



Research Article

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Recurrent Lumbar Disc Herniation after Microendoscopic Discectomy

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Abstract

Introduction: The purpose of this study was to investigate the incidence and risk factors of recurrent lumbar disc herniation (LDH) after microendoscopic discectomy (MED).

Methods: The subjects were 210 patients who underwent MED for LDH performed by the same operator at our hospital. There were 132 male and 78 female patients. The treated level was L3/4 in 6 patients, L4/5 in 88, and L5/S in 116. The mean duration of postoperative follow-up was 72.0 ± 36.4 months. The age, sex, BMI, level of LDH, type of LDH, smoking habit, diabetes mellitus (DM), and learning curve of the surgeon were subjected to multiple logistic regression analysis to identify risk factors for recurrence.

Results: The recurrence rate was 8.58%, and the mean time to recurrence was 24.18 months. Of the 18 patients, 4 required reoperation and the remaining 14 patients received conservative treatment. On multiple logistic regression analysis, none of the examined factors—age, sex, BMI, level of the LDH, type of herniation, smoking habit, past history of DM, and surgical experience of the operator—were a significant risk factor for recurrence.

Conclusion: The recurrence rate was 8.58%, which is comparable with that of open discectomy. Many cases of recurrence occurred relatively early after surgery. Recurrence was seen in 6 of 18 patients within 6 months after surgery, but the mean time was about 2 years. The factors responsible for recurrence were unclear.

Keywords

Microendoscopic discectomy; Recurrence; Risk factor

Introduction

Discectomy for Lumbar disc herniation (LDH) is useful for sciatica patients who do not respond to conservative treatment. Open discectomy (OD) is the gold standard and the outcomes are mostly favorable, although it depends on the evaluation method [1-4]. However, reoperation is not uncommon for conditions such as recurrent herniation, new herniation at a different level, postoperative scar, postoperative hematoma, infection, facet syndrome, secondary spinal canal stenosis, and intervertebral instability. Recurrent herniation is the most common reason for reoperation, and the reported incidence is 5-11% [5-7]. Reasons for the variation in the

reported recurrent herniation rates are inconsistency in the definition of recurrent herniation, variations in treatment, and varying duration of observation of the disease course.

Microdiscectomy (MD) became popular after establishment of the OD, and microendoscopic discectomy (MED) and Percutaneous endoscopic lumbar discectomy (PELD) are now becoming widespread as non-invasive surgeries that facilitate early rehabilitation. Despite these procedural advancements, reoperation is still unavoidable for conditions that require reoperation, including recurrent herniation. The aim of the present study was to investigate the incidence of postoperative recurrent herniation and identify risk factors of recurrence in MED-treated patients.

Materials and Methods

This study was performing according to a protocol approved by the Institutional Review Board (IRB) of Toho University School of Medicine. Informed consent was obtained from all patients. The subjects were 210 patients who underwent MED for disc herniation after 2000 at our hospital. MRI was performed in all patients, and disc herniation was diagnosed based on MRI findings in addition to clinical symptoms. Patients with herniation at the level consistent with radicular symptoms were selected. When hernia was absent on MRI and only narrowing of the lateral recess was noted, the patient was diagnosed with spondylotic radiculopathy and excluded from the study.

MED was performed by the same operator. Patients with a past history of lumbar surgery, those undergoing reoperation for herniation, those requiring surgery for two intervertebral segments, and those requiring open conversion were excluded from the study. A total of 132 male and 78 female patients were examined. The mean age at the time of surgery was 40.3 ± 15.6 years. The treated level was L3/4 in 6 patients, L4/5 in 88, and L5/S in 116. The type of herniation was protrusion (type P) in 94 patients, subligamentous extrusion (Type SE) in 68, transligamentous extrusion (Type TE) in 29, and sequestration (Type S) in 19. The mean duration of postoperative follow-up was 72.0 ± 36.4 months (range, 7-144 months).

No drain was inserted in 87 patients while a suction drain was placed for 24-48 hours postoperatively in the remaining patients.

For the disc resection procedure, limited disc removal (LD) i.e., herniotomy was performed in all patients and aggressive removal of the whole disc (aggressive discectomy, AD) was not required. Patients wore a corset after surgery and were encouraged to mobilize the following day. Exercise and heavy labor were prohibited for three months.

Recurrent herniation was defined as reappearance of preoperative symptoms after the absence of symptoms for at least 1 week, and required MRI confirmation of disc herniation at the same level. Age [8,9], sex [8,9], BMI, level of the herniated disc, type of herniation [10], smoking [11], past history of diabetes mellitus (DM) [12], and surgical experience of the operator were subjected to multiple logistic analysis to identify factors associated with recurrence. The surgical experience of the operator was assessed by determining the number of operated patients; the following 3 categories were used: 1-50, 51-100, and > 100 patients.

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Table 1: Evaluation of the relationship between the response variable of recurrence and explanatory variables.

