

## Clinical Article

# Surgical versus Conservative Treatment for Lumbar Disc Herniation with Motor Weakness

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**Objective :** The aim of this study is to assess outcomes during first one year for patients with severe motor weakness caused by lumbar disc herniation that underwent surgical or nonsurgical treatment.

**Methods :** The 46 patients with motor weakness because of lumbar disc herniation who were treated at neurosurgical department and rehabilitation in our hospital from 2006 to 2010, retrospectively. Each group had 26 surgical treatments and 20 conservative treatments. We followed up 1, 3, 6 months and 12 month and monitored a Visual Analogue rating Scale (VAS) of back and leg pain, Oswestry Disability Index (ODI) and degree of motor weakness. We analyzed the differences between surgical and nonsurgical groups using Mann-Whitney U test and repeat measure ANOVA in each follow-up periods.

**Results :** In the recovery of motor weakness, surgical treatment uncovered a rapid functional recovery in the early periods ( $p=0.003$ ) and no difference between groups at the end of follow-up period was found ( $p>0.05$ ). In VAS of back and leg, the interaction between time and group was not found ( $p>0.05$ ) and there was no difference between groups ( $p>0.05$ ). In ODI, the interaction between time and group was not found ( $p>0.05$ ) and there was no difference between groups ( $p>0.05$ ).

**Conclusion :** Surgical treatment for motor weakness caused by herniated intervertebral disc resulted in a rapid recovery in the short-term period, especially 1 month. We think early and proper surgical treatment in a case of motor weakness from disc herniation could be a good way for providing a chance for rapid alleviation.

**Key Words :** Lumbar Region · Disc · Herniation · Surgery · Weakness.

## INTRODUCTION

Several studies had compared the difference between surgical and nonsurgical treatment for patients with herniated disc, but the baseline differences between their groups or small sample sizes or lack of validated outcome measures in these studies limits to get an evidence-based conclusions that is regarded as to the optimal treatment.

The peak incidences of lumbar disc herniation are in the third and fifth decades. Fortunately, only 3% to 6% of lumbosacral disc herniations become symptomatic<sup>9,12,19,24</sup> and management of lumbar disc herniation has a wide range of variable modality. Patients are commonly treated in primary care, but a small proportion is referred to secondary care and may eventually undergo surgery when a related symptom continues for at least 6

weeks. Conservative treatment is primarily aimed at pain reduction, by either analgesics or decreasing pressure on the nerve root without a conventional surgery. There seems to be a consensus that surgery is indicated in carefully selected patients with severe sciatica or serious or progressive neurologic deficits and image demonstrations correlating with the patient's examination findings<sup>15</sup>.

There are many previous articles that announced several modalities for treating motor weakness caused by lumbar disc herniation, but few randomized controlled trials that had compared the efficacy of one treatment over another treatment except cross-over treatment<sup>15</sup>. In this study, we excluded patients who underwent with a cross-over treatment. The objective of this study is to analyze the effectiveness of surgery over conservative treatment for patients who present motor weakness caused by

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lumbar disc herniation.

## MATERIALS AND METHODS

### Patient population

Fifty-five patients with motor weakness caused by a lumbar disc herniation from 2006 to 2010 were participated in this study. We confirmed that all herniated disc lesions led to the patient's symptoms by an image study using magnetic resonance image (MRI). In this study, we included patients who underwent surgery or conservative management for motor deficit resulted from lumbar disc herniation. However, the patients with the following history were excluded : prior lumbar spine surgery, cauda equina syndrome, developmental spine deformities, vertebral fractures, spine infection or tumor, inflammatory spondylopathy, pregnancy, or severe comorbid conditions. In addition, patients who were treated with both surgical and conservative treatments and disappeared were excluded. The 46 patients were included finally and divided into two groups. One group included 26 patients who underwent surgical treatment and another group consisted of 20 patients who didn't get a surgical treatment but only conservative treatment. The characteristic of patients were presented in Table 1.

### Radiological classification

The herniation types in the patients on this study were divided into subligamentous, transligamentous and sequestered herniation. Subligamentous herniation implies that the displaced nuclear material is still confined by the outermost fibers of the annulus. The disc herniation has traveled up behind the vertebral body above, or down behind the vertebral body below. Transligamentous herniation is that part of the displaced nuclear material has burst through the posterior fibers of the annulus and the PLL to lie in the spinal canal. However, there is still a connection between the extruded discal material and the disc space cavity. Sequestered herniation notes nuclear material has not only ruptured through the annular-PLL complex, it has completely separated from the nuclear cavity, and the discal fragment lies free in the spinal canal.

