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Fitness for work after surgery for lumbar disc herniation: a retrospective study

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Abstract This report retrospectively evaluates fitness for work in 3956 cases of surgery for lumbar disc herniation between 1992 and 1994. Patient records were derived from a database including all interventions of the insured population of the largest Belgian sickness fund. The datafile consisted of 126 cases of percutaneous nucleotomy (nucleotomy group), 286 cases of lumbar disc surgery with fusion (fusion group) and 3544 cases of standard lumbar disc surgery (standard group). Fitness to resume work within 12 months after intervention was obtained in about 70% of the patients in the standard and nucleotomy groups but in only 45% of the patients in the fusion group. Ten medico-social factors were related to fitness for work as outcome measure. Incapacity for work more than 12 months after intervention was defined as a bad outcome. Logistic regression

was used to test the combined relative significance of the different variables. For the standard group a long duration of work incapacity before intervention, older age, lower benefit, employment as a blue-collar worker, a long duration of hospital stay and unemployment were significantly associated with a poor outcome. Related factors for the fusion group were a long duration of work incapacity before operation, a long duration of hospital stay and unemployment. For the nucleotomy group, no factor was significantly associated with a poor outcome. For the total group, discectomy combined with fusion was significantly related to a poor outcome whereas a standard discectomy and a percutaneous nucleotomy did not differ in their impact on fitness for work.

Key words Disc herniation · Fitness for work · Lumbar spine surgery

Introduction

Back pain constitutes one of the most prominent causative factors in long-term work incapacity and early retirement [6]. A herniated disc is the cause of pain in only a small percentage of patients, with 5–10% requiring surgery for symptomatic disc herniation [5]. In the last few years, many articles dealing with the result of those surgical interventions have been published [14]. Surgical outcome is usually defined in terms of return to work and/or both

subjective and objective clinical factors such as pain relief and restoration of neurological function [1, 3, 4, 13].

Since physicians (medical advisers) working for the Belgian sickness and invalidity insurance system are responsible for assessing fitness for work and granting the period of sickness benefit, we can use fitness for work as an outcome.

Like return to work, fitness for work corresponds substantially to the restoration of the patient's social dignity and it also provides a quantitative and qualitative standard to evaluate the socio-economic impact of herniated lum-

bar disc on the social security system in most western countries. Additionally, fitness for work is judged by an independent non-treating physician and is not necessarily limited to patients who were involved in a job before surgical intervention.

Some previous investigations were restricted to one particular therapeutic centre or had a patient population fulfilling strict criteria for surgery [2, 12]. However, one cannot, without reservations, apply conclusions from such selected groups to the less uniform general patient population.

Bearing the above in mind, the present study was undertaken to survey fitness for work after lumbar disc surgery in the current practice of surgery in Belgium. Additional objectives were to elucidate the association between ten medicosocial factors and fitness for work per intervention group and to assess the impact of surgery for the whole group.

Materials and methods

Almost the entire Belgian working population is legally covered by sickness and invalidity insurance, which is carried out by five sickness funds. This study was based on a datafile of the largest Belgian sickness fund, covering approximately 45% of all those legally insured. Based on the Belgian fee list for surgical interventions ("procedure code"), all ($n = 5808$) records of insured patients operated on for lumbar disc herniation between 1992 and 1994, were reviewed. This population consists of blue- and white-collar workers and jobseekers in the private sector and self-employed workers. Patient records were followed until December 1995, resulting in an individual follow-up of 1–3 years.

The Belgian procedure code is a numerically encoded system that lists the official description of a surgical procedure with regard to the financial reimbursement as defined in the Belgian social security legislation. The surgeon has to register every intervention performed for lumbar disc herniation according to this procedure code. This system enables us to define the most frequently used interventions, regardless of any specification in surgical technique. Spinal fusion for conditions other than discal hernia, such as degenerative spinal stenosis, are grouped under a different code, and therefore could be easily excluded from the present investigation.

A subgroup of patients was selected from the original population according to three criteria:

1. The patients underwent no second procedure in the follow-up period.
2. The patients neither switched to another sickness fund nor retired or died in the follow-up period. (According to Belgian legislation, retirement is mandatory at the age of 60 for women and at the age of 65 for men.)
3. Patient records had no missing variables.

According to these criteria, respectively 430, 124 and 1298 patients were excluded.

There was no difference between this last group (excluded on the grounds of incomplete records) and the studied population with respect to the outcome variable.

