



# Short-term outcome after microdiscectomy for lumbar disc herniation – a single centre study

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## Abstract

**Introduction.** Lumbar disc herniation (LDH) is a common cause of back pain and leg pain. For more than 60 years, standard discectomy by fenestration has been used to treat LDH. In his study, three commonly used scales were used to assess the outcome after microdiscectomy, such as the Low Back Pain Rating Scale (LBPRS), Oswestry Disability Index (ODI) and the Visual Analogue Scale (VAS). To the best of the authors' knowledge, this is the first study analyzing treatment results at 3 months after microdiscectomy.

**Materials and method.** During almost 5 years, a total of 327 patients underwent microdiscectomy operations for single level disc disease. Of these, 286 patients were available for 3-month follow-up. All patients were operated on at the Neurosurgery Department in the Specialist Hospital in Sandomierz, Poland. Before surgery and 3 months after surgery, all patients were asked to complete LBPRS, ODI and VAS scales. The statistical analysis used was  $p_2$ , the effect size indicator for ANOVA.

**Results.** Significant improvement was observed in all scales used 3 months after surgery.

**Conclusions.** There are new, minimally invasive percutaneous techniques available, such as percutaneous laser disc decompression and intradiscal injection of radiopaque gelified ethanol. There are also trials with platelet-rich plasma or mesenchymal stem cells injected into the disc, aimed at the restoration of healthy disc properties. The hypothesis that metabolic products of bacteria propionibacterium acnes can contribute to disc degeneration inspired attempts at antibiotic therapy. This study was conducted on a large group of patients and confirmed that discectomy is the recommended method of surgery which produces good treatment results in 3-months follow-up.

## Key words

low back pain, lumbar disc herniation, microdiscectomy

## INTRODUCTION

Low back pain is a common problem in industrialized societies [1]. Lumbar disc herniation (LDH) is a common cause of back pain and leg pain [2]. For more than 70 years, standard discectomy by fenestration has been used worldwide to treat lumbar disc herniation [3]. Despite the emergence of new and often less invasive treatment methods, standard discectomy is the preferred technique for the surgical treatment of disc herniation, recognized by many surgeons for producing good results [4]. Surgery treatment is usually offered to patients with persisting pain in the lower back, with or without radiating to the leg despite conservative treatment, difficult to control pain or acute paresis, including cauda equine syndrome [5].

Three commonly used scales were used in this study to assess outcomes following therapeutic interventions for low back pain. The Low Back Pain Rating Scale (LBPRS) developed by Manniche et al., consists of three clinical components: pain (0–60 points), disability (0–30 points) and physical

impairment (0–40 points). The Oswestry Disability Index (ODI) is an indicator calculated on the basis of the Oswestry Low Back Pain Questionnaire used to assess disability due to low back pain. The Visual Analogue Scale (VAS) was the last scale used [6,7].

The aim of the study was to measure clinical outcomes at three months following first time surgery of single-level lumbar microdiscectomy. To the best of the authors knowledge, this is the first study analyzing treatment results at 3 months after microdiscectomy.

## METHOD AND RESULTS

Between September 2014 – January 2019, a total of 327 patients were operated on by microdiscectomy for single level disc disease using the fenestration method. Of these, 286 patients were available for 3-months follow up. All patients were operated on at the Neurosurgery Department in the Specialized Hospital of the Holy Spirit in Sandomierz, Poland. Inclusion criteria were 1) radicular pain lasting for a minimum of 21 days, 2) an MRI finding of intervertebral disc extrusion or sequester, 3) at least one specific physical finding (a positive straight leg raising test  $< 60^\circ$ , muscle

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weakness, weakness in tendon reflex, or a dermatomal sensory change). Patients who had previously undergone lumbar spine surgery, extra-foraminal disc herniation, or coexisting spinal degenerative spondylolisthesis and/or scoliosis, were excluded.

Before surgery and three months after surgery, All patients were asked to complete LBPRS, ODI and VAS scales. Significant improvement was observed in all scales used three months after surgery (Tab. 1).