The herniation zones on an axial view in the patients on this study were divided into the central, subarticular and foraminal herniation. Central herniation implies that it has its thickest part of displaced nuclear material at the center of spinal canal from disc space. In this region, the herniated disc usually deviated to the left or right from the midline. Foraminal zone is defined as the space through neural foramen from medial to lateral margin of the pedicle structure, and lastly, subarticular zone is located between central and foraminal zone.

### Treatment modality

We performed only standard often microdiscectomy, which involved a surgical removal of the herniated disc materials by an operation. Other minimally invasive surgical techniques includ-

ing endoscopic or tubular-retracted operation were excluded.

The conservative treatment group from other department in our center was received epidural steroid injection, selective nerve root block, active physical therapy and other non-operative methods.

### Outcome measures

We monitored a Visual Analogue Rating Scale (VAS) of back and leg pain, Oswestry Disability Index (ODI) and degree of motor weakness on 1, 3, 6 months and 1-year.

VAS is a measurement instrument that tries to measure a characteristic or attitude that is believed to range across a continuum of values and cannot easily be directly measured. Operationally, a VAS is usually a horizontal line, 100 mm in length, anchored by word descriptors at each end. The patient marks on the line the point that they feel represents their perception of their current state (degree of pain). The VAS score is determined by measuring in millimeters from the end of the line on the left hand to the point that the patient marks<sup>22</sup>.

ODI is the most commonly used outcome measure for low back pain. Patient-completed questionnaire that gives a subjective percentage score of level of function (disability) in activities of daily living in those rehabilitating from low back pain. There are 10 items (pain intensity, personal care, lifting, sitting, standing, sleeping, social life, traveling, changing degree of pain). The questions are designed in a way that to realize how the back or leg pain is affecting the patient's ability to manage in everyday life<sup>3,10</sup>.

The degree of weakness was estimated by Medical Research Council Scale for Muscle Strength<sup>6</sup>.

### Statistical analysis

Data analysis was performed using SPSS Version 20.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were obtained to determine the influences of each group's clinical feature to results and  $\chi^2$  test, exact  $\chi^2$  test and t-test were conducted to assess the overall differences between groups. We used Mann-Whitney U test to analyze the difference by variables between groups at each designated follow-up times and repeated measure ANOVA (RM-ANOVA) was used to found an interaction between time and group by variables. The results were considered significant at  $p < 0.05$ .

## RESULTS

### Patient characteristics

The patient's clinical characteristics are presented in Table 1. The mean age of all participants were 48.6 (surgery : 50.8, non-surgery : 43.9) years old and the ratio of male and female was 2.83 to 1 (male : 34, female : 12). The most common disc herniation level, disc herniation type and disc location were L4-5, transligamentous type and subarticular zone. There were no statistically significant differences on the distribution in disc herniation level, type and location between two groups ( $p > 0.05$ ).

## Outcomes

### Motor recovery

The assessment of differences in motor recovery between two groups was performed using a Mann-Whitney U test and RM-ANOVA. The effect of treatment type at each monitoring point of follow-up period are presented in Table 2, and the interaction between time course and group are pre-sented in Fig. 1.

There were statistically significant differences at the 1 ( $p=0.031$ ), 3 ( $p=0.014$ ) and 6 ( $p=0.002$ ) month monitoring point of follow-up period between two groups and significant interaction between time and group ( $p=0.009$ ). The results reveal that a rapid motor recovery could be obtained with surgical treatment at the early stage of follow-up period, even though the degree of motor recovery at 12th month has no significant difference.

### VAS score on back

The assessment of differences in VAS score on back between two groups was performed using a Mann-Whitney U test and RM-ANOVA. The effect of treatment type at each monitoring point of follow-up period are presented in Table 3, and the interaction between time and group are presented in Fig. 2.

There were no statistically significant differences at any monitoring point of follow-up period between two groups and interaction between time and groups. However, we could not find out whether there was a tendency of rapid decrease of pain score in a surgical group within first 1 month postoperatively.

### VAS score on leg

The assessment of differences in VAS score on leg between two groups was performed using a Mann-Whitney U test and RM-ANOVA. The effect of treatment type at each monitoring point of follow-up period are presented in Table 4, and the interaction between time and group are presented in Fig. 3.

