Fragmentectomy versus Conventional Microdiscectomy in Single-Level Lumbar Disc Herniations: Comparison of Clinical Results and Recurrence Rates

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Objective: This retrospective study aimed to compare clinical outcomes in terms of pain relief and recurrence rate between fragmentectomies and conventional microdiscectomies in patients with lumbar disc herniation (LDH).

Methods: Between January 2008 and May 2011, a total of 175 patients met the inclusion criteria of this study. The visual analogue scale (VAS) scores of back and radicular pains were recorded before surgery, 2 and 6 weeks after surgery. Recurrence was defined when a patient had the same pattern of preoperative symptoms and was confirmed with magnetic resonance imaging.

Results: Seventy-four patients (42.3%) were suitable for fragmentectomy, and 101 patients underwent conventional microdiscectomy. There were no significant differences in VAS scores between the fragmentectomy and conventional microdiscectomy groups 2 and 6 weeks after surgery. During the follow-up period, 3 patients (4.05%) in the fragmentectomy group and 7 patients (6.93%) in the conventional microdiscectomy group relapsed.

Conclusion: If patients are selected according to well-defined criteria, fragmentectomy can be a good surgical option for LDH, in the physiological aspect of preserving healthy intervertebral disc materials.

Key Words: Fragmentectomy · Microdiscectomy · Lumbar disc herniation · Clinical results · Recurrence rates.
most accurate expression. Conservative microdiscectomy is usually carried out for free-fragment LDH, which is sequestrated from the defect of the posterior longitudinal ligament (PLL). However, fragmentectomy can also be performed in the contained-fragment LDH which has intact PLL without sequestration. The difference between the fragmentectomy and conventional microdiscectomy is the removal or preservation of normal disc materials apart from already extruded discs. Fragmentectomy showed good success rates of greater than 90%, according to some studies. However, such results cause spinal surgeons to debate whether recurrent disc herniation would increase after fragmentectomy. Therefore, this retrospective study was conducted to compare the clinical outcomes of fragmentectomy and conventional microdiscectomy in patients with single-level LDH in terms of pain relief and recurrence rate.

**MATERIALS AND METHODS**

Between January 2008 and May 2011, a total of 397 consecutive patients underwent single-level lumbar microdiscectomy by the same surgeon at our institute. Of these patients, 175 met the inclusion criteria of our study having undergone either fragmentectomy or conventional microdiscectomy (Table 1).

This study included patients who had unilateral single-level canalicular LDH from L2 through S1 and whose radiographic confirmation of LDH corresponded to clinical signs and symptoms refractory to conservative treatment. Patients with free fragments as well as those with subligamentous herniation and transannular herniation were also included. Patients were excluded if they had 1) histories of previous lumbar spinal operations at any level, 2) foraminal or extraforaminal LDH, 3) bulging discs which were treated with bipolar thermocoagulation, 4) combined spinal instability, and 5) postoperative infections or hematomas.

The visual analogue scale (VAS) scores of back and radicular pains were recorded before surgery, 2 and 6 weeks after surgery (Table 2). Although the mean follow-up duration was 23 months (range, 4-45 months), we did not include the VAS scores at the last follow-up in order to eliminate the influence of patients' environmental factors, especially occupational activities after the operation period.

The operating time from skin incision to skin closure was recorded for each patient. Recurrence was defined when a patient had the same pattern of preoperative symptoms and was confirmed with magnetic resonance imaging (MRI).

Decisive factors for performing either a fragmentectomy or conventional microdiscectomy were 1) the size of fibrous annular ring defect which was measured by a hook with 5-mm tip, 2) the presence of additional extrusion of nuclear materials during subannular probing with a hook, and 3) the stability of the fibrous annular ring, which was estimated by pressing against the PLL around the tear site with a hook. If there was no additional extrusion during compression, the fibrous annular ring was considered stable. These factors were examined not only in the lumbar kyphotic position with the Wilson frame but also in the lordotic position by releasing the Wilson frame and were identified repeatedly during the surgery. If the fibrous annular ring defect was less than 5 mm and there was no additional extrusion, the fibrous annular ring was considered stable.

### Table 1. Demographic and clinical characteristics of the fragmentectomy and conventional microdiscectomy groups

|                        | Fragmentectomy | Conventional microdiscectomy |
|------------------------|----------------|------------------------------|
| No. patients           | 74             | 101                          |
| Mean age (range)       | 48.3 years (18-69) | 42.9 years (19-68)          |
| Male : Female          | 40 : 34        | 60 : 41                      |
| Mean follow-up (range) | 22.3 months (4-45) | 23.8 months (4-45)          |
| Level of surgery       |                |                              |
| L2-L3                  | 1              | 2                            |
| L3-L4                  | 5              | 2                            |
| L4-L5                  | 40             | 49                           |
| L5-S1                  | 28             | 48                           |
| Relation to PLL        |                |                              |
| Subligamentous         | 11             | 21                           |
| Transligamentous       | 63             | 80                           |

No statistical difference found between groups in all categories listed. No.: number, PLL: posterior longitudinal ligament.

