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

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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. Reoperation 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

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본 논문의 요지는 2007년도 대한정형외과학회 추계학술대회에서 발표되었음.

postoperative back pain and recurrence of herniated disc,⁵⁾ 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 difference of which were analyzed: L3-4 upper level; L4-5 level; L5-S1 level.

The clinical results of the 142 patients with more than 5 years follow-ups were divided into Excellent, Good, Fair and Poor ratings according to Kim and Kim's criteria⁶⁾ afterwards, the Excellent and Good ratings were categorized as Satisfactory clinical results, and the Fair and Poor ratings were categorized into Unsatisfactory clinical results, and then analyzed.

The evaluations of the reoperation rates were analyzed according to these criteria: gender, age at first operation, the

operated level, timing of reoperation, and region of reoperation. The recurrence was defined as when the symptoms occurring again after they had disappeared post-operation. The age at the operation was divided into these 3 groups and the differences among them were analyzed: 30-years-old or younger, between 31 and 45-years-old, and 46-years-old or older. The operated level were divided into these 3 groups and the difference 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 the L3-4 upper level group seemed to show higher more than 5 years follow-ups than other 2 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

Table 1. Five year follow-up rate, satisfactory rate and reoperation rate after open discectomy

		No. of total operated	No. of Followed	5Y*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)

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 74% 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 76% of the patients, and for 46-years-old or older, Satisfactory in 31 cases (Excellent 12 cases, Good 19 cases), and Unsatisfactory in 11 cases (Fair 3 cases, Poor in 8 cases), which showed satisfactory results in 73.8% 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 4 cases (Fair 0 case, Poor in 4 cases), which showed satisfactory results in 69.2% of the patients, for the L4-5 level group, Satisfactory in 72 cases (Excellent 33 cases, Good 39 cases), and Unsatisfactory in 22 cases (Fair 7 cases, Poor in 15 cases), which showed satisfactory results in 75.5% 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 2. Reoperation of disc site according to time

	<6 [‡] M	6M-2 [‡] Y	2-5Y	>5Y	Total	Time(M)	%
*S,S	5	1	2	3	11	32.5	52.4
[†] S,C	0	1	2	3	6	62.4	28.6
[‡] O	0	0	1	3	4	90.8	19.0
Total	5(23.8%)	2(9.5%)	5(23.8%)	9(42.5%)	21(100%)	52.1	100

*S, S; same level-same side [†]S, C; same level-contralateral side

[‡]O; other level [‡]M; month, [‡]Y; year

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, the 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 discectomy 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.⁷⁾ 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 25-32years). Loupasis et al.⁸⁾ 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.⁹⁾

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; Davis²⁾ 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, of the 142 patients (of the total of 289 patients who underwent open discectomy) who were followed up for more than 5 years, 106 cases showed satisfactory results with a 74.6% success rate; although 21 cases (14.8%) underwent reoperation, there were only 11 cases (7.7%) of recurrence in the same level-same side; these results were not too different from those of the aforementioned studies.

Crock,¹⁰⁾ Ebeling et al.,¹¹⁾ Fandino et al.,¹²⁾ Greenwood et al.,¹³⁾ and Shin et al.¹⁴⁾ 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,²⁾ it was reported that the L5-S1 level group showed the highest reoperation 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, Davis²⁾ 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.¹⁵⁾ 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, Davis²⁾ 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⁾ Davis²⁾ 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.

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관혈적 추간판 절제술 시행 후 5년 이상 추시 결과

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목적: 관혈적 추간판 절제술 시행 후 5년 이상 추시 결과를 임상적 결과와 재발을 중심으로 분석하여 보고하고자 한다.

선행문헌의 요약: 관혈적 추간판 절제술은 요추부 추간판 탈출증에 대한 수술적 치료 방법의 표준 술식으로 인정 되어 있음에도 불구하고 장기 추시 결과를 발표한 문헌은 많지 않다.

대상 및 방법: 1989년부터 2000년 사이에 관혈적 추간판 절제술을 시행 받은 289명의 환자 중 5년 이상 추시된 142명을 대상으로 하였다. 추시율과 임상 결과는 성별, 수술시 연령, 그리고 수술 분절에 따라 분석하였다. 그리고 재수술율은 성별, 수술시 연령, 그리고 수술 분절 및 부위를 같은 분절-동일 부위, 같은 분절-반대편 부위, 다른 분절의 세 군으로 나누어 재수술 시기에 따라 분석하였다. 임상적 결과는 Kim 과 Kim의 판정 기준으로 평가하였다.

결과: 관혈적 추간판 절제술 후 5년 이상 추시율은 49.1%였다. 평균 추시 기간은 99.2 개월이었다. 임상적으로 만족스러운 결과는 약 75.4%였고, 성별, 수술 시 연령 및 수술 분절과는 관련이 없었다. 재수술이 필요하였던 경우는 21예(14.8%)였다. 재수술율은 나이와 성별에 따른 차이는 없었고, 수술 후 6개월 이내에서는 같은 분절-동일 부위인 경우가 많았으나 시간이 지남에 세 군의 빈도가 일정하게 나타나는 양상을 보였다.

결론: 관혈적 추간판 절제술의 5년 이상 추시 결과 만족할만한 임상 결과(75.4%)를 보였다. 재수술은 수술 후 6개월 이내에는 같은 분절-동일 부위인 경우가 주를 이루었으나 2년이 경과한 후부터는 세 군에서 고르게 발생한 것으로 보아 술 후 2년 이상이 경과한 후 재수술이 필요한 경우는 최초 수술의 영향이라기 보다는 자연 경과로 발생하는 병변으로 볼 수 있을 것으로 판단된다.

색인 단어: 요추부, 추간판 탈출증, 관혈적 추간판 절제술, 재수술

약칭 제목: 추간판 절제술 후 증장기 추시 결과