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# Risk Factors and Post-Operative Predictors for Recurrent Lumbar Disc Herniation: A Long-term Follow-up Study

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Most of the patients had rLDH within the first 36 months after surgery. At multivariate analysis, recurrence of LDH was associated with higher pre-operative body mass index (BMI) and higher post-operative Oswestry disability index (ODI) with statistical significance.

**Conclusions.** Baseline BMI and post-surgery ODI could predict rLDH after surgery during a long-term follow-up.

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## Abstract

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The purpose of this study is to identify some risk factors and post-operative predictors for recurrent lumbar disc hernia (rLDH) during a long-term follow-up in patients treated with microdiscectomy.

**Aim of the paper:** This study analyzes some risk factors and postoperative predictors for recurrent lumbar disc hernia (rLDH) during a long-term follow-up in patients treated with microdiscectomy.

**Material and methods.** We analyzed retrospectively a consecutive series of patients who underwent lumbar spinal microdiscectomy for lumbar disc herniation (LDH) from January 2013 to June 2018 at our Institute. The rate of rLDH during long-term follow-up was analyzed and correlated with baseline and post-operative data.

**Results.** A total of 263 patients were included with a median follow-up time of 24 months (from 13 to 43 months).

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**Keywords:** recurrent disc herniation, lumbar disc herniation, lumbar microdiscectomy, discectomy.

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## Introduction

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Recurrent herniation of the lumbar disc after microdiscectomy is a common complication ranging from 2% to 25% of all operated patients [1]. Still today the factors underlying LDH recurrence are under debate and many authors postulate that heavy activities, advanced age, constitutional weakness of the fibrous annulus could have a role [2]. In patients with rLDH and intractable pain or neurological deficit the revision surgery may be mandatory but clinical results are poor. In this light the knowledge of risk factors for recurrence is important to avoid a reoperation with elevated risk of infection [3], failed back syndrome and elevated costs for the health care system.

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## Aim of the paper

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This study analyzes some risk factors and post-operative predictors for recurrent lumbar disc hernia (rLDH) during a long-term follow-up in patients treated with microdiscectomy. The knowledge of the predictive factors may help to identify patients at risk of recurrence.

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## Material and Methods

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We retrospectively reviewed data of consecutive patients who underwent standard lumbar spinal microdiscectomy for disc herniation (LDH) at our institution from January 2013 to June 2018. Under general anesthesia the patient was positioned prone on frame, a horizontal skin incision of approximately 4 cm in length above the lumbar spinal segment was made followed by the incision of the lumbo-dorsal fascia. Using the operating microscope, a partial hemilaminectomy of the superior and inferior lamina and flavectomy were performed. The hernia and the intra-discal fragments were removed by a combination of water and rongeurs.

Finally, coagulation of the annulus, hemostasis and reconstruction were made. Radiological examination included MRI imaging of the lumbar spine before and after surgery. Exclusion criteria were multi segmental spinal canal stenosis, spinal infection, spondylolisthesis, vertebral trauma and spinal deformities. Open microdiscectomy was performed by the same group of surgeons using a standard technique. Recurrence of disc herniation was defined as disc herniation at the same level and side of previous microdiscectomy after a period free of postoperative pain for 3 months at least. In this study we evaluated the rate of recurrent lumbar disc herniation (rLDH) after standard microdiscectomy during long-term follow-up and its relationship with baseline and post-operative variables.

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## Statistical analysis

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Values were presented as mean  $\pm$  standard deviation (SD) or median (interquartile range [IQR]) for continuous variables and as the number (percent) of subjects for categorical variables. The Kaplan-Meier survival curves analysis and log-rank test were used to analyze the time to rLDH and assess differences between subgroups. Uni- and multivariate analyses by Cox regression model were performed to estimate hazard ratios (HRs) and corresponding 95% confidence intervals (CIs) for the following variables: age, sex, smoking status, body mass index (BMI), disc hernia level, and post-operative Oswestry disability index (ODI). Subgroup analysis was planned based on the post-operative ODI (below versus above the average value observed in the study cohort). Results were considered significant for  $p$  values  $<0.05$  (two sided). Data analysis was performed using STATA/IC 13.1 statistical package (StataCorp LP, Texas, USA).

## Results

A total of 262 patients were included in this study. The mean age of patients was 46.5 (12.5) years and 161 (61.5%) were males. Baseline characteristics of patients are summarized in Table 1.

The median follow-up time was 24 [13-43] months. During the follow-up, 46 (17.6%) patients presented rLDH, with most cases occurring within 24 months from surgery (Figure 1). At the multivariate analysis, higher BMI and higher post-operative ODI were associated with the risk of rLDH (Table 2). The risk of recurrence was significantly increased in patients with high post-operative ODI value (Figure 2).

