

Surgical Results of Endoscopic Discectomy for Lumbar Disc Herniation: Three-Year Follow-up

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Summary. Three years of follow-up results in lumbar disc herniation patients after endoscopic discectomy were evaluated using the Japanese Orthopaedic Association (JOA) scoring system by direct examination and questionnaires. The average postoperative JOA score was 28.4 points, and the average recovery rate was 91.9%. Eighty percent of patients doing light labor were able to return to their preoperative work within 1 month postoperatively. One patient was pregnant 2 years after surgery, and there was no adverse event related to childbirth and the discectomy. Within 3 months postoperatively 96.2% of the patients were able to return to their occupation. At 3 years, there was 92.3% follow-up. Endoscopic discectomy results were excellent at 3 years of follow-up.

Key words. Lumbar disc herniation, Endoscope, 3-year follow-up, Employment

Introduction

Since 1997, we have performed endoscopic lumbar discectomy in 97 cases using the instruments developed by our institution [1, 2].

Conventional discectomy is the preferred management technique, and it has favorable outcomes for lumbar disc herniation as demonstrated by numerous studies among the majority of surgeons [3–5]. However, these reports have noted that residual low back pain and recurrent herniation are major postoperative problems; i.e., recurrent herniation at the same level,

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heavy labor, age (under 35 years), disc degeneration, instability, and disc-high ratio are factors associated with recurrence. Weinstein et al. [6] reported that patients should return to work after having obtained complete symptomatic recovery or a minimum convalescence of 12 weeks. Psychological factors also have an impact on the outcome of the discectomy. These are some major post-operative problems encountered after conventional discectomy, as mentioned above. In this Chapter we evaluate the long-term surgical results of endoscopic lumbar discectomy.

Patients and Method of Analysis

Clinical records were obtained for 34 patients who underwent endoscopic lumbar discectomy from February 1997 to August 1999 at Chiba University Hospital, Inoue Memorial Hospital, and Kashiwa Hospital. Twenty-six patients were available for this study (survey rate, 76.5%); 8 patients could not be contacted. The indication for endoscopic lumbar discectomy was severe leg pain that had not resolved after at least 3 months of conservative management. Preoperative magnetic resonance imaging (MRI) and myelography confirmed the diagnosis of lumbar disc herniation in all patients.

The study group was composed of 11 men and 15 women, whose ages at the time of surgery ranged from 16 to 56 years (average, 32.4 years). The follow-up period ranged from 36 to 54 months. The levels involved were L4-L5 in 11 cases and L5-S1 in 15 cases. The type of herniation was classified according to the modified Macnab's system by reviewing appropriate studies and surgical records. Based on this evaluation, 10 cases were classified as protrusion, 10 as subligamentous extrusion, 4 as transligamentous extrusion, and 2 as sequestration.

The patients' pre- and postoperative Japanese Orthopaedic Association (JOA) scores (Table 1) for management of low back pain [subjective symptoms, clinical signs, activities of daily living (ADL), and urinary bladder function; 29-point system] were scored. The JOA score results show the final follow-up data, but data from recurrent cases of lumbar disc herniation are excluded.

Occupational activity has been divided into three categories according to the criteria of physical involvement needed: light labor (office job) in 10 cases, moderate labor (including household tasks) in 8 cases, and heavy labor (construction work, truck driving) in 8 cases. Postoperative return to work was tracked for each occupation. There was no time restriction for light labor. However, there were 12 weeks of restriction before return to heavy and moderate labor. Each patient wore a corset for 3 months after the operation.

