

Comparison of early and delayed lumbar disc herniation surgery and the treatment outcome

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ABSTRACT

Aim To evaluate the influence of preoperative symptoms duration on surgical outcome of one-level lumbar disc herniation surgery.

Methods In a prospective randomized study, 67 adult patients with one-level lumbar disc herniation were analysed. The patients whose duration of symptoms was <6 months were included in the case group, while those with the duration of symptoms >6 months formed the control group. The investigated preoperative variables were: pain intensity in the back and legs (Visual Analogue Scale - VAS), Sciatica Bothersomeness Index (SBI), index of disability (Oswestry Disability Index - ODI). Postoperative variables were: pain intensity in the back and legs (VAS), SBI, ODI, and outcome according to the Odom's criteria (excellent, good, satisfactory and poor). Significance level was set at $p < 0.05$.

Results A statistically significant difference was recorded between the groups, showing a better decrease of radicular pain intensity and sciatica bothersome, as well as patients disability in the case group ($p < 0.001$). According to the Odom's criteria the outcome was better in the case group, since the difference between the groups was statistically significant too ($p < 0.05$).

Conclusion Early lumbar disc herniation surgery performed within the first 6 months from the start of symptoms is beneficial due to decreases of radicular pain intensity, sciatica bothersomeness, and patient's disability.

Key words: discectomy, intervertebral disc, pain, radiculopathy, syndrome

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INTRODUCTION

The first publications on lumbar intervertebral disc surgery were made by Mixter and Barr in the first half of the last century (1). After that, many studies reported success of the surgical treatment and Weber was the first one who pointed out better results of the surgical treatment after one year of follow-up of patients when compared to conservative treatment (2). Although a period between 4 to 8 weeks for an operation following lumbar radiculopathy has been proposed, in the lumbar intervertebral disc surgery, the optimal timing of the surgical procedure is still not aligned considering the onset of radicular pain syndrome and radicular pain duration (3). According to some studies, the optimal time for surgery, which positively affects the outcome of treatment ranges from two to twelve months from the onset of symptoms. Some of the reports of prolonged duration of lumbar radiculopathy related to poor treatment outcome are: Hurme and Alaranta (4) if the duration of pain syndrome is longer than two months, Støttrup et al. (5) if the period was longer than three months, Dvorak et al. (6), Carrage et al. (7), and Siccoli et al. (8) if it was longer than six months. Nygard et al. (9) showed that the duration of radiculopathy longer than 8 months determined poorer outcomes of lumbar discectomy while similarly, Ng and Sell (10) showed for a time frame longer than 12 months. A recent study by Pitsika et al. involving 107 patients showed that significantly positive effects of surgery in carefully selected patients can be expected after one and two years from the onset of symptomatology (11). Also, there are some researches that reject the hypothesis that the shorter duration of the discogenic lumbar radicular syndrome has a positive effect on the outcome of surgery (12,13).

There are a few recorded reports on the impact of operation time onto the outcome of the lumbar disc herniation surgery in Bosnia and Herzegovina. Bečulić et al. pointed out that the early decompression (operation time of up to 48 hours from the onset of symptomatology) was associated with a better outcome considering only patients with cauda equina syndrome caused by lumbar disc herniation (14). Moranjković et al. have also mentioned the preoperative pain duration in order to find a set of available variables that may predict the short-term outcome of lumbar disc herniation surgery (15).

The aim of this study was to evaluate the influence of preoperative symptoms duration on the outcome of one-level lumbar disc herniation surgery in the two groups of patients, as well as to make a conclusion about the optimal time of surgical treatment. The hypothesis was that lumbar disc herniation surgery in patients with shorter duration of symptoms (radicular pain) (<6 months) - early discectomy, significantly leads to better postoperative results and has a positive effect on the treatment outcome compared with patients whose symptoms lasted longer (>6 months) - delayed discectomy. The purpose of this study was to contribute to finding the optimal time of surgery in relation to the duration of preoperative symptoms using an extended range of different outcome scales. An attempt was also made to highlight a possible impact of time of surgery as one of the most important and least investigated predictors of the favourable treatment outcome.

PATIENTS AND METHODS

Patients and study design

In this prospective randomised study 67 adult patients of both genders aged 18-65 years operated in the Cantonal Hospital "Dr Safet Mujić" Mostar and the University Clinical Hospital of Mostar diagnosed with herniation of the lumbar intervertebral disc during the period 2013-2017 were included.

