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Prognostic criteria for work resumption after standard lumbar discectomy

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Abstract The purpose of this study was to determine prognostic criteria for return to work 9–12 years after standard nucleotomy for herniated nucleus pulposus confirmed by CT. From 1985 until 1988, 182 patients (102 male, 80 female, mean age 45 years) with a single-level herniated nucleus pulposus were operated on for the first time. In summer 1997, an average of 10.2 years after the operation, 101 of 182 patients (55.5%) returned a standardised questionnaire. Eighteen patients (9.8%) had died during the intervening years, while 63 patients (34.6%) were lost to follow-up because of moving to other cities. Two groups could then be distinguished: group I worked full time in their usual job; group II did not. The influence of the degree of the paresis, time elapsed since the occurrence, intraoperative findings, age, sex, weight, type of work and re-operations were analysed statistically. Group I consisted of 44 patients who still worked full time in their usual job. Group II contained 57 patients, of whom 18 worked

only part of the time, 9 had changed to a lighter full-time job, 23 had taken early retirement, and 7 were receiving a pension. Patients in group I were significantly younger (38 vs 51 years), had a smaller proportion of patients with more than 20% overweight (27% vs 44%), had a smaller proportion of severe, grade 0 and 1, motor dysfunction (0% vs 16.3%), had been operated sooner (within 3 days: 52.3% vs 19.3%), had undergone fewer re-operations for recurrence of the herniation (4.5% vs 21.1%), and had worked less frequently in physically demanding jobs (6.7% vs 22.8%). We concluded that when there is a relative indication for herniated nucleus pulposus surgery, it should be limited to patients aged below 40 years, with slight motor dysfunction, who work in physically undemanding jobs, so as to make a satisfactory long-term result more likely.

Key words Herniated nucleus pulposus · Lumbar discectomy · Job-related reintegration

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Introduction

The surgical treatment of lumbar intervertebral disc herniation has been known since 1934 [18]. In Germany and in the United States, more than 20,000 and 200,000 patients, respectively, are operated for lumbar disc prolapse per year [4]. According to the literature, results are evaluated

in different ways. Long-term results are considered unsatisfactory in up to 50%, with rates of recurrence varying from 1% to 20% [2, 17, 28, 31]. Weber [29] randomized 126 patients with suspected lumbar disc prolapse, half of the patients were operated, and the other half were treated conservatively. At 1-year follow-up the operated patients did better, but at 10 years there was no difference between the two groups. His study therefore indicated that there

were no differences in the long term between the results of the operative and those of the non-operative group. However 26% of the conservatively treated patients underwent surgery during the 1st year of observation because of persistence or worsening of pain.

In 1994 our study group [6] showed that the degree of intensity of motor deficit was a good criterion for the assessment of the short-term postoperative course. The goal of the present study was to analyse various recorded parameters for their influence on long-term work resumption.

Materials and methods

From 1985 to 1988, 182 patients with a single-level lumbar disc herniation were operated on at the Orthopedic University Hospital of Mainz for the first time. Patients involved in litigation were excluded from the study. Anamnestic, clinical, and CT findings were recorded on a standard protocol preoperatively.

In 1997, 9–12 years (mean 10.2 years) after operation, standard questionnaires containing the Low Back Pain Outcome Scale according to Greenough and Fraser [9] (Fig. 1) together with questions about the work situation, compensation, temporary or permanent disability, residual pain, necessity of treatment and satisfaction with the operative outcome were sent to the 182 operated patients included in this study. A total of 101 returned questionnaires (55.4%) gave enough information to be analyzed for this study. Eighteen patients had died, another 63 patients were lost to follow-up after having moved to other cities.

Statistically, the 101 patients who answered the questionnaire did not differ significantly in age, gender, preoperative deficits, length of complaints or inability to work from those who did not answer (Table 1).