There were no statistically significant differences at any monitoring point of follow-up period between two groups and interaction between time and groups. However, we can find out there was a tendency of rapid decrease of pain score in a surgical group within first 1 month postoperatively.

### ODI score

The assessment of differences in ODI score between two groups

**Table 1.** Patient baseline demographic characteristics and clinical findings

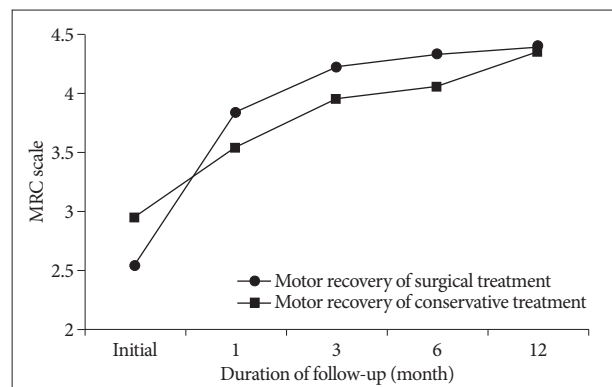
Variables	Number of patients (%)		p value*
	Surgical treatment (n=26)	Conservative treatment (n=20)	
Sex			0.227
Male	21(80.8)	13 (65)	
Female	5 (19.2)	7 (35)	
Age	52.23±14.06	43.85±17.85	0.082
Herniation level			1.000
L3-4	1 (3.8)	0 (0)	
L4-5	21 (80.8)	17 (85)	
L5-S1	4 (15.3)	3 (15)	
Herniation type			0.429
Subligament	5 (19.2)	1 (5)	
Transligament	12 (46.1)	10 (50)	
Sequestered	9 (34.6)	9 (45)	
Herniation zone			0.854
Subarticular	19 (73)	16 (80)	
Central	6 (23)	3 (15)	
Foraminal	1 (3.8)	1 (5)	

\*p values were assessed using  $\chi^2$  test, exact  $\chi^2$  test and t-test

**Table 2.** Motor recovery after treatment

Duration	Surgical treatment	Conservative treatment	p value*
Initial	2.54	2.95	0.54
1 month	3.85	3.55	0.031
3 months	4.23	3.95	0.014
6 months	4.33	4.05	0.002
12 months	4.38	4.35	0.062

\*p values were assessed using Mann-Whitney U test between surgical and conservative treatment group in each follow-up period time



**Fig. 1.** There is statistically significant interaction between time and group ( $p<0.05$ ). The results reveal that a rapid motor recovery could be obtained with surgical treatment at the early stage of follow-up period, even though the degree of motor recovery at 12 months has no significant difference. MRC : Medical Research Council.

was performed using a Mann-Whitney U test and RM-ANOVA. The effect of treatment type at each monitoring point of follow-up period are presented in Table 5, and the interaction between time and group are presented in Fig. 4.

There were no statistically significant differences at any monitoring point of follow-up period between two groups and interaction between time and groups. The results reveal that ODI score was not affected by a sort of treatment during the follow-up period.

### DISCUSSION

For decades, the different recommendations and comparisons among surgical and conservative treatment for patients with

lumbar disc herniation were published. Patients with mild symptoms did well, regardless of the treatment. For those with moderate or severe symptoms, surgery may facilitate recovery and result in better outcomes compared with nonsurgical treatment<sup>1)</sup>. Also, some patients need surgical intervention due to the neurological deficit and prolonged or uncontrolled pain.

Weber<sup>5,28)</sup> estimated that one year after disease onset, about 25% of patients would need a surgery. The larger Maine Lumbar Spine Study showed that 15% of patients who initially received conservative treatment would undergo surgical inter-

vention within 3 months<sup>1,5)</sup>. However, the proper time of surgery after unsuccessful conservative treatment is controversial. Postacchini<sup>21)</sup> recommends considering surgery after 6 months of unsuccessful conservative treatment, Dvorak et al.<sup>8)</sup> after 4 months, Dauch et al.<sup>7)</sup> after 6 weeks, Hurme and Alaranta<sup>14)</sup> after 3 weeks, and Jönsson<sup>17)</sup> after “a certain amount of time”. Peul et al.<sup>20,27)</sup> randomly assigned 141 patients with sciatica to an early surgery (at a mean of 2.2 weeks) and 142 patients with same symptom to conservative management. Of those managed conservatively, 55 patients (38.7%) were converted to surgery after a mean of 18.7 weeks. They found that those patients who undertaken an early operation were relieved in their leg pain more quickly than another one with delayed operation.