TABLE 1. Scoring system of the Japanese Orthopaedic Association for low back pain (JOA score)

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1. Subjective symptoms (9 points)
 - A. Low back pain
None (3), occasional mild pain (2), frequent mild or occasional severe pain (1), frequent or continuous severe pain (0)
 - B. Leg pain and/or tingling
None (3), occasional slight symptoms (2), frequent slight or occasional severe symptoms (1), frequent or continuous severe symptoms (0)
 - C. Gait
Normal (3)
Able to walk farther than 500 m, although it results in pain, tingling, and/or muscle weakness (2)
Unable to walk farther than 500 m owing to leg pain, tingling, and/or muscle weakness (1)
Unable to walk farther than 100 m owing to leg pain, tingling, and/or muscle weakness (0)
 2. Clinical signs (6 points)
 - A. Straight leg-raising test (SLR) (including tight hamstrings)
Normal (2), 30°–70° (1), less than 30° (0)
 - B. Sensory disturbance
None (2), slight disturbance (not subjective) (1), marked weakness (grade 3–0) (0)
 - C. Motor disturbance (MMT)
Normal (grade 5) (2), slight weakness (grade 4) (1), marked weakness (grade 3–0) (0)
 3. Restriction of activities of daily living (ADL) (14 points)
 - Turn over while lying
 - Leaning forwards: moderate restriction (1)
 - Sitting (about 1 h): severe restriction (0)
 - Lifting or holding heavy objects
 - Walking
 4. Urinary bladder function (–6 points)
 - Normal (0), mild dysuria (–3), severe dysuria (–6)
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15 point system: 1(9 pts) + 2(6 pts) + 4(–6 pts).

Recovery rate: $(B-A/15-A)*100(\%)$.

A: Preoperative JOA score.

B: JOA score at final follow-up.

Surgical Technique

The patient is placed in the prone position with knees flexed. The flare sheath that was designed according to our instructions is inserted to retract the muscle. A 5-mm, 30 degree rigid endoscope is inserted from the cephalad direction through a flexible sheath, made of polyurethane membrane and designed to fix to the interlaminar space (Fig. 1). This feature allows an un-

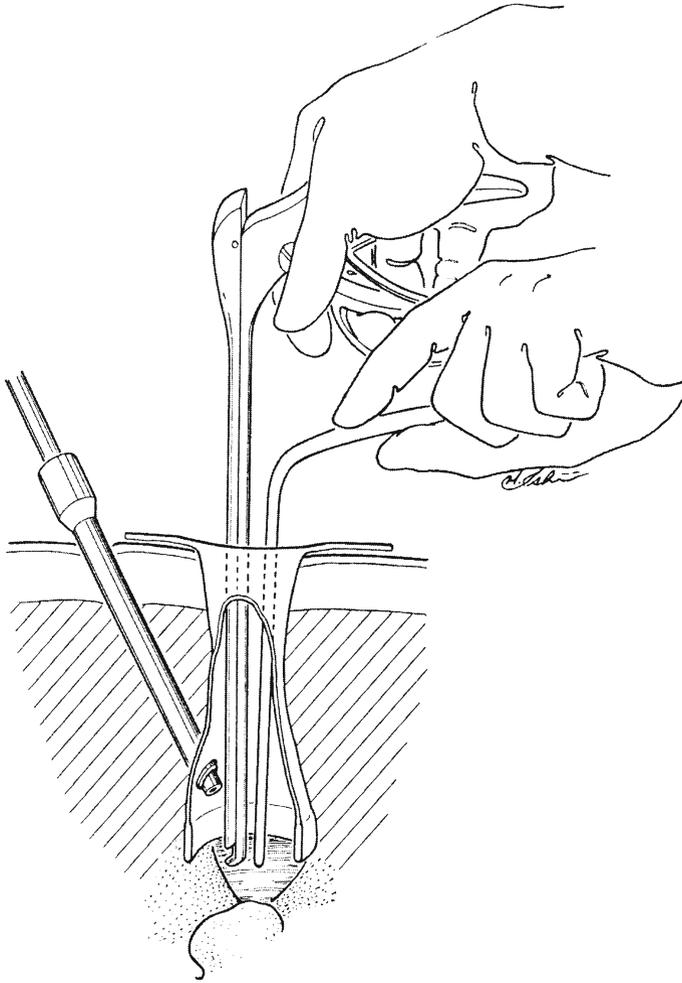


FIG. 1. The 30 degree rigid endoscope is inserted from the cranial side. The flare sheath has a wide working space for the instrument