Patients

A total of 182 patients were included in the study. Their mean age was 45 years. Occupational activity was divided, according to

Fig. 1 Criteria of the Low Back Outcome Scale [9]. According to the significance, 9, 6, or 3 points are attributed to each parameter. A total score of 75 points may be achieved. 65–75 points are regarded as an excellent result, 50–64 as a good result, 30–49 points mean a fair outcome, less than 30 points a poor outcome

Table 1 Demographic and medical variables of responders and non-responders

Variables	Responders (n = 101)	Non-responders (n = 81)
Age (yrs)		
Mean	44.1	45.7
Range	20–78	18–72
Sex (%)		
Male	54.5	57.8
Female	45.5	42.2
Weight (%)		
Normal	23.7	26.6
< 20% overweight	39.6	35.9
> 20% overweight	36.7	37.5
Type of work (%)		
Light work	35.2	33.9
Medium work	45.1	48.6
Heavy work	19.7	17.5
Length of follow-up (yrs)		
Mean	10.4	10.0
Range	9–12	9–12
No. of disc spaces treated per patient (% of patients)		
One	100	100
Two	0	0
Three	0	0
Specific disc spaces that were treated (% of patients)		
L3/L4	7.7	9.9
L4/L5	56.6	53.1
L5/S1	35.2	37.0
Duration of motor deficit (% of patients)		
< 1 day	15.8	16.2
< 3 days	17.9	16.1
< 1 week	26.8	27.2
< 4 weeks	13.8	15.1
> 4 weeks	11.9	12.8
No deficit	13.8	12.6
Intensity of motor deficit (% of patients)		
Grade 0	29.9	30.8
Grade 1	37.9	39.5
Grade 2	23.0	25.9
Grade 3	8.1	3.8
Grade 4	1.1	0

Dvorak et al. [4], into three categories with regard to physical exertion needed, i.e., light work (office job or white collar), medium strenuous work (including household tasks) and heavy work (construction workers, farmers, or blue-collar workers). Demographic variables are given in Table 1.

In the majority of our patients (139, 76.4%) the origin of low back pain could not be attributed to any particular event. Inappropriate lifting started low back pain in 31 patients (17%). In 12 cases (6.6%) symptoms were initiated by hard physical work.

In 119 patients (65.3%) surgical intervention was carried out for an acute radicular syndrome of less than 2 weeks' duration. In the other 63 cases symptoms were present for an average of 64 days (range 14–180 days).

Of the 182 patients, 129 (70.8%) complained of low back pain combined with radicular irradiation, 26 (14.2%) described pseudo-radicular irritation, while 27 (14.8%) had low back pain only. Motor dysfunction was present in 136 cases (74.7%), bladder dysfunction in 5 (2.7%). The severity of the motor weakness was classified grade 0: no motor function; grade 1: visible contraction; grade 2: movement without gravity; grade 3: movement against gravity; grade 4: movement against slight resistance; grade 5: normal motor function. Two physicians independently evaluated the grade of the motor loss, the interobserver conformity being 93.9%. Hypoesthesia was found in 162 patients (89%).

CT scans revealed a herniated nucleus pulposus at L4/L5 in 100 patients, at L5/S1 in 66, at L3/L4 in 15 patients, and at L2/L3 in one.

Statistics

The result of surgery was considered successful if the patient had achieved and maintained full working capacity (group I). If not, surgery was rated as a failure (group II). Using the chi-square test or, where possible, instead of chi-square approximation, using Fisher's exact test (for 2×2 cross tabs), the following variables were statistically evaluated to determine which were predictive of a successful surgical outcome: age, sex, weight, segment of disc herniation, intraoperative finding, duration of motor deficit, intensity of motor deficit, employment status, and the number of re-operations. No multivariate analysis was performed.

Results

The evaluation of the long-term results (9–12 years after the initial intervention) is based on 101 returned questionnaires.

Two groups were distinguished on the basis of working capacity 10 years after surgery for lumbar disc herniation. Group I consisted of the 44 patients who still worked full time in their original job. Group II contained the remaining 57 patients: 18 worked only part-time in their usual

Fig. 2 Working capacity 10 years after lumbar discectomy. Only 44% of the patients worked full time (FT) in their original job. The remainder worked part time (PT; 18%); changed to a lighter job (9%); or were no longer working due to complete disability (29%)

job, 9 had changed to a lighter job, and 30 patients had been unable to continue working as a consequence of residual low back pain (Fig. 2, Table 2).