Surgeons and patients should think about the economic issue. Three studies found surgical effect in the early postoperative period. This is relevant because a faster recovery rate could, besides the clinical benefit, have an economic advantage in a relatively young patient population<sup>15,20,27)</sup>. A cost effectiveness study

**Table 3.** VAS scores on back

Duration	Surgical treatment	Conservative treatment	p value*
Initial	4.17	3.4	0.545
1 month	1.46	1.51	0.746
3 months	1.12	1.1	0.981
6 months	1.29	1.44	0.747
12 months	0.67	0.43	0.635

\*p values were assessed using Mann-Whitney U test between surgical and conservative treatment group in each follow-up period time. VAS : Visual Analogue Rating Sale

**Table 4.** VAS score on leg

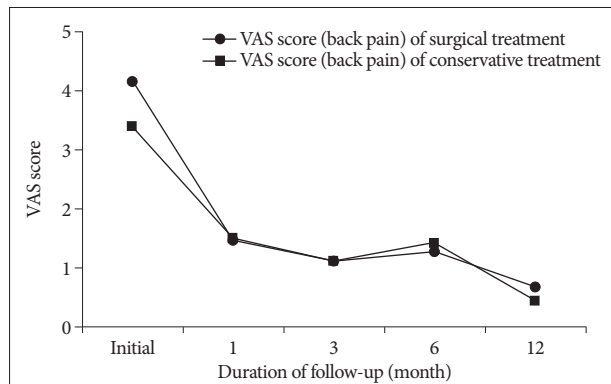
Duration	Surgical treatment	Conservative treatment	p value*
Initial	7.7	7.68	0.831
1 month	1.89	2.44	0.164
3 months	1.72	1.78	0.991
6 months	1.35	2.15	0.245
12 months	1.06	1.63	0.291

\*p values were assessed using Mann-Whitney U test between surgical and conservative treatment group in each follow-up period time. VAS : Visual Analogue Rating Sale

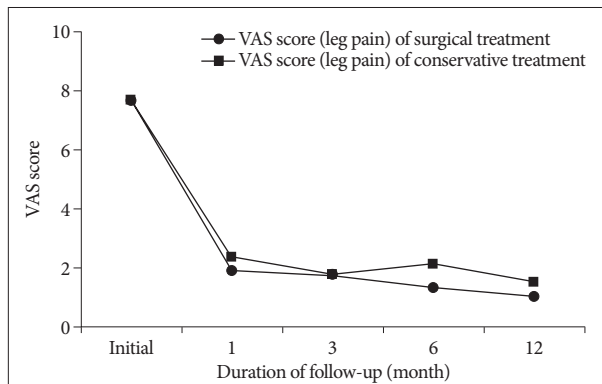
**Table 5.** ODI score

Duration	Surgical treatment	Conservative treatment	p value*
Initial	68.85	64.15	0.387
1 month	30.65	25.9	0.103
3 months	22.15	18.6	0.351
6 months	17.19	16.25	0.368
12 months	11.65	11.35	0.687

\*p values were assessed using Mann-Whitney U test between surgical and conservative treatment group in each follow-up period time. ODI : Oswestry Disability Index



**Fig. 2.** There is no statistically significant interaction between time and groups in VAS score on back ( $p > 0.05$ ). VAS : Visual Analogue Rating Sale.



**Fig. 3.** There is no statistically significant interaction between time and groups in VAS score on leg ( $p > 0.05$ ). VAS : Visual Analogue Rating Sale.

which was performed alongside the trial of Peul et al.<sup>15,20,27</sup> showed that surgical group was cost-effective with a willingness as per quality-adjusted life years.

Moreover, many studies have analyzed long-term outcomes of patients with sciatica caused by herniated lumbar disc<sup>1,13,28</sup>. In the Weber study<sup>1,28</sup>, good results were reported in 70.2% of patients who got a surgical modality as a first treatment after 4 years and 51.5% of those initially received conservative treatment. However, unfortunately this difference did not reveal a statistical significance, and there were similar improvement in the predominant pain symptom and functional status in long-term period.