obstructed view and wide working space for the instrument (Fig. 2). The ligamentum flavum is removed by a Kerrison rongeur and the lamina is cut using a round-shaped chisel and rongeur. Next, the fat tissue of the epidural space is seen under the ligamentum flavum. The dural tube and the nerve roots are retracted by a Penfield retractor, and the herniated mass is inspected. The affected nerve root is freed until it becomes loose and the entrance zone of the foramen is wide enough for the nerve root to pass through. Only one or two stitches are necessary to close the fascia of the back muscles (Fig. 3).

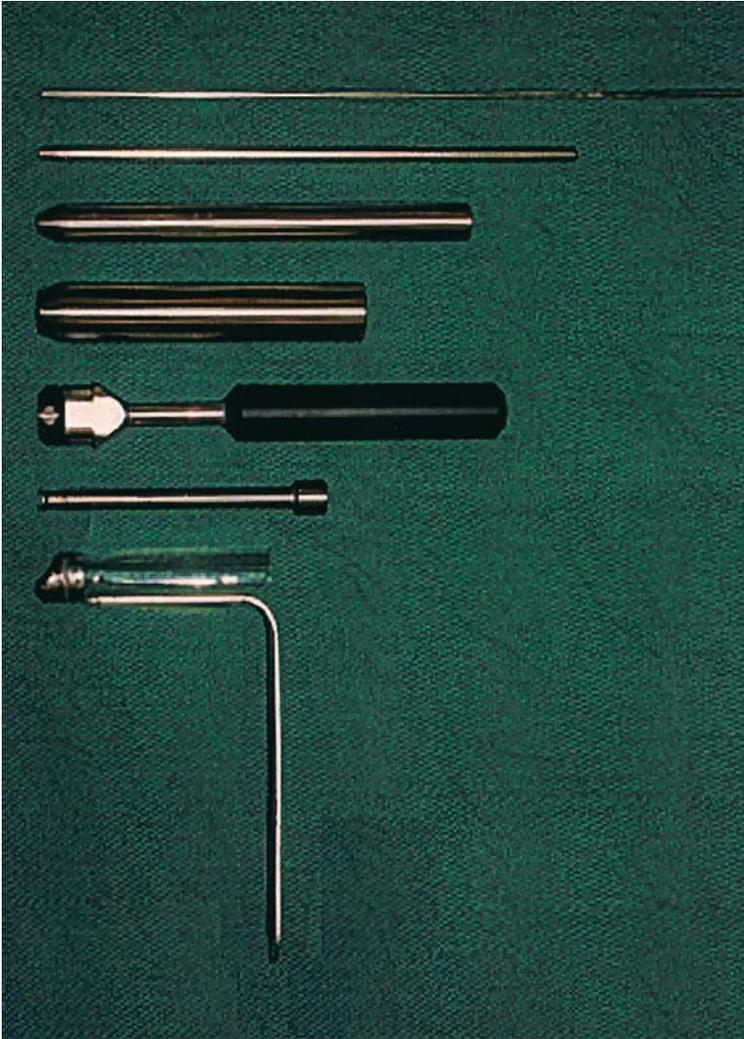


FIG. 2. Instruments (*above to below*) for endoscopic discectomy: introductory, dilator, sound, mandrin, pusher, side sheath, and flare sheath

Surgical Results

The patients' leg pain, low back pain, and daily activities were evaluated by the JOA score. In this system, the maximum score is 29 points. The average preoperative JOA score was 12.0 points. After 1 year, the average postopera-