The study included only patients whose neuro-radiological findings of single-level lumbar disc herniation correlated with neurological symptoms and radicular pain maintained despite conservative treatment applied. These patients underwent surgery and were divided into two groups based on preoperative radicular pain duration: the case group consisted of 34 patients who underwent early lumbar discectomy (duration of symptoms was <6 months) and the control group consisted of 33 patients who underwent delayed lumbar discectomy (duration of symptoms was >6 months).

All patients had proper medical documentation, performed preoperative diagnostic processing and also pre-operative and post-operative check-ups. Pre-operative and post-operative check-ups included completing a structured survey questionnaire.

The exclusion criteria were: incomplete medical records, the presence of postoperative recurrence

or residual disc on the same level, extensive neurological deficits (*cauda equina* syndrome), various pathologies of the lumbar spine of another etiology (previous fractures, infections, spinal tumours and metastases), advanced osteodegenerative pathology in which degeneration of the intervertebral disc is not a dominant etiological factor (spondylosis, spondylolisthesis, spinal canal stenosis), as well as congenital or acquired malformations of the spinal column. The exclusion criteria were also diagnosed comorbidities in which lumbar disc surgery was contraindicated, previous lumbar disc surgery, as well as other neurological and osteomuscular diseases, verified malignancy and pregnancy.

Data obtained were used only for the purposes of this research, and the data and identity of each participant remained anonymous. Before participating in the research, the participants were informed about the purpose, goals and possible scientific contribution of the research. An informed consent was obtained from all patients and/or their legal representatives, according to the local legislation.

An ethical approval was obtained from competent ethics committees of the Cantonal Hospital "Dr. Safet Mujić", and the University Clinical Hospital Mostar, Mostar, Bosnia and Herzegovina.

Methods

The data were obtained by prospective analysis of the medical documentation, as well as on the basis of clinical examinations of the patients and analysing results of a written structured survey preoperatively and for at least 6 months after the surgery. Lumbar disc herniation was established by MRI of the lumbar spine. The investigated preoperative variables were pain intensity in the back and legs (Visual Analogue Scale - VAS) (16), Sciatica Bothersomeness Index (SBI) (17), and index of disability (Oswestry Disability Index - ODI) (18).

The VAS (16) is relating to patient pain perception by metric analogue scales 0-10 cm (0 - no pain, 10 - the strongest pain). The SBI (17) 0-6-point scale, following symptoms according to how bothersome they were in the past week, which refers to leg pain, numbness or tingling in the leg, foot or groin, weakness in the leg or foot, back or leg pain while sitting. The ODI (18), 10-point patient-reported outcome questionnaire, scored from 0 to 5, giving a maximum score of 50.

The investigated postoperative variables were: pain intensity in the back and legs (VAS), SBI, ODI, and outcome according to the Odom's criteria (excellent, good, satisfactory and poor) (19). Output postoperative data were obtained at least six months after surgical treatment and after performing postoperative control diagnostics (MRI of the lumbar spine). Microdiscectomy was a method of surgical treatment. All patients were treated equally during hospitalisation. Everyone was advised to continue the physical therapy at home after discharge from hospital and also avoiding static loads. Influence of the operation time on treatment success was analysed by comparing differences between preoperative and postoperative parameters obtained by evaluating the VAS, SBI, and ODI questionnaires in both of groups. The intensity of pain before and after surgery was measured and changes in the level of pain intensity (improvement), according to all the measured scales (pain before surgery - pain after surgery) were calculated in both groups, as well as the values of statistical testing of the obtained results.

Statistical analysis

Gender differences between the observed groups of patients as well as the differences according to age, height, body weight, Body Mass Index (BMI) and operated level of lumbar disc herniation were calculated using the Fisher exact test and χ^2 test. Comparisons of surgical outcomes between case and control group according to changes of values of measured scales (VAS for the lower back and leg pain, SBI and ODI scores) were performed using the t-test for independent samples. The difference between the observed groups according to the Odom's criteria was done using the Fisher exact test. A statistic significance was set at $p < 0.05$ and p values that could not be expressed up to three decimal places were reported as $p < 0.001$.

RESULTS

There were 21 (61.8%) males and 13 (38.2%) females in the case group of operated patients (duration of radiculopathy < 6 months). In the control group (duration of radiculopathy > 6 months) were 17 (51.5%) male and 16 (48.5%) female patients ($p = 0.397$).

