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Predictors for work incapacity continuing after disc surgery

by Peter Donceel, MD,¹ Marc Du Bois, MD¹

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Objectives This study was carried out to provide information on and identify factors about the fitness for work 12 months after disc herniation surgery. In addition a predictive tool for this outcome was developed.

Methods A selected patient population (N=177) operated on for lumbar disc herniation from September 1995 until May 1996 was evaluated by medical advisers of a sickness fund. The patients were submitted to a standardized interview about their personal, social, medical, professional, and psychological status. To assess the functional status of the lumbar spine, a standardized clinical examination was used.

Results Eighty-five percent of the patients were employed 1 year after surgery. The most important predictors at 6 weeks after intervention were the estimation of pain according to a visual analogue scale, the patient's prediction of his possibilities to resume work, the Oswestry disability index score, and the Zung depression score. Of the clinical factors, nonorganic signs and sensory disturbances after surgery were negative prognosticators for long-lasting disability. Using the Oswestry score, the Zung score, the patient's own prediction, the score on the Social Readjustment Rating Scale, and the score on the Modified Somatic Perception Questionnaire, 86% of the poor outcomes could be correctly classified.

Conclusions The Oswestry disability scale and the Zung depression scale should be included in the routine postoperative assessment after disc surgery and the patient's own prediction of his possibility for fitness for work should be taken seriously. If a poor outcome is predicted, the patient is in need of rehabilitation and should be guided more intensely.

Key terms coping, depression, disability, lumbar discectomy, outcome, predictors, social factors, work loss.

The outcome of lumbar disc hernia surgery constitutes a serious problem for patients, spinal surgeons, and physicians involved in professional rehabilitation and the evaluation of work incapacity. This type of surgery has a considerable variation in success rate, ranging from 70% to more than 90% (1—3). A great deal of the variability can be attributed to the outcome criteria used. There is no generally accepted and standardized method for assessing the outcome of lumbar disc surgery. Attempts to make outcome studies of disc herniation have been confounded by the paradox that the most relevant problem (pain) is not objective, whereas the most objective signs are often not relevant to the patient's function and sense

of well-being. Return to work is a more useful and objective outcome measurement (4, 5). Moreover, the Task Force on Pain in the Workplace of the International Association for the Study of Pain has stated that work loss is the most important consequence of low-back pain and that return to work is the most important outcome measure of medical care (6).

Research investigating outcome after surgery for lumbar disc herniation has found some important predictors of surgical success (7—10). Apart from studies on clinical or medical prognosticators, several investigations have been carried out on the significance of psychological, social, and personal factors associated with a poor

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surgical outcome (11—17). Most studies report a relation between job function or social status and surgical result (18—21); they have also found that older age and depression is associated with less favorable outcomes (14, 18, 22).

The relevance of psychological factors is also shown by research on coping strategies. These investigations suggest that patients with negative coping strategies are more likely to experience negative outcomes (23).

To objectify the clinical picture, Waddell et al (26) developed and validated a group of reproducible, inter-related signs that could be used in diagnosis and evaluation. He pointed out the nonorganic signs related to low-back pain as negative factors or even contraindications for surgery (24—27).

Studies on disc herniation surgery and return to work have generally focused on variables assessed preoperatively. These surveys emphasize the importance of patient selection in terms of predictive risk factors (28—32). In practice many physicians have their first patient contact after the surgical procedure. The main issue currently is the need for quick and efficient rehabilitation and professional integration. Therefore, we have hypothesized that factors assessed about 1 month after an operation may have predictive value with respect to a patient's rehabilitation. These factors may be of value to medical advisers, occupational health physicians, general practitioners, and specialists as they attempt to identify patients in need of rehabilitation after their operation.

The aims of the present study were to (i) provide information about fitness for work 12 months after disc herniation surgery, (ii) identify factors and variables, assessed 6 weeks after the intervention, that influence the outcome of lumbar disc surgery in a workers' compensation population, and (iii) construct a model based on this assessment that would be able to predict the outcome 12 months later with a high sensitivity and specificity.