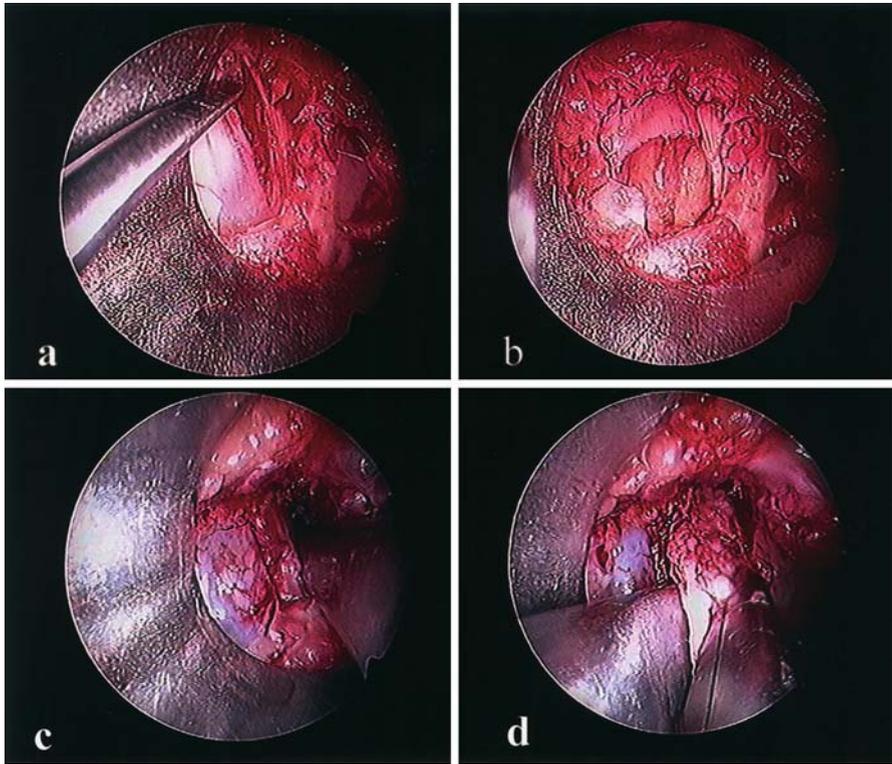


FIG. 3. **a** The ligamentum flavum is removed by a Kerrison rongeur. **b** The fat tissue of the epidural space is seen under the ligamentum flavum. **c** The dural tube and the nerve root are retracted by a Penfield retractor. **d** The herniated mass is respected

tive JOA score was 27.2 points and the average recovery rate was 89.4%. After 3 years, the average postoperative JOA score was 28.4 points and the average recovery rate was 91.9%. All patients could walk the day after the operation.

Subjective Symptoms

Preoperatively, low back pain was noticed in 25 patients (96.2%). After 3 years, residual low back pain lingered in five patients (21.7%). An interbody fusion was subsequently performed on two patients because of severe, chronic low back pain. Preoperatively, leg pain and tingling was noticed in all patients; after 3 years of postoperative follow-up, these remained in four patients (17.6%). Preoperatively, 23 patients had gait disturbance, whereas at 3 years postoperatively all patients had recovered (Fig. 4a).

