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Does the choice of outcome scale influence prognostic factors for lumbar disc surgery?

A prospective, consecutive study of 121 patients

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Abstract From January to June 1994, we operated conventionally on 121 consecutive herniated lumbar disc patients as part of a prospective study. We analysed general data, case histories, neurological findings on admission and all data from imaging investigations and therapy. In addition, all patients received a questionnaire based on the Low Back Outcome Score. Most of the patients (93%) were followed-up for 1 year postoperatively in the same manner. On the Prolo Scale, we obtained a good result in 70%; 76% had a good Low Back Outcome Score. Predictive factors are different for different outcome scales. The preoperative duration of pain, the preoperative duration of paresis and smoking seem to be general predictive factors.

Key words Functional-Economic Outcome Rating Scale · Low Back Outcome Score · Lumbar disc surgery · Quality of life

Introduction

Unfortunately, a generally acceptable, standardised method of assessing results after lumbar disc surgery is not available [11, 17, 19]. Most studies, therefore, use their own method to evaluate their results. On the basis of these outcomes, they draw conclusions for the predictive factors for lumbar disc surgery [1–3, 5–7, 12–15, 17, 19–22]. Howe and Frymoyer showed retrospectively that results depend on the questionnaire design, with satisfactory outcomes ranging from 97% to 60% in the same population [11]. Dauch et al. investigated this problem in a prospective study in 1994 [2]. They used 24 different sets of patient data as starting points and had five different outcome parameters. They showed that there are different predictors for different outcome parameters of lumbar disc surgery. Dauch et al. recommended a multi-dimensional measurement for appraising the outcome of lumbar disc surgery [2]. In 1986 Prolo et al. initiated the Economic-Functional Rating Scale for assessing the outcome of lumbar spinal operations [19]. Greenough and Fraser (1992) introduced the Low Back Outcome Score. In our opinion this has the advantage that it may be used pre- and postoperatively to estimate the functional starting condition and the operative results in prospective studies [10]. Up to now none of these scales have been used in a prospective study to assess the outcome of lumbar disc surgery. The aim of this study was to investigate prospectively the influence of these multi-dimensional outcome measurements on prognostic factors in lumbar disc surgery.

Materials and methods

Between January and June 1994, we operated on the herniated discs of 121 patients at the Neurosurgery Department of the University of Regensburg Hospital. All patients underwent this operation for the first time. Approximately two-thirds (72%) were men and 28% women. Their ages ranged from 15 to 76 years, with a median of 44.4 years. Hyperuricaemia was present in 27% of the patients, 2.5% had diabetes mellitus and 43% were smokers.

On admission, 96% had sciatic pain, with 18% of the patients reporting a diffuse pain radiation and the remaining patients a radicular pain radiation. Only 3% had low back pain without radiation. One patient felt no pain. Sixty-five percent of the patients had radicular sensory loss, and 13% had hypoaesthesia in more than one dermatome. Twenty-two percent were without sensory loss. Radicular paresis was found in 55%, and 43% showed no motor weakness. A diffuse weakness was present in 2%. According to the grading scale of paresis (0 = plegia, 5 = no weakness) there

Table 1 Information derived from the Low Back Outcome Score (LBOS) and pain grading scale questionnaires on admission and follow-up (*a.* ≙ affected)