Subjects and methods

Twenty medical advisers of the Christian Sickness Fund were involved in our investigation. This sickness fund covers more than 50% of the Belgian population with mandatory insurance. The participating medical offices are geographically spread over Flanders. This study was based on a selected patient population operated on for lumbar disc herniation verified by myelography, computed tomography, magnetic resonance imaging, or a combination of the three. All the patients belonging to the geographic area of a participating medical office were included from September 1995 until May 1996. The inclusion criteria were (i) member of the active population (in Belgium, workers' compensation is mandatory for

every member of the wage-earning population; self-employed workers were excluded), (ii) between 15 to 64 years of age, and (iii) the surgical procedure consisting of standard lumbar discectomy. A written informed consent was obtained from 96% of the potential participants. There were no dropouts amid the included patients because the follow-up by the social security doctor has a legal and mandatory character.

A total of 177 patients was operated on consecutively for lumbar disc herniation and fulfilled the preceding criteria. The final study group included 64 women and 113 men.

The postoperative work capacity was assessed by 20 medical advisers of the Christian Sickness Fund. The evaluations of the medical advisers took place regularly from about 6 weeks after surgical intervention until the patients returned to work.

Predictors of employment

At the medical advisers' offices, the patients were submitted to a standardized interview of their subjective clinical symptoms and social history, pain relief, requirements for pain medication, activity tolerance, and fitness for work. To assess the functional status of the lumbar spine, a standardized clinical examination was used.

Data fell into the following 4 categories: (i) personal, social and professional status, (ii) treatment and pain history, (iii) clinical status, and (iv) specific questionnaires. The personal, social, and professional history included duration of incapacity for work before the intervention, period between first contact with the medical adviser and the date of operation, age, gender, professional status, employment, marital status, and education. The description of the previous job was converted into a job category scale which provided a ranking of 6 levels of occupation according to back load or back stress. Additional data were clinical specialty of the surgeon, the nature of the complaints before intervention, radicular pain pattern, and the onset of symptoms. The treatment and pain history before the surgery included the administration of information, analgesics, narcotics, and corticosteroids. Additional questions about treatment options concerned whether the patient was referred to a pain clinic or back school, use of traction, use of an orthosis, physical education, and number of office visits with treating physician. Data collected after the surgery included pain evolution, treatment (use of analgesics, narcotics, physical education, referral to a pain clinic or back school and use of an orthosis) and patient's opinion about resuming former work.

At 6 weeks after the intervention, the medical adviser of the sickness fund performed a clinical examination standardized according to the guidelines of the National Institute for Occupational Safety and Health (NIOSH) (33). The investigation included the straight-leg raising

test, knee and ankle jerks tested in the supine position, sensibility in the lower extremities, the shober test, paravertebral tenderness, iliopsoas strength, and the sit-up test. In addition nonorganic signs were recorded.

The pain felt by the patients was recorded postoperatively on a visual analogue scale (VAS) which provided a summary score based on the intensity and frequency of pain (34).

Disability was scored using the Oswestry disability scale, which has been shown to have interrater and intrarater reliability of 0.71 and 0.91, respectively (34, 35). This questionnaire is based on 10 different variables that refer to activities of daily life. Each of the variables is rated on a 0—5 scale. The 10 raw scores obtained are added, and the sum is transferred into a percentage score, with 0 as the minimum (ie, no functional impairment) and 100 as the maximum (ie, complete functional impairment).

At the end of the first consultation, the patients received the following 5 questionnaires: the Utrecht Coping Scale, a Questionnaire on Work and Health, the Zung Depression Scale, the Somatic Perception Scale, and the Social Readjustment Rating Scale (36—39). These additional questionnaires were filled out at the patient's home and collected by social workers, who were also at the patient's disposal for any additional help to complete the questionnaires. The Utrecht Coping Scale (39) is used to determine coping strategies. Under the question "Could you indicate how many times you generally react in the described way?" 47 coping items are given. The patients answer on a 4-point scale. The score is 1 if the strategy is never applied, and it ranges up to 4, for which it should have always applied. The 47 items form the following 7 coping scales: active reaction, palliative reaction, avoidance, social support, passive reaction, expression of emotions, and easing one's mind. The Zung Depression Scale (35, 38) is used to measure the severity of depression. Scores from this questionnaire reflect the degree of depression. Higher scores correspond to more severe depression. The questionnaire consists of 20 items. The scores from the Modified Somatic Perception Questionnaire (MSPQ) (35, 38) reflect the degree of heightened autonomic or somatic awareness. The Questionnaire on Work and Health (37) consists of 10 items based on factor analyses. We used the following 6 of these items: job description, estimation of the job and future expectations, job demands, work organization, work environment, and management and colleagues. Each scale consisted of 3 to 5 items based on a 2-point scale (0 = absence of the item or no complaint, 1 = complaint, presence of the item). Finally, the number and impact of life events were measured by the Social Readjustment Rating Scale of Holmes & Rahe (36). This questionnaire solicits identifying data and information about recent experience with 42 life events. Each life event is