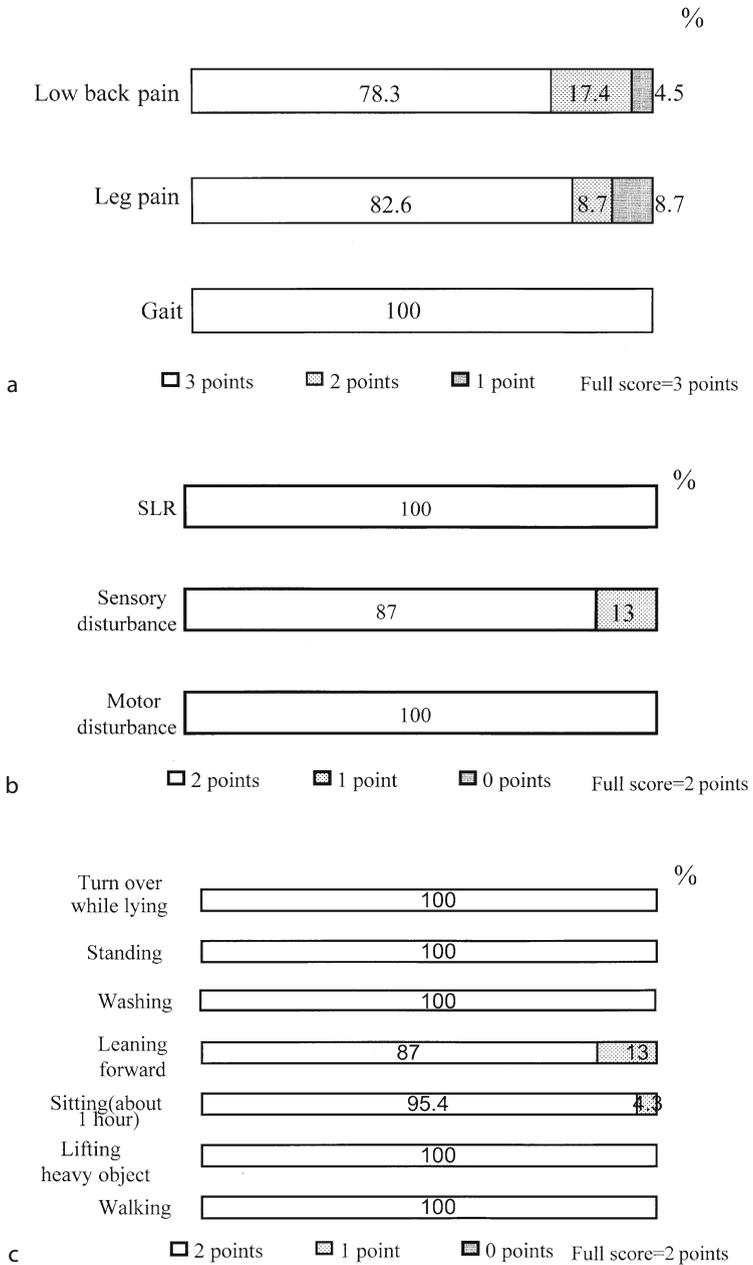


FIG. 4. Japanese Orthopaedic Association (JOA) score at final follow-up examination. **a** Subjective symptoms. **b** Clinical signs. *SLR*, Straight leg-raising test. **c** Activities of daily living

Clinical Signs

Preoperatively the straight leg raising test (SLR) was positive in all patients except one. The average SLR was 40.6°. Nineteen patients (76.9%) had motor weakness. Fourteen patients (53.8%) had a sensory disturbance. After 3 years, the postoperative SLR was negative in all patients, and there was no motor weakness. Sensory disturbance remained in only three patients (13%) (Fig. 4b).

Activities of Daily Living

The maximum ADL score is 14 points. Preoperatively, the ADL was 5.6 points. Postoperatively, ADL scores were excellent overall except for two patients. One patient when leaning forward and one patient when sitting for about 1 h experienced discomfort (Fig. 4c).

These are the excellent results of endoscopic discectomy with 3 years of follow-up. In the early stages of developing our technique, the three patients had dura mater tears. The JOA scores of these patients were excellent postoperatively. Complications occurred in four cases during the 3 years of follow-up. Two patients had recurrent herniation of the same disc, and reoperation was performed at 6 months and 1.4 years after surgery.

Employment Results

The occupation return rate was 96.2%, and at present 93.2% are working in their previous occupation. Each occupation was analyzed according to labor levels is demand.

Eighty percent of patients doing light labor were able to return to their preoperative work within 1 month postoperatively. One patient was pregnant 2 years after surgery and had a safe childbirth. One hundred percent of patients doing moderate labor were able to return to their preoperative work within 3 months postoperatively. However, one patient retired for reasons related to age. Another patient changed occupation from taxi driver to guard. Of those doing heavy labor, 87.5% were able to return to their preoperative work within 3 months postoperatively. One patient could not return to his original job because of persistent low back pain. Thus, 24 of the 26 patients were able to return to their preoperative work. One patient was even able to engage in heavier work compared with his preoperative occupation (Fig. 5).

