Scand J Rehab Med 30: 221–225, 1998

BACKGROUND VARIABLES (MEDICAL HISTORY, ANTHROPOMETRIC AND BIOLOGICAL FACTORS) IN RELATION TO THE OUTCOME OF LUMBAR DISC SURGERY

Vibeke Graver[1,2], A. Elisabeth Ljunggren[2,3], Mitchell Loeb[4], Alf K. Haaland[5], Håkon Lie[6] and Bjørn Magnæs[7]

From the [1]Department of Neurology and [2]Research Forum, Ullevål University Hospital, [3]Division for Physiotherapy Science, University of Bergen, [4]National Institute of Public Health, Oslo, [5]Haematological Research Laboratory, Ullevål University Hospital, [6]Chris Med A/S, Oslo and [7]Department of Neurosurgery, Ullevål University Hospital, Oslo, Norway

ABSTRACT. In a prospective cohort study 122 patients with herniated intervertebral lumbar disc and no previous low back surgery preoperatively were assessed regarding medical history, anthropometric and biological background variables. The outcome of surgery (traditional methods) was evaluated one year postoperatively, mainly using a composite Clinical Overall Score (COS), including pain intensity, physical signs, functional capacity and analgesics. Return to work was also assessed. In regression analyses, low body height, high values of weight and body mass index, as well as long duration of sickness absence were shown to be significantly related to a poor outcome, as evaluated by the COS. However, after controlling for modifying effects of previously determined predictive fibrinolytic and psychological variables, the background variables lost their significance. Female sex, low stature, long duration of sickness absence and physically strenuous work activities were statistically significantly related to lower frequencies of return to work.

Key words: anthropometric variables, biological variables, lumbar disc herniation, medical history, prediction, surgery.

INTRODUCTION

While the rate of lumbar disc surgery is increasing (3), the success rate varies considerably, the results seemingly dependent upon pre-, peri- and postoperative factors (7, 11, 13, 17, 19). All reviews of poor outcome emphasize the importance of patient selection in terms of predictive risk factors. Most patients have been burdened with low back complaints for a long time prior to surgical intervention, and are often known to sustain significant impairment in their physical, psychosocial and leisure activities. For clinicians, it is essential to understand the way in which these factors may influence the outcome of surgery. In previous papers we have shown that preoperative impaired fibrinolytic activity (11), as well as many symptoms of anxiety and psychosomatic proneness (7), was a predictor of poor one-year clinical outcome of lumbar disc surgery. The aim of the present study was to assess the predictive value of background variables regarding medical history, anthropometric and biological factors, controlling for the known effects of impaired fibrinolytic activity and psychological traits.

MATERIALS AND METHODS

Patients

This study was part of a more extensive prospective cohort investigation of prognostic factors for the outcome of lumbar disc surgery (7–11). One hundred-and-twenty-two patients (56 women and 66 men) with sciatica and/or severe neurological deficits, e.g. cauda equina symptoms, due to unambiguous herniated lumbar discs were included. Previous low back surgery was an exclusion criterion. All the patients were operated on with traditional surgical methods, including either full or partial laminectomy (8).

Methods

Medical history, anthropometric and biological background variables One week before surgery the following background variables were recorded by means of a standardized interview, a questionnaire and blood samples (Table I):

Medical history: Age, duration of present attack of sciatica, duration of present sickness absence, number of months since first attack of lumbago-sciatica, number of sickness absences due to lumbago-sciatica and smoking history.

Anthropometric variables: Height, weight and body mass index (BMI).

Table I. *Background variables in 122 patients with herniated lumbar disc (56 women and 66 men)*

	Mean	Range	SD
Medical history			
Age (years)	40.8	18–66	10.9
Duration of present attack of sciatica (months)	8.8	1–99	11.8
Duration of present sickness absence (months)	5.5	0–168	15.5
No. of months since first attack of lumbago-sciatica	102.2	2–420	106.4
No. of sickness absences due to lumbago-sciatica	3.8	0–40	5.7
Smoking, daily number of cigarettes	10.7	0–80	12.2
Anthropometric variables			
Height (cm)	175.4	156–196	9.0
Weight (kg)	72.9	50–102	11.5
BMI (kg/m^2)	23.6	16.6–37.3	3.1
Biological variables			
Cholesterol (mmol/l; $n = 121$)	5.59	3.50–9.12	1.66
HDL cholesterol (mmol/l; $n = 119$)	1.27	0.66–2.09	0.33
Triglycerides (mmol/l; $n = 121$)	1.41	0.26–5.97	0.82
GGT (U/l; $n = 120$)	35.3	5.0–379.0	44.8

BMI = Body Mass Index; HDL = High Density Lipoprotein; GGT = Gamma Glutamyl Transpeptidase.