**Table 1.** Minimum, maximum and median values in the scales

Scale		Before surgery			3 months after surgery		
		Min	Max	Median	Min	Max	Median
Low Back Pain Rating Scale	Pain	0	82	31	0	52	12,5
	Disability	2	71	19	0	86	9
	physical impairment	2	37	17	0	24	4
	maximum points	13	116	68	0	146	30,5
Oswestry Disability Index		0	94	44	0	66	20
Visual Analogue Scale	back pain	0	10	5	0	10	2
	leg pain	0	10	5	0	10	0

**Characteristics of the group.** The participants included 149 males (52.1%) and 137 females (47.9%). The age of the patients ranged from 18 – 79 years with the median age of 47 years. Most patients were operated on at level L4-L5 (154 patients – 53.9%), level L5-S1 (102 patients – 35.8 %), 23 (0.9%) patients at level L3-L, and 7 (0.4%) patients at level L2-L3. The median length of symptoms before surgery lasted nine months, a maximum of 24 years and a minimum of 21 days.

**Statistical analysis.** The statistical analysis used was  $\eta^2$ , the effect size indicator for ANOVA with repeated measurements. Effect size is a measure of the extent of variation in the distribution of the studied populations. All  $\eta^2 < 0.14$  are classified as ‘large effect’, i.e. very large differences (or experimental effects). In the obtained results, all effects were very large, which means that the results of individual scales before and after the operation differed not only significantly, but to a large extent their distributions had very few points in common. Of all the measurements examined, the impact of surgery in LBPRS scale physical impairment was the most positive ( $\eta^2 = 0.67$ ).

## RESULTS

The median LBPRS-maximum points before surgery was 68 points and after surgery 30.5; the difference was statistically significant  $p = 0.0001$ . Similarly, all components of the LBPRS scale before and after surgery were associated with statistical significant differences  $p = 0.0001$  (Fig. 1).

Median in the ODI scale before surgery was 44 points, and three months after surgery decreased to 20 points ( $p = 0.0001$ ) (Fig. 2).

The median VAS scale before surgery was 5 points for back and leg pain, with significant improvement ( $p = 0.0001$ ) after surgery, with a median of 2 and 0, respectively.

## DISCUSSION

There are several possible treatments for lumbar discopathy. Conservative improvement is expected in pain in 90% of patients [8]. However, surgical as well as conservative treatment had good long-term treatment outcome for sciatica symptoms in patients with lumbar disc herniation. Compared to conservative treatment, surgical treatment relieved back pain faster, although no advantage was seen in any treatment after three months. [9].

The findings of this study confirm the well-established observation that discectomy is a safe and effective treatment method in lumbar discopathy with sciatic pain. Although success-rates as high as 88–97% have been reported for this procedure, more realistic outcomes, as measured by patient-reporting scales, range from 75 – 80% [10]. Studies show that decompression of the neural structures improves not only the quality of life, but also significantly reduces depressive symptoms [11]. 76% patients operated on for lumbar disc herniation are able to return to work in one year [12]. 4% of patients experience deterioration of functional status following the surgery. The correlates of deterioration are: long duration of pain and low ODI (higher function) prior to surgery [13].

Since the introduction of lumbar discectomy by Mixer and Barr in 1934, modifications of the technique have been proposed, with increasing significance of minimally invasive surgery. A meta-analysis of several studies with a total 929 patients have shown that the effects of microdiscectomy and sequestrectomy are similar in the reherniation rate, hospitalization time and postoperative pain [14]. However, studies with prolonged follow-up times show that 25% may need a second operation at the same lumbar level [15]. SPORT study and previous reports have demonstrated that older age was associated with lower number of reoperations, possibility due to surgeons' reluctance to indicate reoperations for older patients [16]. The cumulative risk of leg pain recurrence within three years after surgery is 45%, but it is substantially lower if the pain resolves completely immediately after the initial surgery [17].

In the current study, the incidence of disc herniation at particular lumbar levels reflects the typical distribution, L4/L5 and L5/S1 being the most common in over 90% of cases, which is confirmed by other studies [2,5,12].