Questions	Information		Answers	
	All patients on admission	All patients at follow-up		Points on the LBOS
How often do you have to take pain killers for your pain?	23%	80%	Never	6
	25%	10%	Occasionally	4
	23%	5%	Almost every day	2
	29%	5%	Several times each day	0
How often do you have a consultation with a doctor?	2%	51%	Never	6
	14%	20%	Rarely	4
	25%	19%	1–2 times a month	2
	59%	10%	1–2 times a week	0
At present, are your working?	26%	65%	Full time at your usual job	9
	3%	16%	Full time at a lighter job	6
	4%	3%	Part time	3
	67%	16%	Not working	0
Do you need to rest during the day because of pain?	13%	61%	Not at all	6
	12%	20%	A little	4
	15%	8%	Half the day	2
	60%	11%	Over half the day	0
At present, can you undertake household chores or additional jobs?	17%	52%	Normally	9
	24%	33%	As many as usual, but slowly	6
	29%	13%	A few, not as many as usual	3
	30%	2%	Not at all	0
At present, can you undertake sports or active pursuits (e.g. dancing)	3%	13%	As much as usual	9
	15%	33%	Almost as much as usual	6
	27%	27%	Some, much less than usual	3
	55%	27%	Not at all	0
Please tick the box that describes best how much your back pain affects each of the following six activities				
Dressing	9%	64%	No effect	3
	59%	28%	Mildly or moderately affected (a.)	2
	31%	8%	Difficult a.	1
	1%	0%	Not possible	0
Sitting	4%	38%	No effect	3
	46%	57%	Mildly or moderately affected (a.)	2
	42%	5%	Difficult a.	1
	8%	0%	Not possible	0
Walking	7%	60%	No effect	3
	38%	31%	Mildly or moderately affected (a.)	2
	52%	9%	Difficult a.	1
	3%	0%	Not possible	0
Sleeping	14%	58%	No effect	3
	48%	36%	Mildly or moderately affected (a.)	2
	37%	6%	Difficult a.	1
	1%	0%	Not possible	0
Travelling	9%	42%	No effect	3
	31%	52%	Mildly or moderately affected (a.)	2
	30%	6%	Difficult a.	1
	30%	0%	Not possible	0

Table 1 (continued)

Questions	Information		Answers	
	All patients on admission	All patients at follow-up		Points on the LBOS
Sex life	34%	66%	No effect	6
	33%	29%	Mildly or moderately affected (a.)	4
	15%	3%	Difficult a.	2
	18%	2%	Not possible	0
Pain grading scale			Calibration	
	5%	66%	0–25	9
	22%	20%	26–50	6
	32%	11%	51–75	3
	41%	3%	76–100	0

Table 2 Results according to the Prolo Scale

Points	Outcome	Patients	
		n	%
E1	Complete invalid	5	4
E2	No gainful occupation	10	9
E3	Able to work, but not at previous occupation	4	4
E4	Working at previous occupation on part-time or limited status	21	19
E5	Able to work at previous occupation with no restrictions of any kind	73	64
Total		113	100
F1	Total incapacity (or worse than before operation)	2	2
F2	Mild to moderate level of low back pain and/or sciatica	16	14
F3	Low level of pain and able to perform all activities except sports	27	24
F4	No pain, but patient has had one or more episodes of recurrent low back pain or sciatica	39	35
F5	Complete recovery, no recurrent episodes of low back pain, able to perform all previous sports activities	29	26
Total		113	100
Sum of points (E and F)			
2		2	2
3		3	3
4		6	5
5		2	2
6		7	6
7		14	12
8		22	20
9		31	27
10		26	23
Total		113	100

were 44% without paresis (5/5), 31% with paresis (4/5), and 13% had paresis (3/5). The remaining 12% had a weakness of 1–2/5. About 49% had normal reflexes; 9% had a hyporeflexia involving more than one nerve root and 42% had a radicular hyporeflexia. In 35%, we found the straight leg sign positive at an angle of less than 30°; in 47% it was positive at more than 30°, and in 18% there was no straight leg sign. A crossed straight leg sign was found in 18%.

Most of the patients (87%) underwent CT of the lumbar spine preoperatively. Only 22% of the patients underwent MRI; 8% underwent lumbar myelography. CT showed a sequestrated disc fragment in 60% of patients; 33% had a prolapse and the remaining 7% had a protrusion.

Preoperatively, each patient received a questionnaire based on the Low Back Outcome Score and a rating scale for the classification of their pain level (Table 1), [9, 10]. The standard operation procedure was a conventional discectomy via an extended interlaminar fenestration without microscope. The level operated on was verified by intraoperative radioscopy. The patients were rou-

tinely examined and operated on by different residents and senior surgeons.

