biases. Indeed, the statistical power of the results was very weak in this study. Second, we did not compare surgical outcomes with those observed after fusion surgery, such as direct repair of the pars defect. Although symptoms often improve after discectomy, low back pain may not be relieved in some patients with spondylolysis. Physicians should inform patients of this possibility before surgery. Furthermore, initial fusion surgery should be considered for patients whose chief complaint is low back pain that is relieved by local injection to the pars defect. Third, the follow-up period may not have been sufficient. It was not possible to determine whether newly developed spondylolisthesis, which can occur several years after discectomy, was a result of surgical intervention or unrelated to discectomy. However, because the incidence of progressive slip is relatively rare in adult patients with spondylolysis,[10] we speculate that the probability of progressive spondylolisthesis will be considerably low if the posterior supporting sculpture is well preserved. Nevertheless, patients should be informed of the possibility of future spondylolisthesis, even if short-term surgical outcomes following discectomy are excellent.

Conclusion

MED demonstrated good surgical results, regardless of the presence of spondylolysis. In patients with sciatica with concomitant disc herniation and spondylolysis but without spondylolisthesis, fusion surgery is not always necessary. With preservation of posterior supporting muscles without exploring the pars defect, aggravation of the spondylolysis may be prevented.

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