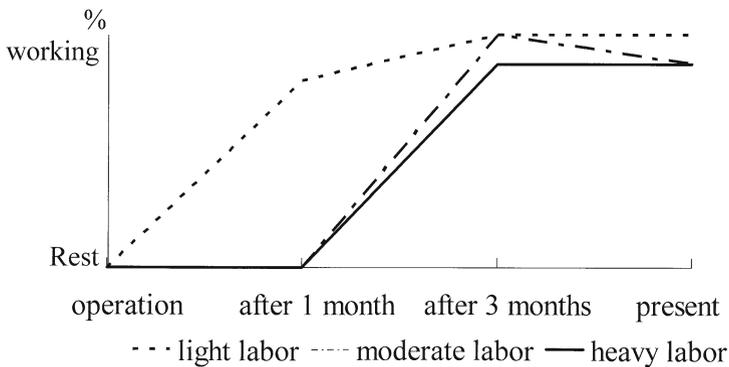


FIG. 5. Occupation return rates according to occupational activity up to 3 months after operation

TABLE 2. Long-term outcome of lumbar discectomy

Author	Year	Patients	Follow-up period (yr)	Success rate (%)	Recurrence rate (%)
Smyth [7]	1983	105	?	87	4
Weber [5]	1983		1.4-10	93	?
Dvorak [8]	1988	371	4-10	17	
Abernathey [9]	1990	236	~10	87	10.8
Williams [10]	1990	989	~15	85.2	14.8
Pappas [11]	1992	654	~4.5	76.3	9.3
Moore [12]	1994	984	10.8	89	6
Findlay [13]	1998	79	1-10	83	6.3
Yorimitsu [14]	2001	72	10	73.5	12.5

Discussion

We performed endoscopic lumbar discectomy in 97 cases from February 1997 to August 2002. The average surgical time was 109 min, and the average blood loss was 41 g. Postoperative pain control was examined and compared with that in a control group. The control group was treated by conventional open discectomy between 1991 and 1997. After the operation, the suppository was used an average of 1.2 times in the endoscopic group versus 3.7 times in the conventional group. These data showed one-third less usage when compared with the control group. The average bed rest in endoscopic group patients was 1.0 day. Endoscopic discectomy has various advantages, including the facts that it is less invasive, has less blood loss, causes less pain, requires less medication after the operation, and allows an early return to daily activities.

There are many reports about the long-term outcome of conventional discectomy. The success rates range from 73% to 93%, and the recurrence rates range from 4% to 17% at 4 to 10 years after the operation (Table 2). Our results

are almost consistent with the previous literature. However, we believe our success rate and recurrence rate would be better with more patients enrolled in the study.

Yajiri et al. [15] reported on employment at 3 to 5 years of follow-up after the conventional open operation. In that study, the rate of return to work at the original occupation was 92%, and the follow-up return rate was 80%. The results with endoscopic discectomy were better with respect to employment. Weinstein et al. [6] reported that the rate of return to work after conventional discectomy was 30.1% at less than 6 weeks, 31.4% at 6 weeks to 3 months, and 4.3% at 6 months to 1 year. The rate of return at more than 1 year was 11.3% in this study.

The above-mentioned operative results with endoscopic lumbar discectomy for disc herniation were better than the those with open method. Almost all light laborers were able to return to their preoperative work within 1 month postoperatively. Short-term studies with less than 2 years of follow-up after the conventional method tend to give an overall success rate that exceeds 90%. On other hand, studies with long-term follow-up have shown unsatisfactory results, up to 60%. Davis [3] suggested that in order to evaluate the results of surgery for herniated lumbar disc, the follow-up period should be more than 4 years. Our patients will continue to be followed for 4 years.