assigned a specific value which reflects its relative impact. Adding up the values of the indicated life events results in a sum score.

Five percent of the values were missing for the variables of the 5 questionnaires.

Definition of outcome criteria

Fitness for work within 1 year after surgery was defined as a good outcome.

Statistical analyses

All the data were processed by a personal computer. The Statistical Package for the Social Sciences was used for the statistical analyses. Absolute and percentage frequencies were calculated for the continuous variables, and also means and standard deviations for the categorical variables were used.

The selection process started with a univariate analysis of each variable per variable category. The appropriate categories for the discrete and continuous variables and the logistic regression model building was established according to the criteria applied by Hosmer & Lemeshow (40).

All the variables were critically reviewed with respect to the reliability and relevance criteria. The predictors were entered as independent variables, the good and bad outcome groups being defined as the criteria. An alpha of 0.05 was set for significance.

Correlation analyses were performed between the remaining variables and the separate elements of the predictor model to get a better insight into the relevance of the unselected variables.

Results

Tables 1—3 summarize the most important patient data obtained with the results of the univariate statistical analysis approximately 6 weeks after the lumbar discectomy.

One year after surgery for disc herniation 151 patients reported they were back to previous work assignments. Figure 1 displays the employment status data as a Kaplan-Meier curve.

Predictors of employment

The most important predictors were the pain estimation on the visual analogue scale, the patient's own prediction of his possibilities to return to work, the Oswestry disability index score, the Zung depression score, and life events. A person who recorded his pain status as the worst possible on the VAS (score=10) was 2.5 times more likely to be classified as not having returned to work after the 1-year follow-up than those with a

pain-free status (score=0). Similarly for every percentage point increase on the Oswestry disability index, employment at 1-year postsurgery was 6% less likely.

The anamnestic variables and clinical findings were used to determine the adjusted relevant predictors between the good and poor outcome groups.

Some of the variables that were significant at the univariate level were dropped from the set of predictors because they were interrelated with one or more of the variables identified as predictors by the logistic regression analysis. In general these patterns were as follows: VAS pain score and use of analgesics after surgery were positively correlated with the Oswestry score; the Zung score, the MSPQ score, and passive coping were interrelated;

the SRE score and the number of life events were positively correlated; sensory disturbances and education level were positively associated with the patient's own prediction; finger-floor distance was negatively associated with the shoher index and the results of the sit-up test; and physical activities before the intervention and period of work incapacity before surgery were positively correlated.

With the use of the Oswestry score, the Zung score, the patient's own prediction, the SRE score, and the MSPQ score, 86% of poor outcomes could be correctly classified, as could 90% of the good outcomes (table 4). This result can be achieved by using the value 0.2 or 20% for the cut point. This statement implies that, if the

Table 1. Personal, social and professional characteristics of the patients in the total, good, and bad outcome groups. P-values for the chi-square test (categorical variables) or for the Kruskal-Wallis analysis (continuous variables) are indicated.