The independent variables for each intervention were gender, age, employment status at the time of surgical intervention, duration of hospital stay, period of work incapacity before surgery, therapeutic centre (university hospital vs other hospital), occupation, surgical specialty, daily compensation (in 1995 US Dollars) and the possible relationship of the hernia with an accident. (If the

hernia is due to a work injury or a car accident, the patient may present a claim under another compensation system which gives higher benefits than sickness and invalidity insurance).

For the whole group, type of intervention was used as an important additional independent variable.

The selected subgroup was split into three groups based on the type of surgical procedure:

1. The "standard group" consisted of all records responding to the procedure code "surgery for disc herniation with the exception of a cervical disc".
2. The "nucleotomy group" encompassed all interventions responding to the procedure code "percutaneous nucleotomy for disc herniation under radioscopic control".
3. The "fusion group" was built up of all operations fulfilling the procedure code "surgery for disc herniation and fusion, harvesting of the graft included".

The period of incapacity for work after operation granted by the medical adviser of the sickness fund was defined as outcome measure. In the first 6 months of work incapacity the medical adviser evaluates fitness for work with regard to the patient's last job. After an incapacity period of 6 months, the criterion is extended to all the occupations the patient may have access to, according to his or her professional career and education.

Cumulative work incapacity was plotted as a Kaplan-Meier curve (survival analysis). The Pearson chi-squared test was performed to analyse each single variable in relation to the outcome. Logistic regression was used to test the combined relative significance of the different variables per intervention group and to clarify the impact of the type of surgical intervention in the whole group, adjusted to the other ten factors. Variables were entered in the regression equation in one single step. Variables related to a P value equal to or less than 0.001 were selected as significant factors. Calculation of the odds ratio was based on the slope coefficient β . Data were processed using the integrated software package SPSS (SPSS, Chicago, Illinois).

Results

Description of the independent variables (Table 1)

The age range of the total group of patients was 18–64 years, with more than 50% of the patients being aged between 30 and 50. There were significantly ($P < 0.001$) more younger patients in the group that underwent a percutaneous nucleotomy, and significantly ($P < 0.001$) more patients older than 50 in the lumbar fusion group. The percentage of male and female patients was respectively 65% and 35% and was the same for all subgroups.

Among the whole population, 63% were blue-collar employees, 30% white-collar employees and 6% were self-employed. No significant differences with regard to this parameter were encountered in the subgroups. The ratio of patients receiving compensation of less than \$ 40 a day to the rest was constant across the subgroups.

Table 1 shows that 8% of the lumbar disc herniations were reported as resulting from a car accident or work injury. The ratio of employed to non-employed was about 7 to 1 and did not differ significantly among the three studied groups. In the total population the duration of work incapacity before intervention ranged from 0 to 30 years with a median of 1 month. In the lumbar fusion group

Table 1 Description of the total patient population

Variable	n (%)
No accident	3607 (91.2)
Accident	349 (8.8)
Employed	3442 (87.0)
Not employed	514 (13.0)
Female	1377 (34.8)
Male	2579 (65.2)
Preoperative incapacity for work	
< 1 month	1969 (49.8)
1–6 months	1433 (36.4)
> 6 months	544 (13.8)
Hospitalisation	
< 6 days	1200 (30.4)
6–10 days	1699 (42.9)
> 10 days	1057 (26.7)
Age	
< 30 years	607 (15.3)
30–40 years	1428 (36.1)
40–50 years	1297 (32.8)
> 50 years	624 (15.8)
Non-university hospital	2799 (70.8)
University hospital	1157 (29.2)
Blue-collar employee	2503 (63.3)
White-collar employee	1203 (30.4)
Self-employed	250 (6.3)
Surgical discipline	
Neurosurgeon	2934 (74.2)
Orthopaedic surgeon	970 (24.5)
General surgeon	52 (1.3)
Daily compensation	
< \$ 40	1973 (49.9)
> \$ 40	1983 (50.1)

there were significantly ($P < 0.001$) more patients with a preoperative work incapacity lasting longer than 6 months and significantly fewer who were incapacitated for less than 1 month before surgery. Of all percutaneous nucleotomies and lumbar fusion operations, respectively 6% and 14% were carried out in university centres, which is significantly lower than the proportion for the standard group. The median duration of hospital stay was 9 days, but there were significant differences between the three groups.