New, minimally invasive percutaneous techniques usually do not require general anaesthesia and hospitalization, thus reducing healthcare costs compared with surgery. They include percutaneous laser disc decompression (PLDD) and intradiscal injection of radiopaque gelified ethanol (DiscoGel®). The first technique aims to indirectly reduce the pressure of the herniation on the nerve root through vaporization of a small volume of nucleus pulposus by laser energy [18]. A randomized/prospective trial of 115 patients demonstrated that PLDD render similar pain-relieving effect to standard microdiscectomy, although the latter is associated with faster recovery and fewer reoperations (38% for PLDD vs. 16% microdiscectomy) [19]. DiscoGel® is believed to work according to the similar principle – ethanol causes local necrosis of the nucleus pulposus decreasing the intradiscal pressure which leads to retraction of the herniation [20].

Volpentesta et al. report significant pain reduction, both immediately after the procedure and in 6, 12 and 18 months' follow-up in 90% patients treated with Discogel®

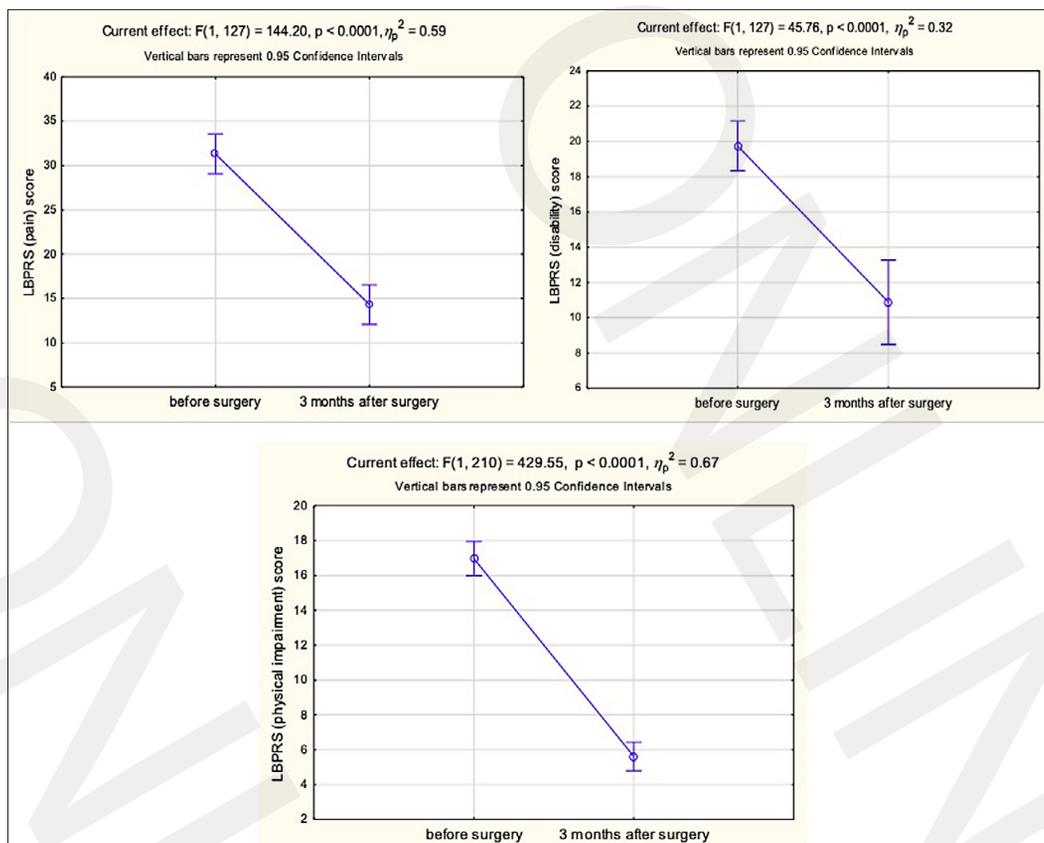


Figure 1. LBPRS scale before and 3-months after surgery

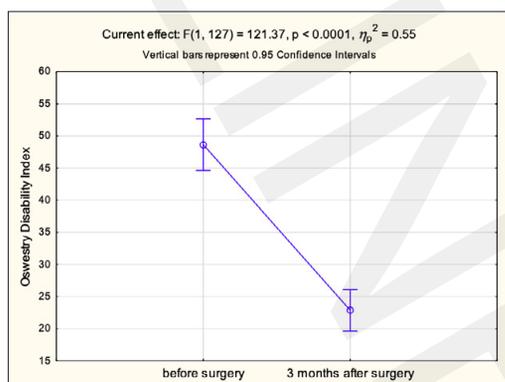


Figure 2. ODI scale before and 3-months after surgery

for lumbar disc herniation [21]. Apart from the relatively new Discogel®, numerous agents have been tested previously for chemonucleolysis: chymopapain and matrix metalloproteinase [22]. These substances also contribute to the attraction of macrophages, desiccation and significant reduction of the volume of herniated disc material [23]. The investigated factors correlating with positive outcome for all types of chemonucleolysis are: dominance of leg over the back pain, posterolateral rather than generalized, broad-base disc herniation, younger age, lack of bony spurs, and shorter duration of symptoms [24].

The variety of lumbar discopathy treatment strategies derives from the multitude of theories about the pathogenesis of radicular pain. Decompression techniques

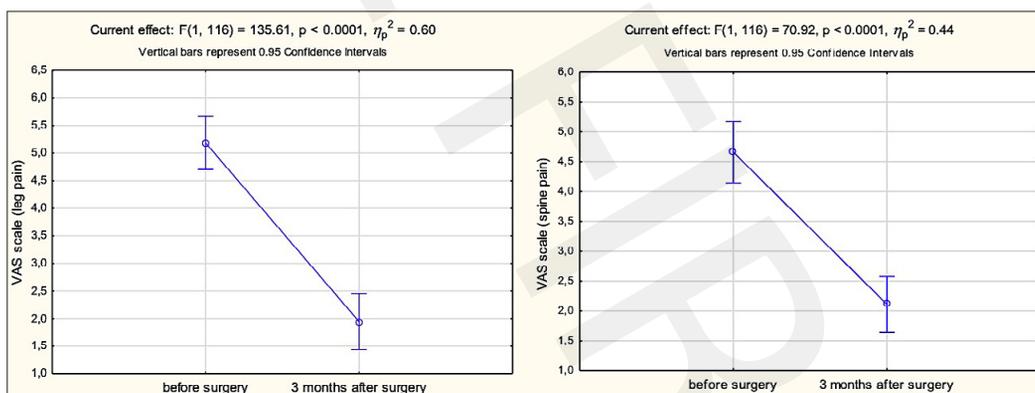


Figure 3. VAS scale before and 3-months after surgery