The indication for endoscopic lumbar discectomy is unresolved symptoms after 3 months of conservative treatment. These results suggest that the indication for endoscopic lumbar discectomy will be expanded to include patients who need to return to work as soon as possible. In this study, almost all patients could return to the same occupation within 3 months, and the light laborers even returned to the same occupation after 1 month. Weber [5] reported that patients had almost the same result at 10 years whether they had the conventional operation or conservative treatment. When lumbar disc herniation is diagnosed in a patient who also has discogenic pain, we must consider the case carefully. In our study, 25 patients (96.2%) had low back pain preoperatively, and after 3 years postoperatively, 5 patients had residual low back pain. Three patients were able to return to moderate labor, even though one patient had an interbody fusion. JOA scores have not clearly differentiated between low back pain, lumbago, and buttock pain. Therefore a diagnosis must carefully distinguish low back pain. Endoscopic lumbar discectomy should be chosen only in the absence of discogenic pain.

Conclusions

After endoscopic lumbar discectomy, most patients returned to their original occupation. Endoscopic lumbar discectomy showed excellent surgical results, even at 3 years of follow-up.

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References

1. Yamagata M, Takahashi K, Moriya H, et al (1999) Development of new endoscopic discectomy for lumbar disc herniation (in Japanese). *Surg Tech Spine Spinal Nerve* 1:8–10
2. Yamagata M, Moriya H, Takahashi K, et al (1998) Endoscopic discectomy for lumbar disc herniation: a new surgical technique (in Japanese). *Endoscopy* 23:115–119
3. Davis RA (1996) A long-term outcome study of 170 surgically treated patients with compressive cervical radiculopathy. *Surg Neurol* 46:523–530; discussion 530–533
4. Loupasis GA, Stamos K, Katonis PG, et al (1999) Seven- to 20-year outcome of lumbar discectomy. *Spine* 15:2313–2317
5. Weber H (1983) Lumbar disc herniation. A controlled prospective study with ten years of observation. 1982 Volvo Award in clinical science. *Spine* 8:131–140
6. Weinstein J, Spratt KF, Lehmann T, et al (1986) Lumbar disc herniation. A comparison of the results of chemonucleolysis and open discectomy after ten years. *J Bone Joint Surg Am* 68:43–54
7. Smyth H, Gallagher J, McManus F (1983) Surgery in lumbar disc protrusion: a long-term follow-up. *Irish Med J* 76:25–26
8. Dvorak J, Gauchat M, Valach L (1988) The outcome of surgery for lumbar disc herniation. 1. A 4–17 years' follow-up with emphasis on somatic aspects. *Spine* 13:1418–1422
9. Abernathey CD, Yasargil MG (1990) Result of microsurgery. In: *Microsurgery of the lumbar spine*. Aspen, Rockville, MD, pp 233–236
10. Williams RW (1990) Result of microsurgery. In: *Microsurgery of the lumbar spine*. Aspen, Rockville, MD, pp 211–214
11. Pappas C, Harrington T, Sonntag V (1992) Outcome analysis in 654 surgically treated lumbar disc herniations. *Neurosurgery* 30:862–866
12. Moore AJ, Chilton JD, Uttley D (1994) Long-term results of microlumbar discectomy. *Br J Neurosurg* 8:319–326
13. Findlay GA, Hall BI, Musa BS, et al (1998) A 10-year follow-up of the outcome of lumbar microdiscectomy. *Spine* 23:1167–1171
14. Yorimitsu E, Chiba K, Toyama Y, et al (2001) Long-term outcomes of standard discectomy for lumbar disc herniation: a follow-up study of more than 10 years. *Spine* 15:652–657
15. Yajiri Y, Imai K, Okabe S (2001) Employment result after discectomy for lumbar disc herniation. *Jpn J Occupat Med Traumatol* 49:P206 (in Japanese)