A percutaneous nucleotomy involved a significantly shorter stay in hospital – in 85% of patients hospitalisation was less than 6 days – whereas a lumbar fusion required a significantly longer stay – more than 10 days in 59% of the patients. Standard disc surgery was carried out by a neurosurgeon in 78% and by an orthopaedic surgeon in 21% of cases. The lumbar fusion operation was performed by a significantly higher percentage of orthopaedic surgeons (59%) than neurosurgeons (39%).

Fig. 1 Duration of postoperative work incapacity after a standard operation for lumbar disc hernia, nucleotomy and hernia operation combined with fusion, plotted as a Kaplan-Meier curve (F = censored case)

Outcome

Forty-seven percent of all patients with an intervention for herniated disc were assessed fit for work less than 4 months after surgery, and 60% were assessed fit for work within 6 months, whereas 25% were still not able to work after more than 1 year. In the fusion group, 29% of patients were judged fit for work within 6 months, whereas more than 50% were assessed not fit for work 1 year after the operation. Work incapacity outcome figures were plotted as Kaplan-Meier curves (Fig. 1).

A period of incapacity for work lasting longer than 1 year was defined as a bad outcome. We obtained a bad outcome in 992 patients. Table 2 shows the relationship between each variable and a bad outcome analysed by contingency tables for the whole group; Table 3 summarises the significant variables for the standard group, the nucleotomy group and the fusion group.

In the total population a bad outcome was related to a discectomy combined with fusion, unemployment, a longer work incapacity before intervention, a longer stay in hospital, older age, blue-collar employment, operation performed by a general surgeon and a daily compensation of less than \$ 40.

In the standard group 20% of patients with a bad outcome were unemployed, 43% had a preoperative incapacity for work lasting more than 6 months, 35% were hospitalised longer than 10 days and 66% were older than 40 years. In the good outcome group 11% were unemployed, 3% had a preoperative incapacity for work lasting more than 6 months, 22% were hospitalised longer than 10 days and 43% were older than 40 years. In the bad outcome group 67% had a low daily compensation and only 18% were white-collar employees versus respectively 44% and

24% in the subgroup with a good result. Surgical discipline was also a significant factor.

In the nucleotomy group a major difference in the postoperative duration of work incapacity was related to the

Table 2 Factors associated with a work incapacity of more than 1 year in the total population

Variable	Bad outcome		
	<i>n</i>	%	<i>P</i> -value
No accident	889	24.6	0.045
Accident	103	29.5	
Employed	786	22.8	< 0.001
Not employed	206	40.1	
Female	374	27.2	0.028
Male	618	24.0	
Preoperative incapacity for work			< 0.001
< 1 month	213	10.8	
1–6 months	327	22.7	
> 6 months	452	83.1	
Hospitalisation			< 0.001
< 6 days	226	18.8	
6–10 days	373	22.0	
> 10 days	393	37.2	
Age			< 0.001
< 30 years	70	11.5	
30–40 years	266	18.6	
40–50 years	328	25.3	
> 50 years	328	52.6	
Non-university hospital	704	25.2	0.864
University hospital	288	24.9	
Blue-collar employee	669	27.9	< 0.001
White-collar employee	184	15.3	
Self-employed	109	43.6	
Surgical discipline			< 0.001
Neurosurgeon	689	23.5	
Orthopaedic surgeon	281	29.0	
General surgeon	22	42.3	
Daily compensation			< 0.001
< \$ 40	661	33.5	
> \$ 40	331	16.7	

Table 3 Factors significantly associated ($P < 0.001$) with a bad outcome in the standard group, nucleotomy group and fusion group using univariate statistics

Standard group	Nucleotomy group	Fusion group
Unemployment	Preoperative incapacity for work > 6 months	Unemployment
Preoperative incapacity for work > 6 months		Preoperative incapacity for work > 6 months
Hospital stay > 10 days		Hospital stay > 10 days
Age > 30 years		Age > 30 years
Self-employed or blue-collar employee		
General surgeon		
Daily compensation < \$ 40		

preoperative period of work incapacity: in the bad outcome subgroup 58% of patients had a preoperative duration of work incapacity of more than 6 months, and only 12% of patients had a preoperative work incapacity of less than 1 month. In the good outcome subgroup these percentages were respectively 3% and 60%. The *P*-values of hospital stay and daily compensation were respectively 0.004 and 0.002.

In the fusion group employment status, duration of preoperative work incapacity, hospital stay and age were associated with a work incapacity lasting longer than 1 year after intervention. In this group of patients with a bad outcome, 54% had a preoperative work incapacity of longer than 6 months, 72% had a hospital stay longer than 10 days and nearly 70% were aged over 40 years. In the good outcome subgroup 4% of patients had a preoperative duration of work incapacity of more than 6 months, 43% had a hospital stay of longer than 10 days and 43% of patients were aged over 40 years.

