Clinical Results about More than 5 Years Follow-up after Open Discectomy

Jae-Wan Soh, M.D. *, Jae Chul Lee, M.D., Hyung-Mo Goo, M.D., Hae-Dong Jang, M.D and Byung-Joon Shin, M.D.
Department of Orthopaedic Surgery, Soonchunhyang University College of Medicine, Seoul, Korea
Department of Orthopaedic Surgery, Soonchunhyang University Cheonan Hospital, Korea *

Study Design: Retrospective study.
Objectives: We analyzed to verify clinical result and recurrence of long term follow-up after open lumbar discectomy.

Summary of Literature Review: There are many reports concerning the clinical result of open discectomy. However, long-term result is not frequently reported.

Materials and Methods: From 1989 to 2000, 289 patients underwent open discectomies. 142 patients who was followed more than 5 years were enrolled in this study. Follow-up rate, clinical outcome were analyzed as gender, age at the operation and operated level. Re-operation rate was analyzed as gender, age at the operation, operated level divided into same level-same side, same level-contralateral side and other level and the time at reoperation. Clinical outcomes were evaluated by Kim and Kim criteria.

Results: More than 5 years follow-up rate was 49.1%. Average follow-up period were 99.2 months. Clinically successful result was obtained in 75.4%, and it was not related with gender, age at the operation and operated level. Reoperations were needed in 21 patients(14.8%). Reoperation rate was not related with gender, age at the operation. Same level-same side reherniation were frequent before 6 months after first surgery, but other side and different level were similar more than 2 years after first surgery.

Conclusions: Our clinical result was acceptable(75.4%). Main cause of reoperations before 6 months after first surgery was recurrence at the same level and same side, but cause of reoperation more than 2 years after first surgery were herniation at the other side and different level increased with time.

Key Words: Lumbar spine, Herniated intervertebral disc, Open discectomy, Reoperation

INTRODUCTION

Although most symptoms of herniated disc are improved with conservative treatments, if cauda equina syndrome occurs or neurologic deficit progresses, and when the patient’ s daily life is severely restricted due to no improvements of symptoms from conservative treatment for a period of time, then surgical treatments are considered. Although as treatments for herniated disc, open discectomy and various procedures such as endoscopic discectomy and microscopic discectomy are being attempted and their results are reported.¹ They are still controversial, and conventional open discectomy is accepted as a standard procedure because numerous authors²⁻⁴ have proven the method as relatively a sound procedure. However open discectomy often requires reoperations due to problems of
postoperative back pain and recurrence of herniated disc, and there are only limited reports on thorough analyses of clinical results and reoperation rates associated with recurrence based on long-term follow-ups after open discectomies. Therefore, we report on the follow-up rates, clinical results, and reoperation rates according to recurrence after open discectomies, by following up a mid-to-long term period of time.

**RESEARCH SUBJECTS AND METHODS**

Of the 289 patients who underwent open discectomy surgeries performed by the single surgeon from April 1989 to December 2000, 142 patients who were followed up for over 5 years after surgery were the study subjects. Surgical method used in all the patients was a conventional open discectomy, and during operation, in addition, the degenerative inner disc fragments were removed. Among the 289 patients, those who had undergone surgery previous thereby making their first surgeries at the authors’ hospital their second, and those with far lateral herniated disc cases were excluded from the study. Of the 142 study subject patients, 100 cases were males and 42 cases were females; at the time of operation, the average age was 36-years-old (range of 17–77-years-old); the average follow-up period was 99.2 months (range of 60–208 months).

The more than 5 years follow-up rates of the 289 patients, the clinical results of the 142 cases that had been followed up for more than 5 years, and the reoperation rates were analyzed. The more than 5 years follow-up rates and clinical results were separated according to gender, age at the operation, and the operated level. For age at the operation criterion, these were the groups: 30-years-old or younger, between 31 and 45-years-old, and 46-years-old or older. For the operated level, these were the groups, the differences among them were analyzed: L3–4 upper level; L4–5 level, and L5–S1 level. The timing of reoperation was divided into these 4 groups and the differences among them were analyzed: less than 6 months after the first operation group, more than 6 months to 2 years, more than 2 years to 5 years, and more than 5-years. In addition, the regions of reoperation were divided into these 3 groups and the differences among them were analyzed: same level—same side, same level—contralateral side, and other level. And, we analyzed the regions of reoperations according to the operation timing, and investigated their association.

