



# Effect of Preoperative Parameters on Outcomes of Lumbar Microdiscectomy: A Retrospective Analysis

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## Abstract

**Objective** The objective of this study was to characterize the effect of preoperative variables on outcomes after minimally invasive lumbar microdiscectomy.

**Materials and Methods** This study was done from January 2019 to May 2020. This included medical records of all patients who were diagnosed with lumbar disc herniation and treated surgically by microdiscectomy. The medical records of such patients from January 2016 to January 2018 were included in this study. Postoperative outcomes were analyzed by Oswestry Disability Index (ODI), visual analog scale (VAS) leg, and VAS back scores, that were noted at preoperative, immediate postoperative, 6 months postoperative, and 1 year after operation. Difference in each outcomes score was calculated postoperatively with respect to the preoperative readings. Minimal clinically important difference was further calculated for each outcome score.

**Results** On analyzing the ODI, VAS leg, and VAS back scores across various age groups, genders, body mass indexes, addictions, comorbidities, preoperative epidural steroid injection and physiotherapy, and levels of disc herniation, and it was found that there was no statistically significant difference across these categories. However, the ODI scores (~ ODI) at all time points showed greater difference in the younger age group, that is, 18 to 30 years, males, nonsmokers, those with symptom duration of less than 6 weeks, and with disc herniation at L3 to L4.

**Conclusion** The findings of this study will help to properly counsel patients with regard to the factors mentioned above so as to set realistic expectations, to help improve the outcomes, and for appropriate surgical decision making, that is, at which point should a surgical intervention be made.

## Keywords

- preoperative
- lumbar microdiscectomy
- ODI
- VAS
- MCID

## Introduction

Herniations of lumbar intervertebral disc are not uncommon. Pain, paresthesias, and weakness are the common accompaniments. Most of the patients with disc hernia-

tion-induced radiculopathy have optimal outcomes with nonsurgical treatment. Therefore, surgical treatment is generally opted in whom nonsurgical treatments are either less responsive or symptoms are persistent, severe, and progressive. The conventional surgical techniques for the treatment

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of lumbar disc herniation are more invasive and thus more sophisticated technique like microdiscectomy is preferred nowadays due to its numerous advantages over conventional techniques. These advantages are less invasion of tissues, reduced duration of operation, rapid recovery, and minimal loss of blood.<sup>1</sup>

Nonsurgical approach for the management of lumbar disc herniation has various drawbacks such as it is very time-consuming therapeutic modality and significant number of patients may encounter poor prognosis even after surgery owing to ill effects of continual spinal nerve root compression during initial ongoing conservative management.<sup>2</sup> The threshold of optimal duration of nonsurgical management for opting for surgical intervention remains a topic of debate. However, it has been noted that prognosis after surgery is better if the symptoms are of less duration.<sup>3</sup>

Multiple factors like age, gender, duration of symptoms, smoking, obesity, diabetes, epidural injections, physiotherapy, and level of disc herniation are known to impact the functional results after microlumbar discectomy.<sup>4–6</sup> Studies also show that in patients with these factors' complications like infections, increased intraoperative blood loss, and increased duration of hospital stays are well documented.<sup>7</sup>

The aim of this study is to characterize the effect of preoperative variables on postoperative outcomes after minimally invasive lumbar microdiscectomy. This provides us an incentive to research the patient factors that may affect surgical outcome and thereby guide us weigh the risks of surgery against its benefits while also enabling us to counsel patients preoperatively about the functional outcomes of microlumbar discectomy.

## Materials and Methods

The present hospital record-based retrospective study was done from January 2019 to May 2020 after institutional review board approval (IRB/1373/AL/20/28). This included medical records of all patients who were diagnosed with lumbar disc herniation and treated surgically by lumbar microdiscectomy from January 2016 to January 2018. Only those medical records with complete details and evaluation in the form of Oswestry Disability Index (ODI), visual analog scale (VAS) leg, and VAS back scores were included in the study. Medical records of patients with repeat surgeries and postoperative follow-up data of less than 1 year were excluded.

Preoperative variables like age, gender, body mass index (BMI), level of disc herniation, addiction, comorbidities, preoperative physiotherapy, epidural steroid injection, and symptom duration were analyzed for their effect on outcome after lumbar microdiscectomy. We have used minimal invasive tubular retractor for microdiscectomy. Intervention-related parameters like average length of stay in hospital after surgery, intraoperative blood loss, and duration of surgery were noted. Postoperative outcomes were analyzed by ODI, VAS leg, and VAS back scores that were noted at preoperative, immediate postoperative period, 6 months and 1 year after operation. Difference in

each outcomes scores was calculated at postoperative time point with respect to preoperative readings of these scores. Minimal clinically important difference (MCID) was further calculated for each outcome score. For ODI, the minimum values were reduced by at least 13 points, 1.2 points for VAS back score, and 1.6 points in VAS leg scores, as per one published study.<sup>8</sup>

## Statistical Analysis

Statistical analysis was done using Microsoft Excel 2016. Descriptive statistics were used to analyze the baseline characteristics. Student *t*-test was used to analyze the outcomes parameters like ODI, VAS leg, and VAS back scores that are continuous variables. MCID was compared across all the preoperative parameters using chi-squared test. Since there was no significant difference in preoperative parameters, there was no need for multivariate analysis.