Biological variables: Cholesterol, high density cholesterol (HDL), triglycerides, and gamma glutamyl transpeptidase (GGT), which was used as an indicator of alcohol abuse.

Physical activity: The level of physical activity at work and leisure was also recorded (15).

Previously determined predictors

The previously determined fibrinolytical (11) and psychological (7) predictors for a Clinical Overall Score (COS) included: plasminogen activator inhibitor, euglobulin clot lysis time, anxiety (The Hospital Anxiety and Depression Scale) and psychosomatic symptoms (The Modified Somatic Perception Questionnaire).

Outcome variables

The Clinical Overall Score (COS): The outcome of surgery was evaluated by a physiotherapist one year postoperatively, mainly using an overall scoring system which included pain intensity in the low back and leg, physical signs (spinal deviation, Lasègue's test, muscle atrophy, muscle strength and sensory deficits), functional capacity (6) and the use of analgesics. The COS was defined as the weighted sum of these four components. When calculating the COS, the higher of the two pain scores was used. A maximum COS of 1000 represented the maximum of pain and clinical symptoms, and a minimum COS of 0 indicated no symptoms or functional impairment (9).

Return to work: One year postoperatively the patients were categorized in relation to the frequency with which they had returned to work: (i) full-time work, (ii) part-time work (at least 1/2 time), and (iii) did not return to work. Other details about the patients and assessments have been described previously (7–9, 11).

Data analysis and statistics

Univariate and multivariate regression analyses were used to identify the background variables significantly related to the one year COS. To control for modifying effects of fibrinolytic activity and psychological traits, these variables were finally included in the multivariate regression equations. Since both height and weight are elements of BMI, and to avoid problems of interdependence, two sets of multivariate analyses were performed: one (I) with the background variables excluding BMI, the other (II) excluding height and weight.

The background variables were assessed in relation to return to work by means of Student's *t*-test, with the exceptions of gender, which was assessed using the chi-square test, and physical activity at work and leisure, which were examined by means of chi-square tests for linear trend in proportions. The statistical analyses were performed using programmes in the Statistical Package for the Social Sciences (SPSS for Windows, version 6) and Epi Info. All results were considered to be statistically significant if $p < 0.05$.

RESULTS

The values of the preoperative background variables are listed in Table I. Regarding physical activity at work, 28.7% of the patients had work that could be described as sedentary, 68.8% were employed in moderate or intermediate physically strenuous work, while only 2.5% reported to have work requiring hard physical activity. In their leisure time, 43.4% were sedate, 54.1% reported moderate or intermediate activity, while 2.5% of the patients undertook hard physical activity.

The outcome of surgery, as measured by the one-year COS and its separate elements, is given in Table II. In the univariate regression analyses, low values of height ($F = 4.07$, $p = 0.05$) and high values of weight ($F = 7.23$, $p = 0.008$) and duration of sickness absence ($F = 4.42$, $p = 0.04$, df = 1/119) were shown to be significantly

Table II. *Clinical assessments and the Clinical Overall Score (COS) registered one year postoperatively in 122 patients with herniated intervertebral lumbar disc*

	Mean	SD	Range
Low back pain*	21.9	24.9	0–90
Leg pain*	15.4	23.5	0–85
Physical signs	11.1	15.9	0–90
Functional capacity	13.8	15.2	0–64
Analgesic	5.9	16.0	0–80
COS**	156.6	166.4	0–740

* The highest value of pain in either the low back or leg was used for the individual COS.
** When calculating the COS, the pain score was quadrupled, while the other subsets were doubled.

related to high values of COS (poor outcome). The results of the multivariate analyses are given in Table III; only height, weight and BMI were significantly associated with poor outcome. However, when the previously determined predictive fibrinolytical and psychological variables were included in the multivariate regression equations, the anthropometrical variables too lost their significance.

Regarding return to work one year postoperatively, 66.4% of the patients had returned to full-time work, 6.6% to part-time, while 27% were classified as not having returned to work. For the statistical analyses the part-time and full-time workers were combined, giving a total of 73%. Altogether 76% of the men and 55.4% of the women had returned to work. Only female sex (chi square = 4.77, $p = 0.03$), low body height ($t = 2.17$, $p = 0.03$), long duration of sickness absence ($t = 2.57$, $p = 0.01$) and physically strenuous work (chi square = 4.74, $p = 0.03$) were found to be significantly associated with lower frequencies of return to work.