The follow-up was carried out between the 341st and 424th postoperative day (mean follow-up period 366 days) by an independent investigator. It consisted of the filling in of a questionnaire (including the Low Back Outcome Score), a rating according to the Prolo Scale and a postoperative examination. A total of 113 patients (93%) were re-examined. Most of the remaining patients could not be followed-up, because they had moved, leaving no forwarding address. The overall outcome measured by the Low Back Outcome Score (LBOS) is calculated by adding the points scored on the pain grading scale to the points scored on the LBOS questionnaire at follow-up. The overall outcome measured on the Prolo Scale is the sum of points scored for working ability and for remaining pain after surgery (Tables 1, 2).

All data were analysed statistically by analysis of variance and the Games-Howell and Dunnett's one-tail and two-tail test as well as by Scheffé's S and χ^2 post hoc tests [4, 8].

Results

Pain and neurological findings at follow-up

At follow-up 55% of all patients reported that they were absolutely painfree. Twenty-seven percent complained of low back pain without any radiation, about 18% still had sciatica, and 14% of all patients had an unequivocal radicular radiation at follow-up.

The hypoaesthesia had improved in 77%, decreased in 1% and remained unchanged in 22%. About one-fifth (19%) still had radicular sensory loss. Paresis was found in 16% of the patients at follow-up. Most cases of paresis had improved significantly (Fig. 1). Four percent of the patients had to be operated on a second time for a herniated disc; 3% on the same side and level.

Results of the different outcome measurements

Quality of life

All patients were asked whether their quality of life had changed after surgery. Sixty-three percent reported that it had improved enormously. In 26% of patients, the quality of life improved only a little. Ten percent reported no change and in 2% it was worse than before surgery.

Pain grading scale

Using the pain grading scale as an outcome measurement (0 = no pain, 100 = worst imaginable pain), 66% of patients rated themselves between 0 and 25 and 20% between 26 and 50. Of the remainder, 11% rated their postoperative pain between 51 and 75 and 3% between 76 and 100 (Table 1).

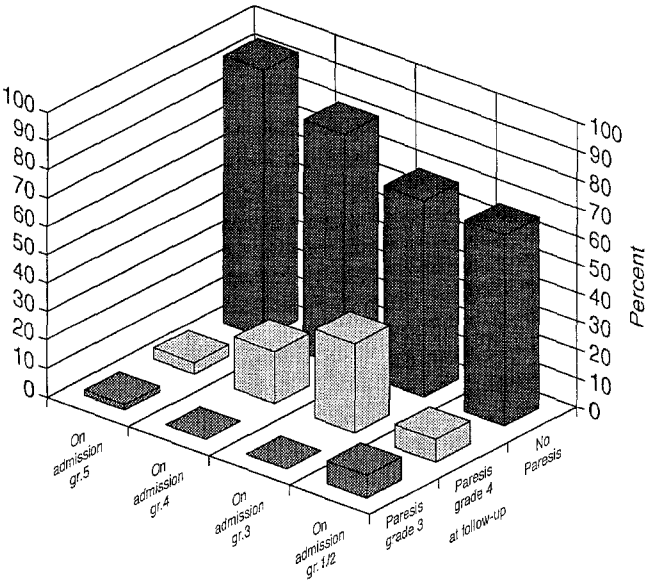

Fig. 1 Development of paresis from admission to follow-up graded from 0 to 5 (0 = plegia; 1 = no movement, muscle contraction; 2 = movement against gravitation; 3 = movement against light resistance; 4 = movement against resistance; 5 = no paresis)

Low Back Outcome Score (LBOS)

The results as measured on the LBOS are presented in Table 1. On this outcome scale, we attained a good outcome in 76% of patients and a poor one in 24% (good = 50–75, poor = < 50).

Functional-Economic Rating Scale (Prolo Scale)

The results as measured on the Prolo Scale are presented in Table 2. On this scale, the outcome was scored as good in 70% of patients and poor in 30% (good = 8–10, bad = < 8).

Predictive factors of different outcome scales

The predictive factors of four outcome scales are presented in Table 3. Regarding quality of life, there are more patients with a medial prolapse ($P < 0.005$) and no paresis ($P < 0.05$) in the group with poor outcome. According to the pain grading scale a radicular sensory loss is a prognostic factor for a good outcome ($P < 0.05$), and on the Prolo Scale the straight leg sign below 30° and a walking distance of less than 500 m are found to be predictive factors for a poor outcome ($P < 0.05$).