Using logistic regression, the same factors as described above were statistically significant with the exception of the surgical specialty for the total and standard group, the duration of preoperative work incapacity for the nucleotomy group and age for the fusion group. Thus, using this method no significant factors remained for the nucleotomy group. In the other groups the variance in postoperative fitness for work was best explained by the period of preoperative incapacity for work. Table 4 displays the adjusted odds ratios for all factors in the total group. In the fusion group, a longer incapacity for work before operation, unemployment and hospital stay were associated with a higher odds of a bad outcome. In the standard and total group the odds of inability to resume work 1 year after operation were also increased for patients older than 30 years, with a compensation below average or working as blue-collar worker. For the total group we found a nearly threefold higher odds on a bad outcome for a discectomy combined with fusion, given standard discectomy as a reference intervention. Surprisingly, percutaneous nucleotomy did not differ from standard discectomy in its relation to fitness for work.

Table 4 Adjusted odds ratios (and 99.9% confidence intervals) of factors related to a bad outcome (fitness for work not achieved 12 months after the operation) in the total group ($n = 3956$), using logistic regression in one step

Variable	Odds ratios (99.9% CI)	<i>P</i> -value
Surgical intervention for lumbar herniated disc		< 0.001
Standard discectomy	1.0	
Percutaneous nucleotomy	1.6 (0.6–3.9)	0.096
Discectomy and fusion	2.8 (1.6–5.0)	< 0.001
No accident	1.0	
Accident	1.4 (0.8–2.4)	0.035
Employed	1.0	
Not employed	1.9 (1.2–2.9)	< 0.001
Female	1.0	
Male	1.0 (0.7–1.5)	0.941
Preoperative incapacity for work		0.001
< 1 month	1.0	
1–6 months	2.6 (1.8–3.7)	< 0.001
> 6 months	30.0 (18.6–48.4)	< 0.001
Hospitalisation		< 0.001
< 6 days	1.0	
< 6–10 days	1.1 (0.7–1.6)	0.668
> 10 days	1.7 (1.1–2.6)	< 0.001
Age	1.0	
< 30 years		< 0.001
30–40 years	2.0 (1.1–3.4)	< 0.001
40–50 years	2.8 (1.6–4.9)	< 0.001
> 50 years	8.0 (4.3–15.0)	< 0.001
University hospital	1.0	
Non-university hospital	1.1 (0.8–1.6)	0.339
Occupation		< 0.001
Blue-collar employee	1.0	
White-collar employee	0.5 (0.3–0.7)	< 0.001
Self-employed	1.1 (0.6–2.1)	0.474
Surgical discipline		0.038
Neurosurgeon	1.0	
Orthopaedic surgeon	0.9 (0.6–1.3)	0.313
General surgeon	2.3 (0.7–7.9)	0.027
Daily compensation < \$ 40	1.0	
Daily compensation > \$ 40	0.4 (0.3–0.6)	< 0.001

Discussion

This project is essentially a retrospective study of the outcome of lumbar disc surgery with a follow-up period of between 1 and 3 years. For 992 patients we were not able to determine the end of the work incapacity period because they were still not able to resume work in a suitable job at the end of the follow-up. Therefore we opted for a

categorical outcome. The cut-off point was fixed at 1 year of work incapacity. Several reasons may explain this particular choice. Firstly, according to our data most patients (75%) resumed work less than 1 year after the operation. Moreover, the longer patients are absent from work because of work incapacity, the lower their chance of returning to employment. It is extremely important to identify all their characteristics so that they can be detected earlier to prevent long-term disability. In general it is assumed that after a 6 month break from work there is a considerable decrease in motivation to return to work. Instead of resuming work these patients will receive an invalidity pension for a longer period or even until the age of retirement. For these patients medical advisers have to direct their policy towards professional reintegration in the early phase of rehabilitation. Professional re-education (alternative task) or partial work resumption should be considered as soon as possible after the operation.