DISCUSSION

In the present study we have shown that low stature, high values of weight and BMI, and long duration of sickness absence were predictors of poor outcome of surgery as evaluated one year postoperatively using the COS. The variables lost their significance, however, when the modifying effects of previously determined predictive value of fibrinolytic activity and psychological traits were controlled for. Fibrinolytical and psychological variables thus seem to have a stronger impact on the outcome than the background variables assessed in the present study. Regarding return to work, female sex, low stature, long duration of sickness absence and strenuous work activities were associated with lower frequencies of return to work.

Weight, BMI and height have also previously been found to be associated with low back pain and sciatica (2, 4, 12, 17). Interestingly, we found that low height was associated with poor outcome, while tallness has been shown earlier to be a risk factor for getting low back troubles (2, 12).

Previous investigators too have found that preoperative long sickness absence might have a negative influence on the outcome of surgery (23, 19). In clinical practice it is therefore of importance that patients do not have an unreasonably long delay during evaluation and selection for surgery.

In some studies, smoking (1, 4, 14, 16) and alcohol abuse (20) have been shown to be associated with low back pain syndromes. We were unable to demonstrate significant associations between these factors and the surgical outcome. In the initial anamnestic interview, information on alcohol consumption was collected, but because of the low reliability of these data they were disregarded and GGT was used instead. Studies by the World Health Organization, however, suggest that GGT and other biological assessments yield measurements that are too low in sensitivity and specificity to be used as detectors of alcohol abuse in non-alcoholic populations (21).

Good physical fitness is known to be significantly related to less dysfunctioning in patients with low back pain (17, 18), and Weber (23) found that physically

Table III. *Results of multivariate regression analyses between preoperative background variables and the one-year postoperative Clinical Overall Score. Only significant variables are shown*

Variables	F	*p*	Equation	F	*p*	df	Rsq
Height	5.27	0.020	I*	1.47	0.130	15/102	0.18
Weight	4.84	0.030	I				
BMI	5.15	0.030	II**	1.43	0.150	14/103	0.16

* Equation I assesses the predictive value of all background variables excluding BMI.
** Equation II assesses the predictive value of all background variables excluding height and weight.

active patients preoperatively performed better postoperatively compared with inactive patients. We did not find statistically significant relationships between physical activity at leisure preoperatively and the clinical outcome of surgery.

There is no generally acceptable and standardized method for the assessments of outcome after lumbar disc surgery. We have used an overall scoring system, based on pain intensity, functional capacity, physical signs and the use of analgesics. This overall assessment proved easy to use, and in a validation study the COS was found to correlate closely with both the patient's and the examiner's opinion of outcome, and with return to work (9). The internal consistency of the COS has also been shown to be good (9). In our opinion the COS therefore seems to be a reliable and valid instrument for the assessment of outcome after lumbar disc surgery (9). Questions regarding the use of overall outcome scores to measure surgical results have been raised, however, as such scores may hide relevant clinical information. These questions are further discussed in another article (9).

Return to work is often used as an outcome measure. However, as the variable might be influenced by factors that are not directly related to healthcare, its validity as outcome measure is questionable (5). We have used return to work only as a supplement to the COS. Findings of the significant associations between lower frequencies of return to work and female sex, long duration of sickness absence and strenuous work activities correspond, however, with those of previous investigators (19, 22).

CONCLUSION

Low stature, high weight and overweight, as well as long duration of sickness absence, were significantly associated with poor clinical outcome, as assessed using a comprehensive COS system. However, after controlling for modifying effects of the previously determined predictive value of impaired fibrinolytic activity and psychological traits, the background variables assessed in the present study lost their significance. Female sex, low stature, long duration of sickness absence and strenuous work activities were shown to be related to lower frequencies of return to work. These factors should be taken into consideration when evaluating and selecting patients for surgery.

ACKNOWLEDGEMENT

This investigation was supported by a grant from the Norwegian Fund for Postgraduate Training in Physiotherapy.

