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.
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 spondylarthropathy, 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 sequestrated 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. Sequestrated 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 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 medical 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 including 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 marks22.

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 life23,24.

The degree of weakness was estimated by Medical Research Council Scale for Muscle Strength25.

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 χ2 test, exact χ2 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, nonsurgery: 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 and group are presented 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 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.

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Table 1. Patient baseline demographic characteristics and clinical findings

| Variables          | Surgical treatment (n=26) | Conservative treatment (n=20) | p value* |
|--------------------|--------------------------|-------------------------------|----------|
| Sex                |                          |                               |          |
| 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   |                          |                               |          |
| L3-4               | 1 (3.8)                  | 0 (0)                         | 1.000    |
| 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)                       |          |
| Sequestrated       | 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 χ² test, exact χ² 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.
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. Also, some patients need surgical intervention due to the neurological deficit and prolonged or uncontrolled pain. Weber 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 intervention within 3 months. However, the proper time of surgery after unsuccessful conservative treatment is controversial. Postacchini recommends considering surgery after 6 months of unsuccessful conservative treatment, Dvorak et al. after 4 months, Dauch et al. after 6 weeks, Hurme and Alaranta after 3 weeks, and Jönsson after "a certain amount of time". Peul et al. 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. 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.](image1)

![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.](image2)
which was performed alongside the trial of Peul et al.\textsuperscript{15,20,27} 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\textsuperscript{1,13,28}. In the Weber study\textsuperscript{1,28}, 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.\textsuperscript{2,4,5,23}, 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\textsuperscript{5,18,26}. This phenomenon may be related to dehydration and/or shrinkage, retraction of herniated discs, and inflammation-related resorption of the herniated disc\textsuperscript{5,11,25}.

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 equina 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\textsuperscript{6,20,22,23}. 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\textsuperscript{29}.

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-
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 an 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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