By using the SPSS 11.0 for statistical analysis, cross-analysis was conducted; the significance level was less than 0.05.

**RESULTS**

Of the entire 289 patients who underwent open discectomy, 204 were males and 85 were females. More than 5 years follow-ups were 142 cases (49.1%) of the 289 total patients, and 100 cases (49.0%) among the 204 males, and 42 cases (49.4%) among the 85 females, which indicated that there were no gender-based statistical differences (p = 0.952). According to the age at the operation, more than 5 years follow-ups were: in 50 cases (50.0%) of 100 patients 30-years-old or younger; in 50 cases (51.5%) of 97 patients between 31 and 45-years-old, and in 42 cases (45.7%) of 92 patients 46-years-old or older, which indicated that there were no age-based statistical differences (p = 0.557). In addition, according to the operated level, more than 5 years follow-ups were: in 13 cases (61.9%) of 21 patients with L3–4 upper level, in 94 cases (48.2%) of 195 patients with L4–5 level, and in 35 cases (47.9%) of 73 patients with L5–S1 level, which indicated that there were no age-based statistical differences (p = 0.557). In addition, according to the operated level, more than 5 years follow-ups were: in 13 cases (61.9%) of 21 patients with L3–4 upper level, in 94 cases (48.2%) of 195 patients with L4–5 level, and in 35 cases (47.9%) of 73 patients with L5–S1 level, which indicated that the L3–4 upper level group seemed to show higher than 5 years follow-up rates than other groups but there was no statistical significance (p = 0.441).

The clinical results were: Satisfactory in 107 cases (Excellent 53 cases, Good 54 cases) of the total 142 patients, and
Unsatisfactory in 35 cases (Fair 13 cases, Poor 22 cases) of the total 142 patients, which indicated that 75.4% of the patients experienced satisfactory results. According to gender, the clinical results were: for males, Satisfactory in 78 cases (Excellent 38 cases, Good 40 cases) of 100 patients, and Unsatisfactory in 22 cases (Fair 8 cases, Poor in 14 cases) of 100 patients; for females, Satisfactory in 29 cases (Excellent 15 cases, Good 14 cases), and Unsatisfactory in 13 cases (Fair 5 cases, Poor in 8 cases), which indicated that 69.0% of patients experienced satisfactory results and there were no statistically significant difference (p = 0.259).

According to the age at operation, the clinical results were: for 30-years-old or younger, Satisfactory in 37 cases (Excellent 23 cases, Good 14 cases), and Unsatisfactory in 13 cases (Fair 7 cases, Poor in 6 cases), which showed satisfactory results in 76% of the patients, for between 31 and 45-years-old, Satisfactory in 39 cases (Excellent 18 cases, Good 21 cases), and Unsatisfactory in 11 cases (Fair 3 cases, Poor in 8 cases), which showed satisfactory results in 74% of the patients and there were no meaningful statistical differences according to the age at the operation (p = 0.292). According to the operated level, the clinical results were: for the L3-4 upper level group, Satisfactory in 9 cases (Excellent 5 cases, Good 4 cases), and Unsatisfactory in 22 cases (Fair 7 cases, Poor in 15 cases), which showed satisfactory results in 61.9% of the patients, and for the L5-S1 level group, Satisfactory in 26 cases (Excellent 15 cases, Good 11 cases), and Unsatisfactory in 9 cases (Fair 6 cases, Poor in 3 cases), which showed satisfactory results in 74.3% of the patients and there were no statistically significant difference according to the operated level (p = 0.362) (Table 1).

The cases where reoperations were needed due to recurrence of symptoms were in 21 cases (14.8%) of the total of 142 patients, based on the gender, males were 14 cases (14.0%) of 100 patients, and females were 7 cases (16.7%) of 42 patients, which did not show a statistically significant difference (p = 0.683). According to the age at the operation, the reoperation rates were: for 30-years-old or younger, 6 cases (12%) of 50 patients; for between 31 and 45-years-old, 8 cases (16.0%) of 50 patients; for 46-years-old or older, 7 cases (16.7%) of 42 patients, which showed the 30-years-old or younger group with lower reoperation rate but there was no statistical significance (p=0.522). In addition, according to the operated level, the reoperation rates were: for the L3–4 upper level group, 4 cases (30.8%) of 13 patients, for the L4–5 level group, 13 cases (13.7%) of 94 patients, and for the L5–S1 level group, 4 cases (11.4%) of 35 patients, which showed the L3–4 upper level group with higher reoperation rate but without statistical significance (p=0.171).