Table 2 Comparison of outcome and various personal and medical parameters by group (LBOS Low Back Pain Outcome Scale, seq. sequestral prolapse)

Variable	Group I	Group II	P-value
LBOS (%)			
Excellent	31.8	10.5	< 0.0001
Good	45.5	28.1	
Fair	22.7	17.5	
Poor		48.9	
Pain relief (%)	87.4	52.1	< 0.001
Additional treatment (%)			
Regularly		31.6	< 0.001
Occasionally	52.3	54.4	
None	47.7	14.0	
Satisfaction (%)			
Complete	70.5	10.5	< 0.0001
Moderate	27.2	61.4	
No	2.3	28.1	
Mean age (yrs)	38.2 (18–52)	48.7 (30–78)	< 0.01
Sex: male (%)	56.8	52.8	n.s.
Weight (%)			
Normal	34.0	15.8	< 0.05
< 20% overweight	38.6	40.3	
>20% overweight	27.4	43.9	
Segments (%)			
L3/L4	9.1	10.5	n.s.
L4/L5	54.5	56.1	
L5/S1	36.4	33.4	
Intraop. results (%)			
Protrusion	18.2	19.2	n.s.
Covered seq.	43.2	40.4	
Free seq.	38.6	40.4	
Duration of motor deficit (%)			
< 1 day	25.0	8.7	< 0.001
< 3 days	27.3	10.6	
< 1 week	20.5	31.6	
< 4 weeks	6.8	19.3	
> 4 weeks	6.8	15.8	
No paresis	13.6	14.0	
Intensity of motor deficit (%)			
Grade 4	44.8	18.4	< 0.01
Grade 3	34.2	40.8	
Grade 2	21.0	24.3	
Grade 1		14.3	
Grade 0		2.0	
Job (%)			
Light	47.8	25.5	< 0.05
Medium	45.5	44.8	
Heavy	6.7	29.7	
Re-operations (%)	4.5	21.1	< 0.001

Outcome

With regard to the subjective Low Back Outcome Scale [9], the average score was 58.6 (42–75) points in group I, and 40.0 (18–66) points in group II ($P < 0.0001$). Asked for an estimation of the percentage relief of pain, our patients reported an average improvement of 87.4% in group I, and of 52.1% in group II ($P < 0.001$). No patient of group I but 18 of group II (31.6%) still complained of constant low back pain and sciatica. These patients required analgesic medication every day, and received some form of treatment about once a month or more at the time of the inquiry. Twenty-three patients (52.3%) of group I and 31 (54.4%) of group II took non-steroidal anti-inflammatory drugs occasionally and needed consultation rarely; 21 patients (47.7%) of group I were pain free, compared to 8 (14.0%) of group II ($P < 0.001$).

Thirty-one (70.5%) patients of group I versus 6 (10.5%) of group II were completely satisfied with the postoperative result. One (2.3%) and 16 (28.1%) in groups I and II respectively expressed dissatisfaction with the treatment outcome ($P < 0.0001$).

Prognostic variables

Age

The mean age of group I was 38.2 years (range 18–52 years), while patients of group II were on average 12 years older (50.6 years; range 40–78 years). This difference was significant ($P < 0.01$).

Sex

Classified according to sex, the male patients dominated in both groups, with 56.8% and 56.1% respectively. So there was no sex dependency of the long-term job-related outcome.

Weight

For assessment of the factor “weight”, patients were classified according to the BROCA index into three categories: those with normal or below normal weight, those who were up to 20% overweight and those more than 20% overweight. In group I, 66% were overweight compared to 84.2% in group II ($P < 0.05$).

Segment

The discs L4/5 and L5/S1 were affected in 90.1% and 89.5% of cases, respectively. An influence on prognosis did not exist.

Intraoperative result

Intraoperative findings were classified into protrusion, covered sequestral prolapse beneath an intact rear longitudinal ligament, and free sequestral prolapse. The proportion of covered and free sequestral prolapses amounted to 81.8% and 80.8% respectively. No influence on the job-related prognosis was observed.

Duration of motor deficit

The time since first occurrence of the paresis was registered. In group I, 52.3% of the patients had suffered from the paresis less than 3 days, compared to 19.3% in group II. Conversely, 13.6% of the patients in group I had suffered a paresis of more than 1 week's duration, compared to 35.1% in group II ($P < 0.001$).

Intensity of motor deficit

The intensity of paresis was classified in degrees of strength from 0 to 5. Grade 0 represented a complete paresis, and grade 5, full strength. No patient in group I had a paresis grade 0 or 1, but eight patients (16.3%) in group II were in this category. There were 17 patients (44.8%) in group I with a grade 4 paresis compared to only 18.4% in group II ($P < 0.01$).

Type of working

Three times more patients in group II were employed doing heavy work than in group I (22.8% vs 6.7%), and just half the number of patients in group II did light work as compared to group I (26.3% vs 47.8%) ($P < 0.05$).