Personal, social and professional history	Total group		Good outcome			Bad outcome			P-value
	Number	Mean	Number	Mean	% ^a	Number	Mean	% ^a	
Sick leave before surgery (days)	45	.	39	.	.	83	.	.	0.002
First contact with medical adviser (days)	54	.	52	.	.	63	.	.	0.042
Age (years)	.	39	.	38.8	.	.	40.6	.	0.380
Gender									0.042
Male	113	.	101	.	89.4	12	.	10.6	
Female	64	.	50	.	78.1	14	.	21.9	
Professional status									0.724
Blue-collar worker	121	.	104	.	86	17	.	14	
White-collar worker	56	.	47	.	83.9	9	.	16.1	
Employment									0.595
Unemployed	18	.	15	.	83.3	3	.	16.7	
Employed part-time	18	.	14	.	77.8	4	.	22.2	
Employed full-time	141	.	122	.	86.5	19	.	13.5	
Marital status									0.322
Not married	35	.	28	.	80	7	.	20	
Married	142	.	123	.	86.6	19	.	13.4	
Education									0.049
Secondary school	87	.	69	.	79.3	18	.	20.7	
University or high school	90	.	82	.	91.1	8	.	8.9	
Job category									0.499
No or minimal back load	113	.	98	.	86.7	15	.	13.3	
Back load	64	.	53	.	82.8	11	.	17.2	
Professional conditions									
Job description	.	0.68	.	0.62	.	.	1.04	.	0.047
Job demands	.	3.14	.	3.02	.	.	3.83	.	0.044
Work organization	.	1.45	.	1.38	.	.	1.87	.	0.102
Work conditions	.	1.77	.	1.67	.	.	2.33	.	0.055
Management and colleagues	.	1.18	.	1.11	.	.	1.58	.	0.153
Future expectations	.	0.87	.	0.87	.	.	0.87	.	0.859
Specialist									0.367
Neurosurgeon	141	.	122	.	86.5	19	.	13.5	
Orthopedic surgeon	36	.	29	.	80.6	7	.	19.4	
Complaints before operation									0.67
<1 month	27	.	24	.	88.9	3	.	11.1	
1-3 months	40	.	35	.	87.5	5	.	12.5	
3-6 months	40	.	35	.	87.5	5	.	12.5	
>6 months	70	.	57	.	81.4	13	.	18.6	
Radicular pattern	146	.	124	.	84.9	22	.	15.1	0.506
Onset									0.373
Acute	54	.	48	.	88.9	6	.	11.1	
Chronic	123	.	103	.	83.7	20	.	16.3	

^a Percentage of the total number of patients.

Table 2. Number of subjects, means and percentages for the most important aspects of the pain history, treatment, and clinical examination of the patient population in the total, good, and bad outcome groups. P-values for the chi-square test (categorical variables) or for the Kruskal-Wallis analysis (continuous variables) are indicated. (PSIS = posterior superior iliac spine)

Personal, social and professional history	Total group		Good outcome			Bad outcome			P-value
	Number	Mean	Number	Mean	% ^a	Number	Mean	% ^a	
Analgesics before the operation	130	.	108	.	83.1	22	.	16.9	0.122
Physical therapy before surgery	64	.	54	.	84.4	10	.	15.6	0.791
Orthosis before surgery	15	.	13	.	86.7	2	.	13.3	0.617
Evolution of back pain									0.056
Pain-free	55	.	51	.	92.7	4	.	7.3	
Better	101	.	85	.	84.2	16	.	15.8	
Unchanged or worsened	21	.	15	.	71.4	6	.	28.6	
Evolution of irradiating pain									0.002
Pain-free	55	.	51	.	92.7	4	.	7.3	
Better	108	.	92	.	85.2	16	.	14.8	
Unchanged or worsened	13	.	7	.	53.8	6	.	46.2	
Analgesics	64	.	46	.	71.9	18	.	28.1	<0.001
Physical education	67	.	56	.	83.6	11	.	16.4	0.612
Orthosis	8	.	5	.	62.5	3	.	37.5	0.095
Patient's opinion about resuming work									
Able to resume work within 3 months	125	.	119	.	95.2	6	.	4.8	
Not able to resume work within 3 months (or no opinion)	52	.	32	.	61.5	20	.	38.5	
Weight (kg)	.	77.7	.	77.8	.	.	77	.	0.924
Height (cm)	.	173	.	174	.	.	171	.	0.099
PSIS deviation (l/r)	27	.	26	.	96.3	1	.	3.7	0.084
Asymmetrical iliopsoas strength	54	.	43	.	79.6	11	.	20.4	0.157
Sit-up test									0.196
Score 1—2	74	.	60	.	81	14	.	19	
Score 3—4	101	.	89	.	88.1	12	.	11.9	
Dysesthesia of dermatomes	49	.	36	.	73.5	13	.	26.5	0.006
Three or more nonorganic signs	8	.	3	.	37.5	5	.	62.5	0.001
Oswestry rating (0—100)	.	26	.	22	.	.	45	.	<0.001
Pain rating (0—10)	.	3.4	.	3	.	.	5.7	.	<0.001

^a Percentage of the total number of patients.