In addition, analyzing the timing of reoperation among the 21 cases where reoperations were performed, reoperations took place: for the less than 6 months after the first operation group, in 5 cases (23.8%); for more than 6 months to 2 years group, 2 cases (9.5%); for more than 2 years to 5 years group, 5 cases (23.8%), and for more than 5 years group, 9 cases (42.5%). According to the region of recurrence, the reoperation rates were: for the same level–same side group, 11 cases (52.4%) of

| Table 1. Five year follow-up rate, satisfactory rate and reoperation rate after open discectomy |
| No. of total operated | No. of Followed | 5 Y *FU rate(%) | E | G | F | P | Satisfactory rate(%) | Reoperation | Reoperation rate(%) |
|----------------------|-----------------|-----------------|---|---|---|---|----------------------|-------------|---------------------|
| Sex                  |                 |                 |   |   |   |   |                      |             |                     |
| M                    | 204             | 100             | 49.0 | 38 | 40 | 8  | 14                  | 78.0        | 14                  | 14.0         |
| F                    | 85              | 42              | 49.4 | 15 | 14 | 5  | 8                   | 69.0        | 7                   | 16.7         |
| Age                  |                 |                 |   |   |   |   |                      |             |                     |
| <30                  | 100             | 50              | 50.0 | 23 | 14 | 7  | 6                   | 74.0        | 6                   | 12.0         |
| 31-45                | 97              | 50              | 51.5 | 18 | 21 | 3  | 8                   | 76.0        | 8                   | 16.0         |
| >46                  | 92              | 42              | 45.7 | 12 | 19 | 3  | 8                   | 73.8        | 7                   | 16.7         |
| Level                |                 |                 |   |   |   |   |                      |             |                     |
| L5-S1                | 73              | 35              | 47.9 | 15 | 11 | 6  | 3                   | 74.3        | 4                   | 11.4         |
| L4-5                 | 195             | 94              | 48.2 | 33 | 39 | 7  | 15                  | 76.6        | 13                  | 13.7         |
| >L3-4                | 21              | 13              | 61.9 | 5  | 4  | 0  | 4                   | 69.2        | 4                   | 30.8         |
| Total                | 289             | 142             | 49.1 | 53 | 54 | 13 | 22                  | 75.4        | 21                  | 14.8         |

*FU; follow-up †E; excellent, ‡G; good, †F; fair, ††P; poor ¶Satisfactory = E(excellent) + G(good)
21 patients: for the same level–contralateral side group, 6 cases (28.6%); for the other level group, 4 cases (19%). Looking at the region of recurrence based on the timing of reoperation, the 5 cases with reoperations in less than 6 months occurred in the same level–same side group, 1 case with reoperation within 6 months to 2 years occurred in the same level–same side group, and the 1 case with reoperation within 6 months to 2 years occurred in the same level–contralateral side group.

In addition, for more than 2 years to 5 years group, there were 2 cases in the same level–same side, 2 cases in the same level–contralateral side, and 1 case in the other level: for more than 5 years group, there were 3 cases in the same level–same side, 3 cases in the same level–contralateral side, and 3 cases of recurrence in the other level. In less than 6 months group after the first operation, the recurrence rate in the same level–same side was statistically significant difference (p=0.023); in the 2 years or longer group, there weren’t any significant association between the region of reoperation and the timing of reoperation (p = 0.665) (Table 2). Thus, although there were many cases of same level–same side in reoperations during the early follow-ups, as time passed, a pattern of similar reoperation rates for the 3 cases was observed. Reoperations of lumbar disc excision were performed in 14 cases (67%) of the total 21 cases, and reoperations of spinal fusion were performed in 7 cases (33%), 5 in the same level–same side, 1 in the same level–contralateral side, and 1 in the other level).

### DISCUSSION

There have been numerous reports regarding follow-ups after open discectomy: Mariconda et al. showed a 90% success rate along with a 10.4% reoperation rate, by following up on 201 patients for average of 27.8 years (range of 25–32 years). Loupasis et al. showed a 64% success rate and 7.3% reoperation rate, by following up on 109 patients for average of 12.2 years (range of 7–20 years). In addition, Keller et al. separated the patients suffering from sciatica secondary due to herniated discs into the surgery group and conservative treatment group and followed them up for over 10 years, and from which they showed a 69% success rate and 25% reoperation rate in the surgery group; Davis followed up for 10.8 years and reported a 89% success rate and 6% reoperation rate. As shown, the long-term follow-ups after open discectomy have shown 64%–90% success rates and 6%–25% reoperation rates. In the case of the authors of this study as well, the reoperation rate was 9.5% in the same level–same side, and 19.0% in the other level, which were not too different from those of the aforementioned studies.