Explanatory variable	Association test method	P-value	Judgement
Sex	Fisher's exact test	0.6111	
BMI	Fisher's exact test	0.4922	
All types	Chi-square test	0.1935	
Type SE	Fisher's exact test	1.0000	
Type P	Fisher's exact test	0.6308	
Type TE	Fisher's exact test	0.2717	
Type S	Fisher's exact test	0.3812	
Smoking habit	Fisher's exact test	1.0000	
Age	Fisher's exact test	0.2546	
Level	Mann-Whitney U-test	0.0401	*
DM	Fisher's exact test	1.0000	
Number of patients	Mann-Whitney U-test	0.6560	

*p value of less than 0.05 was considered statistically significant.

Table 2: Univariate logistic analysis.

Explanatory variable	p value	Judgement	Odds ratio	95% confidence interval	
			Estimate	Lower limit	Upper limit
Level	0.0502		3.04	1.00	9.27
Type TE	0.082		2.69	0.88	8.22
Age	0.256		0.98	0.95	1.01
BMI	0.490		1.05	0.91	1.21
Sex	0.504		1.39	0.53	3.70
Type P	0.601		0.77	0.29	2.07
Number of cases	0.733		0.90	0.51	1.61
Smoking habit	0.907		1.06	0.39	2.86
Type SE	0.928		1.05	0.38	2.92
Type S	0.999		<0.01	<0.01	>999.99
DM	0.999		<0.01	<0.01	>999.99

*p value of less than 0.05 was considered statistically significant.

The association between the response variable of recurrence and explanatory variables was investigated. Univariate logistic analysis was performed to identify risk factors associated with recurrence. Multiple logistic analysis was then performed to examine seven explanatory variables (age, sex, BMI, level of the herniated disc, number of operated patients, Type TE, Type P) after excluding four variables with p-values exceeding 0.9 (smoking, Type SE, Type S, and DM).

Statistical analysis was performed using Excel Statistics 2008 (Social Survey Research Information Co., Ltd, Japan) and IBM SPSS Statistics Version 19 (IBM JAPAN Ltd., Japan). $P < 0.05$ was regarded as statistically significant.

Results

The recurrence rate was 8.58% (18 of 210 patients). Recurrence occurred within 3 and 6 months in 5 and 1 patient, respectively, while it occurred within 1 year in 2, after 1-2 years in 4, and after 3 years in 6 patients. The mean time to recurrence was 24.18 months (range, 1 week-6 years). Of the 18 patients with recurrence, 4 required reoperation while the remaining 14 patients received conservative treatment.

Analysis of the relationship between the response variable of recurrence and explanatory variables revealed that the level of the herniated disc had a p-value of 0.0401, which suggested an association between this factor and recurrence (Table 1); however, it did not reach

statistical significance ($p = 0.0502$) on univariate logistic analysis (Table 2). Multiple logistic analysis was performed to examine seven explanatory variables (age, sex, BMI, level of the herniated disc, number of operated patients, Type TE and Type P) after excluding four with p-values exceeding 0.9 (smoking, Type SE, Type S and DM). None of the variables—age [8,9], sex [8,9], BMI, level of the herniated disc, type of herniation [10], smoking [11], past history of DM [12], and surgical experience of the operator were significant risk factors for recurrence (Table 3).

A total of five patients (2.38%, 5/210) experienced dural tears, but repairs were not necessary because all cases were pin hole injuries. No nerve root injury occurred during surgery. Postoperative infection occurred in 0.95% (2 of 210 patients) of patients; one resolved after percutaneous nucleotomy and antibiotics while the other resolved after oral antibiotics alone. The causative bacterium was *Staphylococcus epidermidis* in the former case while the causative bacterium was unknown in the latter case because the patient refused percutaneous nucleotomy. Postoperative symptomatic hematoma developed in 0.48% (1 of 210 patients) of cases and required an endoscopic reoperation. In this case, cauda equina symptoms developed immediately after the initial surgery despite placement of a drain, thus requiring rapid evacuation of the hematoma using an endoscope. Poor drainage due to inappropriate drain insertion may have caused the hematoma.

Reoperation was required for 4 of 18 cases of recurrent herniation, 1 postoperative infection, and 1 postoperative hematoma. Therefore, the reoperation rate was 2.86% (6 of 210 patients).

Discussion

MED has gained widespread acceptance as minimally invasive surgery (MIS) for lumbar disc herniation in Japan. However, Teli et al. [13] reported a high incidence of complications such as dural tear, nerve root injury, and recurrent herniation after MED compared with OD and MED. The authors attributed it to difficulty in judging the depth of the surgical field because the images were two-dimensional. The cost of MED was also noted to be higher than those of OD and MD.