**Table 1. Baseline characteristics of patients**

	Full cohort (n=262)
Age (years)	46.5 (12.5)
Sex	161 (61.5%)
Body Mass Index (kg/m <sup>2</sup> )	26.3 (3.3)
Smoking	159 (60.7)
Disc hernia level	
L3-L4	47 (17.9)
L4-L5	131 (50)
L5-S1	84 (32.1)
Post-operative ODI	15 [5-20]

Data are mean (SD) or median [IQR] for continuous variables, and n (%) for categorical variables.  
Abbreviation: ODI=Oswestry Disability Index.

## Discussion

Lumbar disc hernia is the most common debilitating disease in adult people. The microdiscectomy is the gold standard of the treatment in patients with persistent pain or motor deficit. Recurrent disc hernia, defined as disc hernia at the same level of previous microdiscectomy in patients with a pain-free interval of at least 3 months after surgery [1], is a frequent complication and the major cause of postoperative failure with onset of the failed back syndrome. Still today the treatment of choice for rLDH is under debate with some authors advocating fusion as the treatment of choice while others prefer to repeat microdiscectomy.

In this light the prevention of the recurrence is mandatory and the knowledge of some pre-operative factors related with recurrence may help patient selection or advise for a prudential convalescence in the postoperative period.

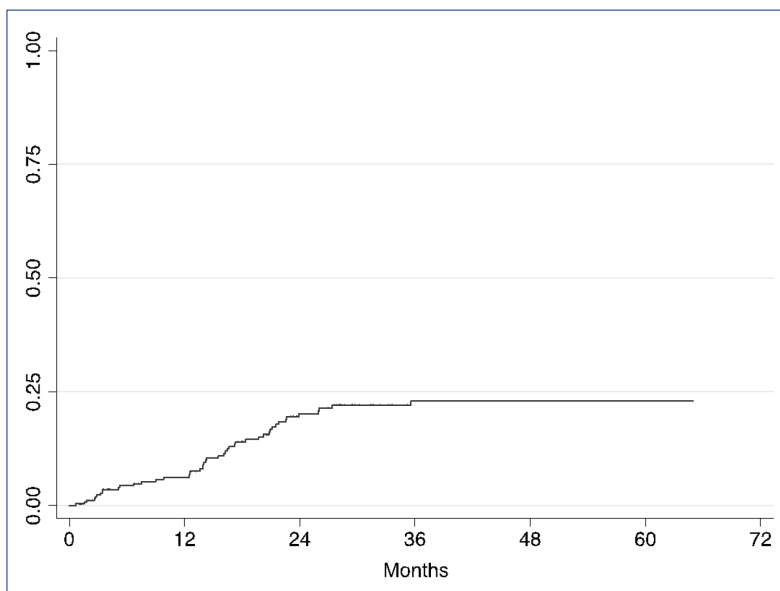
Many studies [1-4-5] in literature analyze the factors influencing the outcome after microdiscectomy for the treatment of lumbar disc hernia. In line with literature our data confirm that age, gender, smoking and type of herniation, side of recurrence and duration of recurrent symptoms were not correlated with the outcome. In our series the recurrence rate in a long-term follow-up (13-43 months) was 17,6% with BMI and postoperative ODI value associated with the risk of rLDH (table 2).

Obesity causes a persistent heavy load on the vertebral column with joint and intervertebral disc damage [6-7-8]. In our study higher BMI was an independent predictor of recurrence both at unadjusted logistic regression

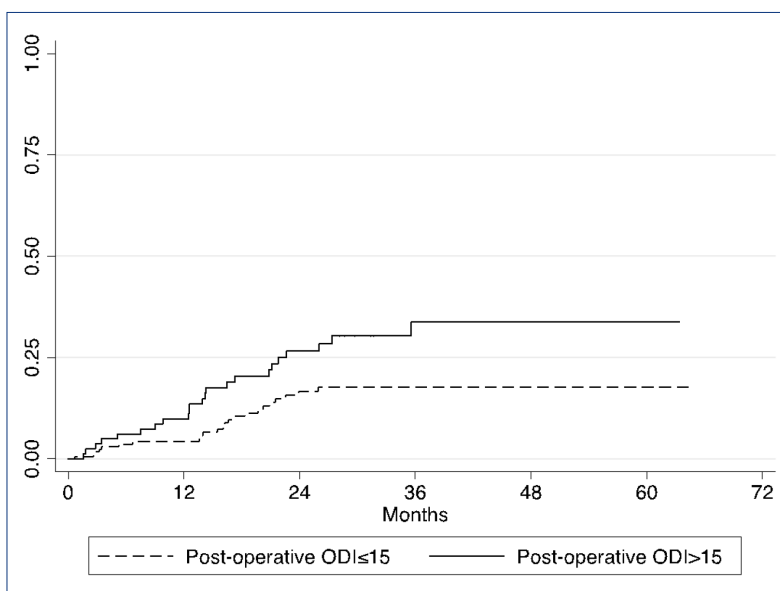
**Table 2. Long-term recurrence of lumbar disc herniation**