The mean age of 48.50 ± 9.34 years, the average height 176.94 ± 8.53 cm, and the average

body weight 82.32±12.88 kg in the case group of patients was found. In the control group the mean age of 50.79±9.80 years, the average height 175.73±8.63 cm and average body weight 81.48±17.70 kg were recorded (p=0.332, p=0.565, and p=0.825, respectively) (Table 1). According to the body mass index (BMI) in the case group there were 12 (35.3%) ideal body weight patients, 18 (52.9%) overweight, while four (11.8%) of them were obese. A total of 16 (48.5%) patients with ideal body weight, 10 (30.3%) overweight, and 7 (21.2%) obese patients were observed in the control group (p=0.160).

Table 1. Comparison of two patient groups by age, height and weight according to preoperative radicular pain duration

Variable	Group*	No of patients	Mean (±SD)	P
Age (years)	< 6 months	34	48.50 (±9.340)	0.332
	> 6 months	33	50.79 (±9.800)	
Height (cm)	< 6 months	34	176.94 (±8.535)	0.565
	> 6 months	33	175.73 (±8.632)	
Body weight (kg)	< 6 months	34	82.32±12.883)	0.825
	> 6 months	33	81.48 (±17.708)	

*preoperative radicular pain duration

In the case group, 11 (32.4%) patients with L5/S1 disc herniation level, 22 (64.7%) with L4/L5 and one (2.9%) with L3/L4 were operated. In the control group, 17 (51.5%) patients with L5/S1 disc herniation level, 13 (39.4%) with L4/L5, and three (9.1%) with L3/L4 were operated (p=0.107) (Table 2).

Table 2. Comparison of groups according to the operated level of lumbar disc herniation

Level of the herniated disc	No (%) of patients in the group		Total	p
	<6 months	>6 months		
L3/L4	1 (2.9)	3 (9.1)	4 (6.0)	
L4/L5	22 (64.7)	13 (39.4)	35 (52.2)	
L5/S1	11 (32.4)	17 (51.5)	28 (41.8)	0.107
Total	34 (100.0)	33 (100.0)	67 (100.0)	

Reduction the intensity of lower back pain according to the mean change of the VAS in the case group was 6.12±2.86 and in the control group 4.76±3.13 (p=0.068). Radicular pain reduction in the case group was 7.50±2.32 and in the control group 4.79±2.52 (p<0.001) (Table 3).

Table 3. Comparison of two patient groups according to the mean change in the level of the pain intensity in the back and legs (Visual Analogue Scale - VAS)

Variable	Group*	VAS mean (±SD)	p
Back	<6 months	6.12 (±2.868)	0.068
	>6 months	4.76 (±3.133)	
Legs	<6 months	7.50 (±2.326)	<0.001
	>6 months	4.79 (±2.522)	

*preoperative radicular pain duration;

The mean change of the ODI score in the case group was 54.00±18.80 whereas in the control group it was 28.12±13.28 (p<0.001) (Table 4).

The mean change of the SBI in the case group was 13.12±4.15 and in the control group it was 9.61±4.41 (p<0.001) (Table 4).

Table 4. Comparison of two patient groups according to the mean change of the Oswestry Disability Index (ODI score) and the Sciatica Bothersomeness Index (SBI)

Group*	ODI score Mean (±SD)	p	SBI Mean (±SD)	p
<6 months	54.00 (±18.800)	<0.001	13.12 (±4.154)	<0.001
>6 months	28.12 (±13.284)		9.61 (±4.415)	

*preoperative radicular pain duration;

According to the Odom's criteria, there were 21 (61.7%) excellent, 9 (26.5%) good and 4 (11.8%) satisfactory results of surgical treatment in the case group after at least six months of clinical follow-up (poor results were not recorded); in the control group, eight (24.2%) excellent, 11 (33.3%) good, 13 (39.4%) satisfactory and one (3.1%) poor results were recorded (p=0.004).

DISCUSSION

Comparison of the patients according the sex, age, height and body weight, was not statistically significant indicating the good selection, consistency and homogeneity of the studied sample. There was no statistically significant difference between the observed groups according to BMI and the level of disc herniation, although the level L4/L5 was dominant in the case group and the level L5/S1 was dominant in the control group.