This study shows that about 70% of all patients who underwent surgical intervention for lumbar disc herniation were evaluated as able to resume work after surgery. Sixty percent of these patients were found to be fit for work within 6 months. The lumbar fusion group obviously had a worse outcome: less than 50% were judged to have full working capacity 1 year postoperatively. After 1 year, work incapacity curves have a flat shape, indicating that only a minority of these patients will return to a working life. Matsunaga et al. found a rate of work resumption of 53% 1 year after a single discectomy, 89% after a disc operation with fusion and 58% after percutaneous nucleotomy [11]. Other authors pointed out that 80–90% of patients return to work after a discectomy [10, 14]. Our lower rates of fitness for work indicate that the outcome of lumbar spine surgery is worse in the general population than in studies with a more selected patient group. Another possible factor is the compensation system of the Belgian social security, which provides relatively high benefits. Caspar et al. attributed the two to four times longer postoperative incapacity in Germany compared with the United States to the German medical social system [3].

Adjusted to ten important confounding medicosocial factors, combined discectomy and fusion was found to be related to a bad outcome (total group). There may be at least two hypotheses for this poor result. Firstly, patients of the fusion group may have had multiple prior low back operations. Secondly, there may be more complications with lumbar spine fusion, as Turner et al. pointed out in a recent review [15].

The importance of the number of days on sick leave before surgery is clearly emphasised in the study of Hurme and Alaranta, in which a duration of preoperative incapacity for work of less than 1 month correlates with relief of pain and fitness for work [8]. A longer sick leave before surgery may result in a longer nerve compression and negatively affect surgical results. Moreover,

a longer sick leave before operation may be attributable to other intercurrent diseases or may indicate that criteria for surgical intervention were not fulfilled because of chronic pain conditions without clear objective findings. Patient selection by the surgeon can also play an important role. These assumptions, however, remain speculative in view of the retrospective character of this investigation.

Like other studies [13], this report revealed that sedentary labour is related to excellent surgical results: white-collar workers have a better outcome than blue-collar employees and self-employed patients. This is not surprising since blue-collar workers are frequently exposed to working conditions with a preponderant rotatory or forced posture and repetitive movements. The situation for the self-employed is complicated, because they can only receive benefits after a period of 3 months on sick leave. This results in an overestimation of bad outcome, because self-employed patients with an early resumption of work are not registered.

Taylor showed in a review article that a duration of unemployment shorter than 12 months was associated with a good outcome [14]. In our investigation, however, we had no information regarding the duration of unemployment. Unemployment at the time of surgery had a negative effect on work resumption.

According to our results older age was significantly related to a bad outcome, which was in agreement with the results of Hurme and Alaranta [8].

A longer hospital stay was associated with a work incapacity lasting more than 12 months in the total, standard and fusion group. This is probably due to a longer postoperative pain period or possible surgical complications.

In the logistic regression analysis medical discipline was no longer a significant parameter for the total and standard group in the ultimate result after surgery. This is due to confounding by the preoperative period of work incapacity, which was significantly longer, particularly for patients operated on by general surgeons.

In the present study some important limitations should be noted. Firstly, our investigation is retrospective so that we have no data on previous back surgery, patient symptoms before the intervention and psychosocial factors. A lot of authors have emphasised the importance of personality factors, life style and working conditions on the out-

come after surgery [7–9, 14]. Secondly, there is no control group of conservatively treated patients for lumbar disc herniation and patients could not be randomly assigned to a treatment group due to the retrospective design of the present investigation. Using logistic regression, however, we were able to differentiate for the impact of an intervention in the surgery group, adjusting for several sociomedical factors. Our data suggest that the outcome of fusion for lumbar disc herniation is worse than that for standard discectomy or percutaneous nucleotomy. These findings need to be confirmed by a prospective study.

Conclusions

It is our opinion that this selected patient population could provide us with a descriptive view of fitness for work after surgery for lumbar disc herniation in Belgium. Firstly, the social insurance fund covers more than 40% of the insured population in Belgium, which enables us to face problems of selection. Moreover, incapacity for work is evaluated in the other sickness funds on the basis of identical legal principles. Nevertheless, all interpretations have to be made carefully within the limits of the retrospective design of this investigation.

More studies are needed to investigate in a prospective way clinical, social and psychological factors related to the results of surgery for lumbar disc herniation in the general population. They can be used to define subsets of patients less likely to be fit for work 1 year after surgical intervention. A rehabilitation effort can be concentrated on those patients so as to obtain a more favourable work status. This can be achieved through work-hardening programmes, partial work resumption or new vocational training. Close co-operation between medical adviser and treating physician is a prerequisite for the success of this rehabilitation, which would decrease the number of compensation days and increase the cost efficiency of lumbar spine surgery. Restoration of the patient's health and social dignity must be the ultimate objective of the surgeon and medical adviser.

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