Re-operations

Eleven of 101 patients were operated for a recurrent herniated nucleus pulposus for second time and three for a third time at the same level. So the overall recurrence rate was 13.9%. While 2 patients regained full working capacity, 12 did not, among them 8 who received complete disability allowance. So the proportion of re-operations in group I was 4.5%, and in group II, 21.1% ($P < 0.001$).

Discussion

Immediately after surgery, results have been reported as satisfactory in more than 85% of patients, but outcome depends significantly on the evaluation method [11, 13]. Prospective studies have not been able to demonstrate better results after microdiscectomy than after standard operations at 1- to 2-year follow-up evaluation [1, 12, 20, 22,

27]. The medium- and long-term results do not differ significantly from the short-term results, with good or excellent results ranging from 80% to 90% [23].

Salenius and Laurent [25] analyzed 695 patients who had undergone surgery 6–11 years earlier. They found that only 56% of the patients had little or no pain, 36% had the same pain as before the operation, and 8% had worse pain. Only 63% of patients had reassumed their former employment. In a retrospective study, Weinstein et al. [30] reviewed 71 patients who had been submitted to standard discectomy 10 years earlier. Eighty percent were satisfied with their treatment. Lewis et al. [15] evaluated 83 patients at 1 year and 5–10 years after standard lumbar discectomy. In the longer term, complete relief of back pain was observed in 62% and partial relief in 29%, the corresponding figures for relief of leg pain being 62% and 27%. These data were found to be as favorable as after 1-year follow-up. The rate of recurrence operations was 18%. DeLuca et al. [3] reviewed 8 of 48 children and adolescents at an average of 6.3 years after discectomy. The results were rated as excellent or good in 91%.

The very-long-term results of surgery are hardly known because few studies have analyzed patients who underwent surgery a decade or more earlier, and all studies were retrospective. Naylor [19] reviewed 204 patients 10–20 years after surgery. He found 38% were pain free, 41% had minor residual symptoms like paresthesia or backache, and only 3% had no relief of pain. Ebersold et al. [5] observed 38% excellent and 58% good results 18 years after surgery in 74 patients aged 16 years or younger at the time of operation. The recurrence rate was 21%, usually within 5 years of the first operation. Dvorak et al. [4] found a very low proportion of satisfactory results in a review of clinical records of 575 patients: 4–17 years after surgery, 70% of the patients still reported back pain, 45% had residual sciatica, 19% were permanently disabled or had taken early retirement. Of 55 patients who were operated a second time, 68% were unable to work or definitely disabled, receiving a permanent disability allowance.

The goal of our study was to evaluate the job-related outcome after standard lumbar discectomy for herniated

nucleus pulposus and to determine parameters that may have a beneficial influence on the outcome. In partial contrast to Dvorak et al. [4], our long-term results of 10 years after the operation were not disappointing, with 65% of 101 patients achieving a good or excellent outcome on the Low Back Pain Outcome Scale [9]. But there was a clear discrepancy between the 44 patients still working full time in their original job and the 57 patients who did not fully resume their original work.

Fourteen of our patients (13.9%) were re-operated for local recurrence of disc herniation. This rate is in between the rates reported by Jerosch et al. [10] (6.3%) and Fritsch et al. [8] (10.9%) on the one hand, and Dvorak et al. [4] (17%), Rish [24] (18%), Berney [2] (19%), and Walker [28] (20%) on the other. Twelve of these 14 patients (85.7%) did not regain full working capacity. Eight of these 12 (66.7%) received early retirement. Dvorak et al. [4] reported 67% out of 55 re-operated patients to be completely disabled. Fritsch et al. [8] found only 22% satisfactory results after a 2- to 27-year follow-up, compared to 40% after an average of 31 years in the study of Jerosch et al. [10].

Outcome tends to deteriorate with time [7, 14, 16, 19, 21, 23, 26], but our data suggest that better long-term results may be expected in younger patients with little motor deficiency who work in light jobs. It must be very clear, however, that in this study we did not gather any information on the psychological status of the patient, nor did we collect any prospective data. A current prospective study is on its way, but no long-term results can be reported. Only 101 of 182 patients could be evaluated. We cannot rule out selective non-response, but statistically we ruled out significant differences between responders and non-responders with regard to baseline data. What is more, we applied the strongest possible objective success parameter, i.e., return to work, after a minimum follow-up of 9 years. Therefore, in our department, when there is a relative indication for operation, nowadays, only group I patients are eligible for lumbar disc surgery, while the others are predominantly treated with conservative procedures.

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