It was observed that the patients in the case group had significantly more pronounced expression symptomatology preoperatively, VAS leg and ODI. However, the difference in the assessment of the intensity of preoperative lower back pain (VAS back) was not statistically significant, nor was the difference between the groups according to SBI. The patients operated within a period of six months from the onset of symptoms had more pronounced intensity of radicular pain preoperatively and greater disability. This is understandable considering the epidemiological data on the gradual regression of lumbar radicular pain in most patients and favourable natural course of lumbar radiculopathy (20-22). According to preoperative ODI, both groups of patients had symptoms, which were marked as severe disability as it was shown in the most other studies (23-25). For all tested variables (VAS leg, SBI and ODI), higher

values of improvements were obtained in the case group (early surgery). An improvement was observed when comparing the changes of lower back pain intensity (VAS back) in both groups, but the difference was not statistically significant. According to the Odom's criteria most patients in the case group had a significantly higher proportion of excellent results.

The results of the presented study are mostly in line with the results of the other studies that support the hypothesis that shorter duration of lumbar radiculopathy symptoms (for a maximum 6 months) leads to better postoperative results (6,7,8,23,26). Hurme and Alaranta and Rothoerl et al. showed the same regarding the shorter duration of preoperative symptoms (less than two months) (4,27). Støttrup takes the duration of symptoms less than three months to achieve better results (5). Nygaard et al. and Blazhevsky et al. take eight and ten months time frames to achieve better postoperative results, which is longer compared to the presented research (9,28). Blazhevsky et al, however, pointed out that by far the best operative results are achieved in a period of up to three months of sciatica duration (28). Even longer duration of symptoms, up to one and two years, after which better treatment outcome can be expected has shown researches conducted by Ng and Sell and Pitiska (10,11). Two studies, by Jönsson et al. and Fisher et al. concluded similarly, but they did not highlight a time limit for undertaking the surgery (29,30).

Several limitations in the existing literature make it impossible to produce a solid evidence about the exact time of surgery treatment. There is considerable variability among the studies according to diversity of applied methods, inclusion and exclusion criteria, as well as the overall quality of the researches itself. Some studies used different scoring systems for outcome evaluation, and also, there is a question of how to measure the treatment outcome. In other words, the classification of treatment outcomes was made by different instruments for assessing the severity of pain syndrome and there have also been validated several questionnaires for measuring outcomes in spine surgery in the past decade (31). Moreover, the self-assessment of the severity of a painful syndrome does not allow conclusions to be drawn about daily functioning of the patient, his/her quality of life, or his/her reintegration into the social community and return

to work (32). It is also questionable whether the evaluation of results is comparable among studies conducted under different socio-economic conditions, because the low socioeconomic status can cause an increased number of complications in certain types of spinal surgery (33,34). There were also differences in the types of statistical methods applied in individual studies, and some research showed a certain discrepancy between the statistical significance of the obtained variable (pain, quality of life) from the perspective of the researcher and the clinical significance from the perspective of the patient (35).

In the presented research, in evaluating the postoperative results, unlike many other studies, multiple rating scales of the treatment outcomes were used. It also showed that the duration of radiculopathy after which good results of a lumbar discectomy can be expected is six months and shorter. The six-month time limit is also important for the prevention of the development the chronic pain and initiation the complex pathophysiological actions of processing sensory signals in certain areas of the brain (36,37); also, optimal surgery time of six months and less cannot be generalized to every patient with lumbar disc herniation. Following the experience, it is necessary to adapt and individualize the decision to each patient. Nowadays, indication for lumbar discectomy and also the time of surgery are based on the lumbar radicular syndrome duration, the patient's ability to suffer pain, and on the preferences of surgeons and patients themselves, since a large number of patients prefer to participate in the decision-making on the type and time of treatment (38). This means that the patient should make a final decision regarding the type and timing of treatment initiation, based on his wishes and individualized requirements following an open discussion with the competent neurosurgeon about the benefits as well as the existing risks of the surgery itself.

Like the other examples of limitations from the existing literature, presented study included a relatively small number of subjects. No more complex statistical analysis was performed considering the heterogeneity of the sample and a large amount of data related to radicular pain syndrome such as the age, body weight and others. The inclusion of these factors with operation time of shorter than six months in a more complex stati-

istical analysis could be the subject of future research and a more accurate selection of patients who will have most benefit from surgery.

In conclusion, our results are in line with most research reporting that the shorter duration of the lumbar radicular pain has a positive effect on the results of lumbar discectomy. An operation performed within the first six months after the onset of symptoms (early surgery) is useful for reducing the intensity of pain as well as the disability of patients. The optimal timing of surgery (up to six months) cannot be generalized to every patient with lumbar disc herniation. It is necessary to adapt and individualize the decision considering preferences and opinion of a surgeon and a patient himself.

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