### Table 2. Comparison of clinical outcomes and reherination rates between the fragmentectomy and conventional microdiscectomy groups

|                        | Fragmentectomy (n=74) | Conventional microdiscectomy (n=101) | p-value |
|------------------------|-----------------------|--------------------------------------|---------|
| VAS scores             |                        |                                      |         |
| Preoperative           |                        |                                      |         |
| Back (SD)              | 3.23 (2.14)           | 3.17 (2.45)                          | 0.863   |
| Radicular (SD)         | 7.43 (1.62)           | 7.50 (1.71)                          | 0.778   |
| 2 weeks after surgery  |                        |                                      |         |
| Back (SD)              | 1.89 (0.79)           | 1.55 (0.97)                          | 0.428   |
| Radicular (SD)         | 2.49 (0.99)           | 2.26 (1.03)                          | 0.284   |
| 6 weeks after surgery  |                        |                                      |         |
| Back (SD)              | 0.99 (0.88)           | 1.07 (1.01)                          | 0.692   |
| Radicular (SD)         | 1.08 (1.06)           | 1.07 (1.22)                          | 0.777   |
| Recurrence             | 3 (4.05%)             | 7 (6.93%)                            | 1.000   |
| Mean operating time (range) | 70 min (60-85)     | 90 min (80-125)                      | <0.001  |

VAS: visual analogue scale, SD: standard deviation, min: minutes.

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trusion of nuclear materials from the annular defect during the compression of the PLL and subannular probing with a hook, we performed fragmentectomy. In case of subligamentous ruptured disc, we made an opening in the PLL with a laser (30C CO\(_2\) laser, Sharplan, FL, USA) and performed a fragmentectomy. Not in case of diffuse bulging discs which were treated with bipolar thermocoagulation, subligamentous ruptured discs had the detached disc fragments almost always. If no detached disc fragment was found through the PLL opening, the bulging area beneath the traversing nerve root was removed by piecemeal fashion, creating a large iatrogenic annulotomy.

The SPSS software package, version 12.0 (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses of the data.

RESULTS

Of the 175 patients who satisfied the study design, 74 (42.3%) were suitable for fragmentectomy and 101 (57.7%) underwent conventional microdiscectomy. The mean age of the patients was slightly older in the fragmentectomy group than in the conventional microdiscectomy group (Table 1). The mean postoperative follow-up durations of the fragmentectomy and conventional microdiscectomy groups were 22.3 and 23.8 months, respectively (range, 4-45 months). The most frequent level of surgery was L4/5 in both groups. The proportion of the subligamentous type to the transligamentous type was 14.9% (11 of 74) in the fragmentectomy group and 20.7% (21 of 101) in the conventional microdiscectomy group. The mean VAS scores of back and radicular pains before surgery were 3.23 and 7.43, respectively, in the fragmentectomy group and 3.17 and 7.50, respectively, in the conventional microdiscectomy group. There were no significant differences between the 2 groups (\(p=0.863, p=0.778\); t-test). At 2 weeks, the mean VAS scores of back and radicular pains in the fragmentectomy group were 1.89 and 2.49, respectively, and improved to 0.99 and 1.08, respectively, at 6 weeks. In the conventional microdiscectomy group, the mean VAS scores of back and radicular pains after surgery were 1.55 and 2.26, respectively, at 2 weeks, and improved to 1.07 and 1.07, respectively, at 6 weeks. There were no significant differences between the 2 groups in relief of back and radicular pains at 2 postoperative weeks (\(p=0.428\) for back pain, \(p=0.284\) for radicular pain) and 6 postoperative weeks (\(p=0.692\) for back pain, \(p=0.777\) for radicular pain). The 2 surgical methods were found to be similarly effective in pain relief (Fig. 1, 2).

During the follow-up period, 3 patients (4.05%) in the fragmentectomy group and 7 patients (6.93%) in the conventional microdiscectomy group relapsed (Table 2). Recurrence was defined as recurrent LDH at the same site of back or radicular pain as confirmed by MRI. All patients with recurrent LDH underwent revision surgery due to persistent pain despite the conservative treatment.

The mean operation times were 70 minutes (range, 60-85 minutes) in the fragmentectomy group and 90 minutes (range, 80-125 minutes) in the conventional microdiscectomy group. Because the disc space was not evacuated, the operation time for fragmentectomy was significantly reduced (\(p<0.001\)).