Table 3. Psychological characteristics of the patient population in the total, good, and bad outcome groups. P-values for the Kruskal-Wallis analysis are indicated.

Psychological factors	Total group (mean)	Good outcome (mean)	Bad outcome (mean)	P-value
Zung depression score	17.28	16	27	<0.001
MSPQ somatization score ^a	5.2	4.6	8.7	0.006
Coping				
Palliative reaction	18	18	18	0.316
Active coping	18	18	17	0.247
Avoidance	15	16	15	0.213
Easing one's mind	14	14	13	0.255
Social support	12	12	12	0.881
Passive reaction	11	11	14	0.001
Expression of emotions	5	5	6	0.865
Number of life events	7	6	11	<0.001
SRE score ^b	219	199	336	<0.001

^a MSPQ somatization score: score on the Modified Somatic Perception Questionnaire. This questionnaire solicits identifying 22 somatic events such as increase in heart rate, stomach churning, and the like. According to the reported frequency, almost every item is scored from 0 to 3.

^b SRE score: score on the Schedule of Recent Experience. This questionnaire identifies data and information about recent experience with 42 life events. Each life event is assigned a value from the social readjustment rating scale of Holmes & Rahe (36).

predicted probability exceeds 0.2, the patient will be classified into the poor outcome group.

Discussion

This cohort study has several methodological strengths. These strengths include prospectively gathered data by 20 independent physicians, a sizeable cohort with a 100% follow-up rate, and simultaneous analysis of many factors that could affect employment after disc herniation surgery. The evaluation was performed by medical advisers and social workers who had no relationship to the medical centers and who could not influence the therapy after the operation. The exclusion of all the patients who had lumbar spinal fusion surgery was to guarantee a patient population group as homogeneous as possible with the main diagnosis of disc herniation and who underwent standardized discectomy without fusion.

There is no generally accepted standardized method for assessing operative results. Since employment

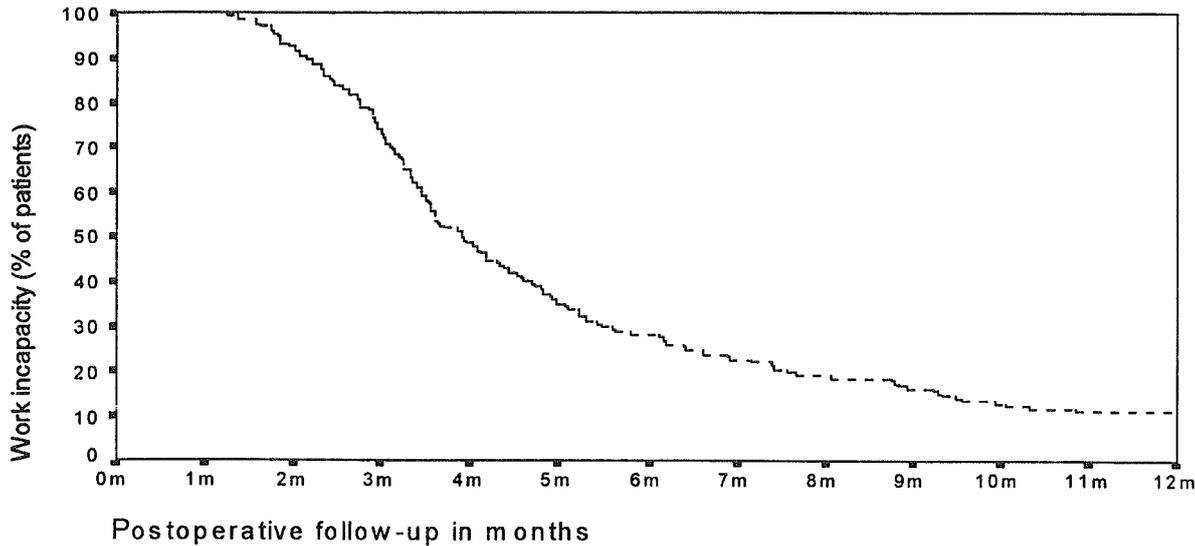


Figure 1. Duration of postoperative work incapacity after a standard operation for lumbar disc hernia, plotted as a Kaplan-Meier curve.

ultimately may bring monetary reward, status within the community and a sense of personal worth (4), we opted for fitness for work as the outcome measure of medical care (6). Unlike most investigations, we studied predictive factors assessed approximately 6 weeks after the intervention. This procedure emphasized the value of the present study, especially since the question of who is in need of rehabilitation after lumbar disc surgery is a matter of great interest for the patient, surgeon, and medical adviser.