There are various reasons that long-term outcomes of patients with a herniated lumbar disc are similar to surgical and conservative treatment. Several studies have reported the ratio of spontaneous regression of herniated disc. Recently, a large study was reported in 2006 by Autio et al.<sup>2,4,5</sup>, in which 68 of 160 enrolled patients (42.5%) documented by lumbar MRI revealed a diminished volume of herniated lumbar disc 2 months later since the occurrence of the disease. In the other studies, the occurrence rate of spontaneous regression of herniated lumbar disc was around 35-63% on average, during a period of 6 months to 1 year<sup>2,5,18,26</sup>. This phenomenon may be related to dehydration and/or shrinkage, retraction of herniated discs, and inflammation-related resorption of the herniated disc<sup>5,11,25</sup>.

In addition, radicular pain can often affect the patient's description of weakness and the findings on clinical examination, and thus, mimic muscle weakness, and the improvement of motor weakness could be shown in conservative treatment false-positively. From the reasons described as above, the newly accepted indication of non-operative management for patients with herniated disc is the absence of progressive neurological signs or cauda equine syndrome. Nevertheless, most patients who present with mild weakness will be tried with non-operative treatment. There are wide variety of non-operative treatment modalities: bed rest, lumbar support, oral analgesics, muscle relaxants, spinal manipulation, physiotherapy, behavioral therapy and epidural steroid injections<sup>16,20,23,24</sup>. Among these modality, bed rest is thought to reduce the pressure of the intervertebral disc over the nerve root, even though there is no definite evidence that this affects the natural history of radicular weakness<sup>23</sup>.

This study analyzed patients with motor weakness caused by a herniated lumbar disc that underwent either surgical or non-surgical treatment modality during 1 year retrospectively. The patients were treated surgically in this study had better outcomes than nonsurgical group at the early stage of follow-up period, even though the degree of motor recovery at 12th month has no significant difference. In addition, the improvement of pain symptom and functional status had similar outcomes between two groups. In this result, we can find out one important thing. On first 1 month, in terms of motor recovery, there is a more steep recovery in a surgical group compare to non-surgical group. Moreover, initial score in surgical group was worse than non-

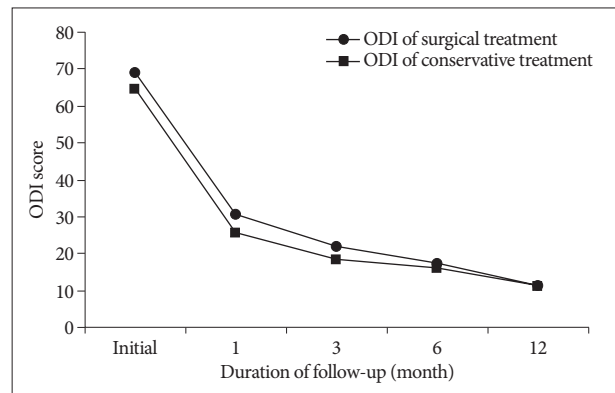


Fig. 4. There is no statistically significant interaction between time and groups in ODI score on back ( $p > 0.05$ ). ODI: Oswestry Disability Index.

surgical group. Fig. 1 shows similar slope on both group after 1 month and the same result in the end. In addition, there were also the alleviation for pain on back and leg from surgical modality, even if we can't find out statistical significant differences.

Nevertheless, surgical method could be a best choice in an early stage, there could be always unpredictable complications. In surgical complications, surgeon and patient need to understand better about a risk versus a benefit of surgical treatment. For example, sometimes conservative treatment can be a optional treatment in a patient with a tremendous risk for general anesthesia, bleeding tendency, when a patient are reluctant for surgery and so on. Because there is no difference between surgical and non-surgical group in a view of the long-term outcome despite there is still no absolute conclusion.

Lastly, there are several limitations originated from relatively small sample size on a statistical aspect, not enough follow-up period limited in 1 year and a risk from lack of consistency for measuring the symptom grade between the different departments.

## CONCLUSION

Surgical treatment showed more benefits on recovery of motor function in the short-term period, especially 1 month, compare to conservative one statistically. Although there was no statistically significance, we can also expect to obtain a rapid recovery on pain symptom with surgical modality within first one month postoperatively. We believe that early and proper surgical treatment in a case of motor weakness from disc herniation could be a good way for providing a chance for rapid alleviation.

However, there are several limitations in this study and further studies are required to get a more proper and reasonable consensus.

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