Crock, Ebeling et al., Fandino et al., Greenwood et al., and Shin et al. gave considerations to, as causes of failure after operation, the pure recurrence of lumbar disc herniation, new disc herniation at different segment or region, infection, subdural fibrosis, arachnoiditis, facet syndrome, and continuing symptoms, and among these, they considered as a major cause the recurrence of herniated disc.

Numerous associations were considered regarding the factors that induce this type of recurrence after an operation, first if the reoperation rate according to the operated level, in the study by Davis, it was reported that the L5–S1 level group showed the highest recurrence rate with 33 cases (55%) of 60 patients, and next was the L4–5 level group with 25 cases (42%). In contrast, in this study by the authors, the L3–4 upper level group showed somewhat higher rate, but there weren’t any associations or relevance due to the statistical insignificance of the results.

Additionally, in terms of the reoperation rate according to the region of recurrence, Davis showed that the same level–same side had the highest reoperation rate with 30 cases (50%) of 60 total patients, and after that it was the different level–same side with 16 cases (26.7%), the same level–contralateral side with 10 cases (16.7%), and then the different level–contralateral side with 4 cases (6.7%); O’Sullivan et al. reported that the same level–same side showed 44%, the same level–contralateral side with 21%, and the 34% occurred anew in the different segment. In this study by the authors as well, the reoperation rate was 52.4% in the same level–same side, 28.6% in the same level–contralateral side, and 19.0% in the other level, which were not
too different from the aforementioned studies.

About the timing of reoperation, Davis\(^2\) reported a 6% recurrence rate during their 34 years follow-up period, and 1/3 of the recurrences occurred within 1 year after operation. In this study by the authors as well, of the 21 cases that underwent reoperations after lumbar discectomy 7 cases (33.3%) underwent reoperation within 2 years, which weren’t too different from those reported by Davis.\(^2\) Additionally, in the case of the authors of this study, of the 7 cases that underwent reoperation within 2 years 5 cases underwent yet reoperation within 6 months, and they were all of the same level–same side. However, reoperation rates of 23.8% (5 cases of 21 total cases) for more than 2 years to 5 years group, and 42.9% (9 cases of 21 total cases) for the more than 5 years group were shown: based on the fact that reoperations took place in the other level and in the same level–contralateral side similar to the same level–same side consistently regardless of the region of operation similar to the 2–years or more timing case, it can be suggested indirectly that pure recurrences mostly occurred within 6 months. Based on this, as causes for reoperation up to 2 years after the initial operation annulus fibrosus damage sustained during disc removal and surgery, which are considered insufficient, and improper surgery can cause recurrence of disc herniation,\(^16\) however, in the cases where reoperations are needed after 2 years, it would be logical to assume that naturally–caused abnormalities have more impact than affects from the initial operation. Suk et al.\(^17\) defined as recurrence the disc herniation that occurs in the same segments unrelated to the proximal area of the initial operation and without a show of symptoms during 6 months after disc discectomy; however, in this study, recurrence was defined as the occurring of the same symptoms after the symptom was relieved after the initial operation.

As a treatment method of reoperation due to recurrence after lumbar discectomy, spinal fusion can be considered in the cases of active patients with acute radiating and back pains and in the cases where spinal stability may be impacted due to excessive tissue ablation during operation.\(^5,18,19\) And, in the case of recurrence in the same level–contralateral side as well, the weakening of the annulus fibrosus can result during a disc discectomy on the contralateral side of the operated side, and this can impact the stability of the segment.\(^16\) Davis\(^2\) performed fusion procedure for spinal stability in 7 cases (11.7%) of 60 patients who had recurrences: in this study by the authors, 7 cases of 21 patients with recurrence (33%, 5 cases in the same level–the same side, 1 case in the same level–contralateral side, and 1 case in the other level) underwent spinal fusion done with consideration for stability.