Independent Variable	Unadjusted		Adjusted*	
	HR (95% CI)	p value	HR (95% CI)	p value
Age	1.02 (1.00-1.05)	0.059	1.02 (0.999-1.050)	0.056
Sex	0.94 (0.52-1.69)	0.831	0.78 (0.42-1.42)	0.425
Smoking	1.47 (0.76-2.84)	0.251	0.15 (0.58-2.2)	0.681
Body Mass Index	<b>1.17 (1.06-1.29)</b>	<b>0.002</b>	<b>1.14 (1.03-1.26)</b>	<b>0.007</b>
Disc hernia level	0.93 (0.62-1.41)	0.739	0.85 (0.55-1.32)	0.474
Post-operative ODI	<b>1.05 (1.02-1.09)</b>	<b>0.003</b>	<b>1.05 (1.01-1.09)</b>	<b>0.014</b>

\*Adjustment by age, sex, smoking, BMI, disc hernia level and ODI.  
Abbreviations: CI=confidence interval; HR=hazard ratio, ODI=Oswestry Disability Index.



**Figure 1. Time to recurrent lumbar disc herniation**  
Kaplan-Meier estimates for the time to recurrent lumbar disc herniation over follow-up



**Figure 2. Time to recurrent lumbar disc herniation according to post-operative ODI**  
Kaplan-Meier estimates for the time to recurrent lumbar disc herniation according to post-operative ODI (p for log-rank test=0.017)

analysis ( $p=0.002$ ) and at adjusted analysis ( $p=0.007$ ). The ODI score documented disabilities related with pain and vertebral diseases such as spondyloarthritis, disc hernia and lumbar stenosis [10-11-12]. In our series elevated ODI score in the long-term follow-up is associated with rLDH. We may postulate that elevated postoperative ODI score values are correlated with the presence of disc material in the vertebral canal and progressive radicular compression. In patients with ele-

vated postoperative ODI score with intractable pain the MRI study is mandatory especially when symptoms are present within 24 months from surgery because in our study the rate of recurrence is maximum within 2 years from surgery.

## Conclusions

In patients operated for lumbar disc hernia by microdiscectomy baseline BMI and postoperative ODI value predict rLDH in a long-term follow-up.

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**Compliance with ethical standards.**

**Conflict of interest:** The authors have no known conflicts of interest to declare. The manuscript submitted does not contain information about medical device(s)/drug(s). All authors contributed to the design of the study.

**Ethical approval:** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional committee and with the latest amendment of the Helsinki declaration.

**Informed consent:** Informed consent was obtained from all individual participants included in the study.

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## ČIMBENICI RIZIKA I POSLIJEOPERACIJSKI PREDIKTORI ZA PONAVLJAJUĆU HERNIJU LUMBALNOG DISKA: DUGOROČNO PRAĆENJE

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Pri multivarijantnoj analizi, recidiv hernije lumbalnog diska povezan je s višim indeksom tjelesne mase (engl. *body mass index* – BMI) prije operacije i višim Oswestry indeksom invaliditeta nakon operacije (engl. *Oswestry disability index* – ODI) sa statističkom značajnošću.

**Zaključak.** Početni indeks tjelesne mase i poslijeoperacijski Oswestry indeks invaliditeta mogu poslužiti kao prediktori ponavljajuće hernije lumbalnog diska nakon operacije tijekom dugotrajnog praćenja.

### Sažetak

**Cilj.** Ova studija analizira određene čimbenike rizika i poslijeoperacijske prediktore za ponavljajuću herniju lumbalnog diska (engl. *recurrent lumbar disc hernia* – rLDH) tijekom dugotrajnog praćenja bolesnika liječenih mikrodiskektomijom.

**Metode.** Retrospektivno smo analizirali niz uzastopnih serija pacijenata koji su podvrgnuti lumbalnoj spinalnoj mikrodiskektomiji zbog hernije lumbalnog diska (engl. *lumbar disc hernia* – LDH) u razdoblju od siječnja 2013. do lipnja 2018. u našem Institutu. Stopa ponavljajuće hernije lumbalnog diska tijekom dugotrajnog praćenja analizirana je i korelirana s početnim anamnestičkim podacima i poslijeoperacijskim podacima.

**Rezultati.** U studiju je uključeno ukupno 263 pacijenta s prosječnim vremenom praćenja od 24 mjeseca (od 13 do 43 mjeseca). Većina pacijenata imala je ponavljajuću herniju lumbalnog diska u prvih 36 mjeseci nakon operacije.

**Ključne riječi:** ponavljajuća hernija diska, hernija lumbalnog diska, lumbalna mikrodiskektomija, diskektomija.