Smoking is calculated to be a prognostic factor for poor outcome according to the pain grading scale, the Prolo Scale and the Low Back Outcome Score ($P < 0.05$).

A long duration of preoperative pain and paresis are prognostic factors for poor outcome as measured by the

Table 3 Pertinent starting conditions according to different outcome measurements and their calculated significance

Findings on admission	Outcome							
	Prolo scale[a]		Low Back Outcome Score[b]		Pain grading scale[c]		Qualitiy of life[d]	
	Good (70%)	Poor (30%)	Good (76%)	Poor (24%)	Good (86%)	Poor (14%)	Good (88%)	Poor (12%)
Duration of pain > 6 months	10%	23%	10%	26%	15%	25%	12%	23%
Duration of pain < 60 days	68%	53%	66%	55%	64%	44%	67%	38%
Duration of pain (mean)	77 days	165 days*	84 days	159 days*	89 days	180 days*	88 days	209 days*
Duration of sick leave >1 month preoperatively	39%	55%	44%	44%	49%	50%	44%	47%
Duration of sick leave (mean)	40 days	68 days	48 days	48 days	46 days	56 days	47 days	57 days
Walking distance < 500 m	28%	47%	34%	32%	36%	19%	35%	23%
Non-radicular radiation	14%	26%	16%	23%	16%	25%	17%	23%
Radicular sensory loss	67%	67%	68%	64%	71%	43%*	69%	54%
No paresis	48%	35%	47%	35%	41%	62.5%	41%	69%*
Radicular paresis	52%	62%	51%	64%	58%	36%	58%	31%
Duration of paresis (mean)	56 days	120 days*	60 days	123 days*	59 days	169 days**	59 days	195 days**
Radicular hyporeflexia	46%	42%	49%	33%	46%	33%	45%	42%
Lasègue < 30°	32%	53%*	30%	58%	34%	63%	35%	61%
Lasègue > 30°	47%	38%	50%	29%	47%	25%	46%	31%
Lasègue negative	21%	9%	20%	13%	19%	12%	19%	8%
Crossed Lasège	16%	21%	17%	19%	17.5%	19%	17%	23%
Medial prolapse at L4/5	3%	9%	4%	6%	3%	13%	3%	15%
Medial prolapse	3%	12%	2%	13%	4%	19%	2%	31%**
Sequestrated disc on CT	57%	67%	61%	58%	57%	62%	62%	46%
Strenuous job	8%	15%	7%	16%	8.2%	19%	9%	15%
Hyperuricaemia	28%	24%	24%	32%	25%	38%	26%	31%
Smoking	34%	59%*	34%	61*%	38.1%	62.5*%	39%	62%

*$P < 0.05$; **$P < 0.005$

[a] Good = 8–10 points, poor = < 8 points

[b] Good = 50–75 points, poor = < 50 points

[c] Good = 0–50, poor = 51–100 at follow-up

[d] Good = considerable or a little improvement in quality of life, poor = no improvement or worse quality of life

Prolo Scale, the Low Back Outcome Score, the quality of life score and the pain grading scale ($P < 0.05$–$P < 0.005$; Table 3).

Discussion

There are no generally accepted predictive factors for lumbar disc surgery, because different predictive factors seem to apply to different outcome measurements. Some authors use the patient's overall assessment as a single measure of success [13, 15, 21, 22]. Other studies apply the pain grading scale [12, 20] and some use a combination of other findings, for example professional rehabilitation, residual symptoms, paresis or activities of daily living and narcotic medication at follow-up [1, 2, 12, 14, 16]. Pappas et al. and Davis applied the Functional-Economic Rating Scale of Prolo et al., which takes into consideration professional rehabilitation and residual pain symptoms [3, 18, 19]. Looking at the results of these studies, the poor results ranged from 0% to 56% (Table 4).

In nine studies compared in Table 4, only 5 of the suggested 27 predictive factors were found to be predictive in more than one study. Preoperative sick leave was of predictive value in four studies, age and legal or workers' compensation claims in three and the remaining factors (radicular pain distribution and duration of present episode) were of predictive value in two studies each (Table 4).