**CONCLUSION**

Upon conducting more than 5 years follow-ups after the open discectomy, the results showed that 75.4% of patients were satisfied with the operations, and 14.8% needed reoperations. The clinical results and reoperation rates, in terms of gender, age at the operation, and the operated level, there were no significant association. However, the region of reoperation had the most case in the same level–same side. The region of reoperation according to the timing of reoperation showed that the reoperations performed within the first 6 months were all in the same level–same side, but in the case of more than 2 years after operation, the regions of reoperation were evenly distributed regardless of the region of operation. Thus, pure recurrences occurred within 6 months after surgery, and the cases where reoperations were needed after more than 2 years, it should be considered as naturally–caused lesions rather than affects from the initial operation.

**REFERENCES**

1. Jang EC, Song KS, Kang KS, et al. Comparative Evaluation of Percutaneous Endoscopic Discectomy and Microdiscectomy Using Tubular Retractor System at L4–5 Level. J Korean Soc Spine Surg. 2009;16:186-93.
2. Davis RA. A long–term outcome analysis of 984 surgically treated herniated lumbar discs. J Neurosurg. 1994;80:415–21.
3. Dvorak J, Gauchat MH, Valach L. The outcome of surgery for lumbar disc herniation. I. A 4–17 years’ follow–up with emphasis on somatic aspects. Spine (Phila Pa 1976). 1988;13:1418-22.
4. Weber H. Lumbar disc herniation. A controlled, prospective study with ten years of observation. Spine (Phila Pa 1976). 1983;8:131–40.
5. Yorimitsu E, Chiba K, Toyama Y, Hirabayashi K. Long–term outcomes of standard discectomy for lumbar disc
herniation: a follow-up study of more than 10 years. Spine (Phila Pa 1976). 2001;26:652–7.
6. Kim NH, Kim DJ. Anterior interbody fusion for spondylolisthesis. Orthopaedics. 1991;14:1069–76.
7. Mariconda M, Galasso O, Secondulo V, Rotonda GD, Milano C. Minimum 25–year outcome and functional assessment of lumbar discectomy. Spine (Phila Pa 1976). 2006;31:2593–9.
8. Loupasis GA, Stamos K, Katonis PG, Sapkas G, Korres DS, Hartofilakis G. Seven- to 20–year outcome of lumbar discectomy. Spine (Phila Pa 1976). 1999:24:2313–7.
9. Atlas SJ, Keller RB, Wu YA, Deyo RA, Singer DE. Long-term outcomes of surgical and nonsurgical management of sciatica secondary to a lumbar disc herniation: 10 year results from the maine lumbar spine study. Spine (Phila Pa 1976). 2005;30:8927–35.
10. Crock HV. Observations on the management of failed spinal operations. J Bone Joint Surg. 1976;58:193–9.
11. Ebeling U, Kalbarcyk H, Reulen HJ. Microsurgical reoperation following lumbar disc surgery. Timing, surgical findings, and outcome in 92 patients. J Neurosurg. 1989;70:397–404.
12. Fandiño J, Botana C, Viladrich A, Gomez-Bueno J. Reoperation after lumbar disc surgery: results in 130 cases. Acta Neurochir (Wien). 1993;122:102–4.
13. Greenwood J Jr, McGuire TH, Kimbell F. A study of the causes of failure in the herniated intervertebral disc operation: an analysis of sixty–seven reoperated cases. J Neurosurg. 1952:9:15–20.
14. Shin BJ, Kim KJ, Jang IK, Suh YS, Kim YI. Early Problems of Open discectomy for Lumbar Intervertebral Disc Herniation, J Korean Soc Spine Surg. 1999;6:104–9.
15. O’Sullivan MG, Connolly AE, Buckley TF. Recurrent lumbar disc protrusion. Br J Neurosurg. 1990:4:319–25.
16. Cinotti G, Giumina S, Giannicola G, Postacchini F. Contralateral recurrent lumbar disc herniation. Results of discectomy compared with those in primary herniation. Spine (Phila Pa 1976). 1999:24:800–6.
17. Suk KS, Lee HM, Moon SH, Kim NH. Recurrent lumbar disc herniation: Results of operative management. Spine (Phila Pa 1976). 2001;26:672–6.
18. Brinckmann P, Grootenboer H. Change of disc height, radial disc bulge, and intradiscal pressure from discectomy. An in vitro investigation on human lumbar discs. Spine (Phila Pa 1976). 1991:16:641–6.
19. Goel VK, Nishiyama K, Weinstein JN, Liu YK. Mechanical properties of lumbar spinal motion segments as affected by partial disc removal. Spine (Phila Pa 1976). 1986:11:1008–12.