REFERENCES

1. Boshuizen H. C., Verbeek J. H. A. M., Broersen J. P. J. & Weel A. N. H.: Do smokers get more back pain? Spine *18:* 35, 1993.
2. Böstman O. M.: Body mass index and height in patients requiring surgery for lumbar intervertebral disc herniation. Spine *18:* 851, 1993.
3. Davis H.: Increasing rates of cervical and lumbar spine surgery in the United States, 1979–1990. Spine *19:* 1117, 1994.
4. Deyo R. A. & Bass J. E.: Lifestyle and low-back pain. The influence of smoking and obesity. Spine *14:* 501, 1993.
5. Deyo R. A., Andersson G., Bombardier C., Cherkin D. C., Keller R. B., Lee C. K., Liang M. H., Lipscomb B., Shekelle P., Spratt K. F. & Weinstein J. N.: Outcome measures for studying patients with low back pain. Spine *19:* 2032S, 1994.
6. Fairbank J. C. T., Couper J., Davies J. B. & O'Brien J. P.: The Oswestry Low Back Pain Disability Questionnaire. Physiotherapy *66:* 271, 1980.
7. Graver V., Ljunggren A. E., Malt U. F., Loeb M., Haaland A. K., Magnæs B. & Lie H.: Can psychological traits predict the outcome of lumbar disc surgery when anamnestic and physiological risk factors are controlled for? Results of a prospective cohort study. J Psychosom Res *39:* 465, 1995.
8. Graver V., Ljunggren A. E., Magnæs B., Loeb M. & Lie H.: Is the outcome of traditional lumbar disc surgery related to the size of the exposure? Acta Neurochir (Wien) *138:* 824, 1996.
9. Graver V., Loeb M., Rasmussen F., Lie H. & Ljunggren A. E.: Clinical Overall Score (COS). Outcome evaluation after lumbar disc surgery, assessments of reliability and validity. Scand J Rehab Med *30:* 227–234, 1998.
10. Graver V., Haaland A. K., Loeb M. & Ljunggren A. E.: Fibrinolytical activity in relation to psychological traits in patients with sciatica. Thromb Res *85:* 363, 1997.
11. Haaland A. K., Graver V., Ljunggren A. E., Loeb M., Lie H., Magnæs B. & Godal H. C.: Fibrinolytic activity as a predictor of the outcome of prolapsed intervertebral lumbar disc surgery with reference to background variables: results of a prospective cohort study. Spine *17:* 1021, 1992.
12. Heliövaara M.: Body height, obesity and risk of herniated lumbar intervertebral disc. Spine *12:* 469, 1987.
13. Hoffman R. M., Wheeler K. J. & Deyo R. A.: Surgery for herniated discs: a literature synthesis. J Gen Int Med *8:* 487, 1993.
14. Holm S. & Nachemson A.: Nutrition of the intervertebral disc: acute effects of cigarette smoking. Ups J Med Sci *93:* 91, 1988.
15. Leren P., Askvold E. M., Foss O. P., Frøili A., Grymyr D., Helgeland A., Hjermann I., Holme I., Lund-Larsen P. G. & Norum K. R.: The Oslo study. Cardiovascular disease in middle-aged and young Oslo men. Acta Med Scand *(Suppl)* 588, 1975.
16. Lindal E. & Stefiánsen Jón J. G.: Connection between smoking and back pain—findings from an Icelandic general population study. Scand J Rehab Med *28:* 33–38, 1996.
17. Ljunggren A. E.: Natural history and clinical role of the herniated disc. *In* The Lumbar Spine (ed. S. W. Wiesel, J. N.

Weinstein), vol. 1, p. 473. W. B. Saunders, Philadelphia, 1996.
18. McQuade K. J., Turner J. A. & Buchner D. M.: Physical fitness and chronic low back pain. An analysis of the relationships among fitness, functional limitations, and depression. Clin Orthop *233:* 198, 1988.
19. Nygaard Ø. P., Romner B. & Trumpy J. H.: Duration of symptoms as a predictor of outcome after lumbar disc surgery. Acta Neurochir (Wien) *128:* 53, 1994.
20. Sandström J., Andersson G. B. & Wallerstedt S.: The role of alcohol abuse in working disability in patients with low back pain. Scand J Rehab Med *16:* 147, 1984.
21. Saunders J. B. & Aasland O. G.: WHO collaborative project on identification and treatment of persons with harmful alcohol consumption. Report on Phase 1. Development of a screening instrument, Geneva, World Health Organization, Division of Mental Health 97, 1987.
22. Svensson H. O. & Andersson G. B. J.: The relationship of low-back pain, work history, work environment, and stress. A retrospective cross-sectional study of 38 to 64-year-old women. Spine *14:* 517, 1989.
23. Weber H.: Lumbar disc herniation. A controlled prospective study with ten years of observation. Spine *8:* 131, 1983.

Accepted November 26, 1997

Address for offprints:

Vibeke Graver
Department of Neurology
Ullevål University Hospital
NO-0407 Oslo
Norway