Using four different outcomes scales, we calculated eight predictive factors (Table 3). Two of them (duration of preoperative pain and duration of preoperative paresis) had been found to be predictive factors on all outcome scales, and one (smoking) on three scales. The remaining five seem to be predictive for only one scale each. Additionally, some findings seem to be conflicting. On the pain grading scale, the quality of life score and the Low Back Outcome Score, patients with a restricted walking ability seem to have a better prognosis. On the Prolo Scale, patients with a walking distance of less than 500 m seem to have a poorer prognosis (Table 3).

The reason for the difference in predicting factors between different studies is probably that every outcome

Table 4a Multiple different outcome predictors from different studies

	Dauch et al. [2]	Hurme and Alaranta [12]	Abramovitz and Neff [1]	Weir [22]	Soerensen and Mors [20]
Study desing	Prospective	Prospective	Prospective	Prospective	Prospective
No. of patients	109	220	740	100	57
Follow-up period	6 months	6 months	12 months	1 year (42 patients)	24 months
Outcome measurement	1. Professional rehabilitation 2. Patient's overall assessment 3. Paresis 4. Activity of daily living 5. Sciatica 6. Lumbago	1. Pain grading scale 2. Activity of daily living	Premorbid level of activity Residual symptoms Narcotic medication	Patient's overall assessment	Pain grading scale
Results	9–56% Poor	10% Poor	5% Poor	< 10% Poor	18% Poor
Prognostic factors:					
Sex					
Age	×	×		×	
Smoking					
High preoperative daily living index		×			
High preoperative pain index		×			
Duration of present episode		×		×	
Leg pain on straight leg raise			×		
Absence of back pain on straight leg raise			×		
Absence of back pain			×		
Reflex asymmetry			×		
Radicular pain distribution			×		×
Radicular hypoaesthesia				×	
Dermatomal hypoalgesia					
Paresis	×			×	
Finneson index					
Gießener complaint scale	×				
Admission of symptoms (MMPI-Scales)					×
Absence of a work-related injury			×		
Preoperative sick leave	×			×	×
Lumbago on the 7th postoperative day	×				
Schober index	×				
Marital status	×	×			
Being employed					×
Strenuous job		×			
Physical activity					
Legal or workers' compensation claims		×		×	
Psychological state		×			

Table 4b Multiple different outcome predictors from different studies

	Manniche et al. [16]	Lewis et al. [15]	Weber [21]	Davis [3]
Study design	Retrospective	Prospective	Controlled, prospective	Retrospective
No. of patients	261	100	126	984
Follow-up period	31 months (median)	5–10 years	1 year /10 years	10.8 years
Outcome measurement	1. Low Back Pain Rating Scale 2. Patient's overall assessment	Patient's overall assessment	Patient's overall assessment	Prolo Scale
Results		9–11% Poor	28%/0% Poor	11% Poor
Prognostic factors:				
Sex	×			
Age			×/×	
Smoking	×			
High preoperative daily living index				
High preoperative pain index				
Duration of present episode				
Leg pain on straight leg raise				
Absence of back pain on straight leg raise				
Absence of back pain				
Reflex asymmetry				
Radicular pain distribution				
Radicular hypoaesthesia				
Dermatomal hypoalgesia	×			
Paresis				
Finneson index	×			
Gießener complaint scale				
Admission of symptoms (MMPI-Scales)				
Absence of a work-related injury				
Preoperative sick leave			×/	
Lumbago on the 7th postoperative day				
Schober index				
Marital status				
Being employed				
Stenuous job				×
Physical activity			×/	
Legal or workers' compensation claims				×
Psychological state				

scale measures different single qualities and/or a combination of different qualities, each of which will clearly have different predictive factors. Furthermore, looking at the follow-up period of the different studies, the number of predictive factors decreases with the increase in follow-up time (Table 4). The fact that three factors (duration of pain, duration of paresis and smoking) had been found to be of predictive value for more than two outcome measurements emphasized their importance for outcome as general predictive factors.

Conclusion

There appear to be different predictive factors for different outcome measurements, including the multi-dimensional ones. In our study, the preoperative duration of pain, the preoperative duration of paresis and smoking seem to have a general influence on outcome regardless of the measurement scale.

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