DISCUSSION

Traditionally, microdiscectomy-related neural decompression is conducted by excision of the herniated disc material, resection of as much disc materials as possible, and curettage of the endplates\(^{5,15}\). However, the amount of disc material which needs to be removed has been called into question. In fact, it is difficult to identify a distinct border between the rigid annulus fibrosus and the soft nucleus pulposus. Visualization of and instrument accessibility to the intervertebral disc space are limited. Furthermore, there is the possibility of the failed back syndrome related to diminished disc height\(^{5,6,13,14,15,17}\). Thus, we attempted to remove the normal disc materials as little as possible and eventually performed only fragmentectomy. If recurrence rates are not higher in the fragmentectomy group than in the con-
conventional microdiscectomy group, fragmentectomy will show
good results on account of maintaining the disc height. In line
with this thinking, several neurosurgeons, including Williams19)
have performed fragmentectomy according to their own crite-
ria. Kast et al.9) performed fragmentectomies when the fibrous
ring was stable without obvious bulging as measured by press-
ing against the fibrous ring with a dissector. They also reported
that patients with stable fibrous rings and small defects (3 mm
or less) had a good success rate. Fakouri et al.10) reported suc-
cessful sequestrectomies in patients who met their inclusion cri-
terias: the free disc fragment was localized posterior to the PLL
and the annular tear was up to 5 mm without significant bulg-
ing of the disc. This decision was made intraoperatively by as-
sessing the integrity of the annulus fibrosus and the PLL, but
the determinations were very subjective and dependent on each
surgeon’s experience. We performed fragmentectomies in pa-
tients who had a defect of the fibrous annular ring less than 5
mm and no additional extrusion of nuclear materials from the
annular defect during the compression of the PLL and during
subannular probing with a hook. Based on our results, it is
thought that the defect size of the annular band is more impor-
tant than that of the PLL. Carragee et al.3,4) reported that since a
large annular defect measuring >6 mm resulted in a recurrence
rate of 27.3%, such annular defects should require more aggres-
sive discectomies. In our study, fragmentectomies were per-
formed on patients with defects of the fibrous annular ring
measuring less than 5 mm. Additionally, the annular defect was
assessed by compression of the PLL around the annular defect
site not only in the lumbar kyphotic position with the Wilson
frame but also in the lordotic position by releasing the Wilson
frame. Our method has not been introduced yet in previous
studies of fragmentectomy. We were able to identify the addi-
tional extrusion of disc materials which has not been fully veri-
ﬁed in the lumbar kyphotic position at initial operation. It is
conceivable that this reconﬁrmation of additional disc extru-
sion by changing patient’s position will help reduce the recur-
rence rates.

In this study, there was no signiﬁcant difference in recurrence
rates between the fragmentectomy and the conventional micro-
discectomy groups. Kast et al.9) and Fakouri et al.10) reported a
lower recurrence rate of 5% in their sequestrectomy group than
the conventional microdiscectomy group. However Rogers13) re-
ported a reoperation rate of 21% in patients undergoing frag-
mentectomy, which is the highest rate in the literature. In con-
trast, Faulhauer and Manicke7) reported the lowest recurrence
rates of 2% in patients treated with sequestrectomy. In our study,
3 (4.05%) of the 74 patients in the fragmentectomy group
reverted, all of whom underwent reoperation such as conven-
tional microdiscectomy. Of course, there were more reoperated
patients who were not selected according to the exclusion criteria.
They underwent reoperation due to infections or postoperative
hematomas. Since these may have affected the VAS scores ob-
tained 2 and 6 weeks after surgery, we excluded these patients
from the study.

The mean recurrence time from the first operation was 4.7
months (range, 1-15 months). We could not determine wheth-
er the differences in recurrence rates were attributable to the
operative method or other factors. One of the reasons for this
difference may be that environmental factors, such as obesity,
occupational activities, and posture. Additional prospective
studies should be performed in these aspects as well as on the
correlation between the preservation of the normal disc materi-
als and the prevention of a series of disc degenerations.

In this study, we compared the VAS scores obtained 2 and 6
weeks after surgery. Patients who underwent fragmentectomy
less frequently complained of back pain the day after surgery
and ambulated more comfortably. However, there were no sig-
niﬁcant differences in VAS scores after surgery between the frag-
mentectomy and conventional microdiscectomy groups. Both
surgical methods showed a remarkable improvement in the
VAS scores for back and radicular pains.

The mean operation time was shorter in the fragmentectomy
group probably because the disc space was not evacuated. There-
fore, fragmentectomy may be a less invasive procedure with a
shorter operation time10. In addition, there is no risk of abdomi-
nal vascular and visceral injuries8,10).

CONCLUSION

From the results of this study, it is suggested that fragmentec-
tomy may not increase recurrence rates or cause signiﬁcant dif-
ferences in postoperative VAS scores of back and radicular pains.
If patients are selected according to well-deﬁned criteria, frag-
mentectomy can be a good surgical option for LDH in that
maintains the healthy intervertebral disc materials.

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