(endoscopic, micro- or open-discectomy, different types of chemonucleolysis, intraspinal process devices) address the mechanical pressure exerted by the herniated disc on the nerve root exiting the intervertebral foramen. Trials with platelet-rich plasma or mesenchymal stem cells injected into the disc seek to restore the balance between the catabolic, pro-inflammatory (interleukin-1 [25] and anabolic mediators (insulin-like growth factor, fibroblast growth factor, bone morphogenic protein [26,27,28])). The aim is the restoration of healthy disc properties and preventing the chemical irritation of the neural structures.

The above-mentioned non-surgical methods are certainly very appealing to many patients, yet discectomy remains the most efficient and wide-spread procedure for discopathy-related lumbar pain resistant to conservatory treatment.

## CONCLUSIONS

The 286 patients treated with lumbar discectomy analyzed in the current study significantly improved after the surgery. The Low Back Pain Rating Scale (LBPRS) and the Oswestry Disability Index (ODI) are relevant and generally accepted tools for evaluating patients pre- and post-operatively. Although there are new, minimally invasive percutaneous techniques such as percutaneous laser disc decompression and intradiscal injection of radiopaque gelified ethanol, there are also trials with platelet-rich plasma or mesenchymal stem cells injected into the disc, aimed at the restoration of healthy disc properties. The hypothesis that the metabolic products of low-virulence anaerobic bacteria propionibacterium acnes can contribute to disc degeneration inspired antibiotic therapy attempts.

This study was conducted on a large group of patients and confirms that discectomy is the recommended method of surgery and produces good treatment results in 3-months follow up. Despite the emergence of new, often less invasive treatment methods, standard discectomy is the preferred technique for the surgical treatment of disc herniation.

The limitations of the study were no longer follow up and no analysis of complications or failures of treatment.

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