The first study objective was to describe the percentage of persons employed 1 year after disc hernia surgery. We found 85% to be so. Since patients who have undergone fusion surgery were excluded, this figure may be overinflated. On the other hand, self-employed persons were not included although it is generally believed that these people have a greater incentive to engage in work in contrast with workers' compensation claimants. The existing literature describes the employment rate, and influencing factors focus on preoperative variables. Caragee et al (41) suggests that return to work occurs at the latest 4 weeks after surgery for lumbar disc herniation. We found a median postsurgery incapacity of 117 days. This difference may be due to the fact that, in the Belgian social security system, compensation payments are relatively high (up to 60% of the previous income will be paid out). These findings were also reported by Caspar for the German system, which has historically served as the basis for the Belgian security system (42).

The second study objective was to identify predictors of employment. Patients with long-lasting preoperative work disability were found more often in the poor outcome group. This finding is in agreement with the results of several authors (5, 9, 43). In agreement with the conclusions of Hasenbring et al (18), the number of

Table 4. Predictors of unemployment in the final logistic model. (Sig = significance, R = multiple correlation coefficient, Exp(B) = estimated odds ratio, 95% CI = 95% confidence interval, SRE = Schedule of Recent Experience, MSPQ = Modified Somatic Perception Questionnaire)

Variable	Sig	R	Exp(B)	95% CI
Oswestry (0—100)	0.005	0.221	1.07	1.02—1.11
Zung depression	0.005	0.220	1.12	1.04—1.22
SRE score	0.002	0.241	1.01	1.00—1.01
Patient's own prediction	0.006	0.211	6.00	1.67—21.55
MSPQ somatization	0.015	-0.177	0.79	0.65—0.95

daily hassles was negatively related to the resumption of work after disc herniation surgery. Of the psychological factors, depression and passive coping were important. This study points out that, in general surgical practice and insurance medicine, the knowledge of the importance of psychological factors — for example, depression — is not yet fully appreciated.

The third study objective was to formulate a model that can predict fitness for work. In disagreement with what is generally mentioned in international literature, a poor outcome was inversely related to the MSPQ score (34, 38). We have no explanation for this finding. The strongest predictors identified ($R > 0.2$) were the SRE score, the Oswestry score, the Zung depression score, and the patient's own prediction. Thus the predictive power is not solely determined by the functional or physical factors of the Oswestry index. This finding suggests that the barriers that perpetuate unemployment or facilitate employment are not exclusively physical, but are also psychological. We found an important association between physical factors (sensory disturbances) and the patient's own prediction. It illustrates the important

interrelationship between psychology and clinics stressing the multitarget approach in postsurgery rehabilitation. Based on our calculated predictors, outcomes were correctly predicted for 86% of the patients with a poor outcome and for 90% of the patients with a good outcome. To become a valid tool for risk detection, however, the current predictor variables should be assessed on a new sample of workers' compensation claimants.

Early vocational counseling may help lessen the burden of long-term work incapacity. Predictors of fitness for work have been identified. We think this information will be useful to those responsible for vocational counseling in identifying the patients at high risk of long-lasting or permanent work incapacity so that proactive treatment strategies can be instituted.

Concluding remarks

On the basis of the present results, we conclude that the Oswestry and Zung depression scales should be included in the routine postoperative assessment of lumbar disc surgery. They had predictive value with regard to the professional outcome of the surgery. The tests maintained significant associations with the outcome when the effects of general physical and anamnestic background factors were controlled for.

We suggest that, if the predictor scores indicate a poor outcome, the patient is in need of rehabilitation and should be followed more intensely by the treating physician and social insurance doctor.

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