Cheng et al. [14] reported that the incidence of recurrent herniation was highest in PELD, followed by MED and OD, whereas the time to recurrence was longest for the OD, followed by MED and PELD. MIS including MED and PELD is performed based on two-dimensional images, and excision of residual or hidden fragments is difficult because of the limited operative field. The authors considered this as a possible reason for the higher recurrence in MIS procedures, similar to the reason proposed by Teli et al. [13]. LD is frequently employed in endoscopic discectomy, but Mc Girt et al. [15] reported that the recurrence rate was higher after LD than after AD. They also reported that postoperative lumbar and leg pain recurred more frequently after AD after ≥ 2 years of follow-up. However, in a nationwide cohort study reported by Kim et al. [16] in which fusion, laminectomy, open discectomy, endoscopic discectomy and nucleolysis for lumbar disc herniation were compared, the reoperation rates were found to be 13.8% and 12.4% for open and endoscopic discectomy, respectively. This finding was based on evaluation of either open or endoscopic discectomy as the initial surgery for lumbar disc herniation. Since the reported outcomes of lumbar disc herniation treated with MIS procedures have been inconsistent, we investigated the surgical outcomes of patients treated in our institution. Our findings revealed a recurrence rate of 8.58%, which is comparable with that after open discectomy [5-7].

Table 3: Multiple logistic analysis of seven variables.

Explanatory variable	Partial regression coefficient	Standard partial regression coefficient	p value	Judgement	Odds ratio	95% confidence interval	
						Lower limit	Upper limit
Age	-0.0224	-0.3512	0.2843		0.9778	0.9386	1.0188
Sex	0.4652	0.2253	0.3809		1.5923	0.5626	4.5068
BMI	0.0824	0.2769	0.2585		1.0859	0.9412	1.2529
Type P	0.2304	0.1148	0.7171		1.2591	0.3621	4.3781
TypeTE	1.1590	0.4008	0.0871		3.1867	0.8449	12.0202
Level	1.0551	0.5856	0.0727		2.8723	0.9074	9.0926
Number of cases	0.0425	0.0351	0.9057		1.0434	0.5169	2.1062
Constant	-6.8398		0.0113	*			

*p value of less than 0.05 was considered statistically significant.

Recurrence occurred relatively early after surgery in many cases, as was seen in other studies [17]. Recurrence occurred within 6 months after surgery in 6 of the 18 cases, but the mean time was about 2 years. The reoperation rate was 2.86% (6 of 210 patients), which was lower than those in previous reports. The reoperation rate was reduced because 14 of the 18 recurrent cases responded to conservative treatment. In the initial surgery of patients with recurrent herniation, the posterior longitudinal ligament had been incised or a protrusion perforating the posterior longitudinal ligament had been excised. Therefore, blood vessels may have invaded the recurrent herniated tissue. Recurrent herniation may spontaneously resolve in many cases if pain can be controlled, and not all cases require surgical treatment. As described above, the definition of recurrent herniation is inconsistent and the indication for surgery is variable including the timing of surgery, and these may markedly influence the incidence of recurrence and reoperation rate. We performed MRI in all patients with recurrence of symptoms, which may have increased the reported recurrence rate. If MRI had not been performed for cases in which conservative treatment was effective and resolved the symptoms, symptomatic cases would not be included in the determination of recurrent herniation, which may result in a lower recurrence rate.

The age [8,9], sex [8,9], BMI, level of the herniated disc, type of herniation [10], smoking habit [11], past history of DM [12], and surgical experience of the operator were possible risk factors for recurrence, but none were significantly associated with recurrence, which is consistent with the finding by Hakkinen et al. [18].

A bright and wide visual field comparable with those in open discectomy and MD is possible in MED because a 25° oblique-viewing endoscope is used, the camera is present in the wound and is not obstructed by surgical tools or the operator's hand, and the light source is adjustable.

Despite the two-dimensionality of the images and narrowness of the working space in MIS, the removal of residual fragments should be easy if the preoperative imaging is examined closely, since the cylindrical retractor insertion angle and camera position can be readily changed. Surgical skill in the procedure can be acquired by performing open discectomy and receiving appropriate training. The outcomes of endoscopic surgeries such as MED and PELD are markedly influenced by the operator's skill. For discectomy, AD may be advantageous in reducing the recurrence rate, but LD may inhibit disc degeneration to a greater degree and prevent recurrence of lumbar and leg pains.

As postoperative pain is mild, excessive exercise and early return to work are possible causes of recurrence after MIS in Japan [16].

To reduce the recurrence rate, it is necessary to explain potential complications and postoperative restriction of work and exercise to patients before the surgery.

Several study limitations warrant mention. First, comparison with open discectomy could not be performed because MED has been performed as the initial surgery for disc herniation at our hospital since 2000. Second, the indication for surgery, observation of the clinical course, and evaluation of outcomes were done by the same operator, so investigator bias may have resulted. However, the intermediate-term outcomes of MED were favorable. In addition, no risk factor for recurrence after MED was identified statistically.

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