## Results

Out of 431 hospital records of patients with lumbar disc herniation who underwent lumbar microdiscectomy, 209 records were included for analysis as per inclusion and exclusion criteria of this study. Number of patients according to various factors are shown in ►Table 1. The operative findings in patients across various parameters are depicted in ►Table 2. The operative findings were comparable across the parameters.

On analyzing the ODI, VAS leg, and VAS back scores across various age groups and gender, it was found that there was no statistically significant difference across subcategories. But the difference in ODI score (~ ODI) at all-time points showed that greater difference was seen in younger age group, that is, 18 to 30 years followed by 31 to 50 years as compared with 51 to 85 years age group and this difference was statistically significant. Similarly, male gender showed greater ODI as compared with female gender and the difference was statistically significant. Such trend was not found in VAS leg and back scores across age and gender subcategory analyses (►Table 3).

On analyzing the ODI score, it was found that greater difference was seen in nonsmokers and duration of symptoms less than 6 months as compared with smokers and symptom duration more than 6 months, respectively, at all postoperative time points and the difference were statistically significant (►Table 3). The greater difference was seen in ODI score with disc herniation at the level of L3 to L4 as compared with patients with disc herniation at the levels of L4 to L5 and L5 to S1, and this difference was statistically significant at every postoperative time-point (►Table 3).

There was no statistically significant difference present in VAS leg and VAS back score in subcategories of symptom duration and levels of intervertebral disc herniations. There was no statistically significant difference on analyzing the ODI, VAS leg, and VAS back scores across various subcategories of BMI, alcoholic versus nonalcoholic, comorbidities like diabetes and hypertension, preoperative epidural steroid injection, and physiotherapy.

**Table 1** Baseline characteristics of patients in this study

Sr. no.	Category	Subcategory	n (%)
1	Age	18–30 years	29 (14%)
		31–50 years	78 (34%)
		51–85 years	102 (52%)
2	Sex	Male	101 (48%)
		Female	108 (52%)
3	BMI	18–24.9	112 (53%)
		25–30	72 (34%)
		> 30	25 (13%)
4	Addiction	Smokers	34 (16%)
		Nonsmokers	175 (84%)
		Alcoholic	56 (27%)
		Nonalcoholic	153 (73%)
5	Comorbidity	DM	48 (23%)
		HTN	61 (29%)
		None	100 (48%)
6	Duration of symptoms	< 6 months	102 (49%)
		6–12 months	79 (38%)
		> 12 months	28 (13%)
7	Pre-op physiotherapy	Yes	45 (21%)
		No	164 (79%)
8	Epidural steroid	Yes	34 (16%)
		No	175 (84%)
9	Level of disc herniation	L3-L4	33 (16%)
		L4-L5	98 (47%)
		L5-S1	78 (33%)

Abbreviations: BMI, body mass index; DM, diabetes mellitus; HTN, hypertension.

MCID was achieved in a greater number of patients for ODI in age group 18 to 30 years, male gender, and nonsmokers as compared with age groups more than 30 years, female gender, smokers, respectively, and the difference was statistically significant. No such difference in VAS leg and VAS back scores was noted in age, gender, addiction, BMI, and comorbidities category analysis (– **Table 4**).

MCID was achieved in a greater number of patients for ODI in patients with symptom duration less than 6 months and disc herniation at the level of L3 to L4 as compared with symptom duration more than 6 months and disc herniations at the levels of L4 to L5, L5 to S1, respectively, and the difference was statistically significant. No such difference in VAS leg and VAS back scores was noted in symptom duration, preoperative physiotherapy and epidural steroid injection, and level of disc herniation category analysis (– **Table 4**).

There were 22 (10.52%) peri- or postoperative complications as listed below. We have included this in – **Table 5**. There were nine cases of recurrent herniations at same site

and all were managed conservatively. Out of 9 cases of recurrent herniations, there were 4 smokers. 3 patients had superficial surgical site infections which were treated with short term antibiotics and dressing. Culture was sent but was negative for all. In regard with the immediate postoperative complications, 4 patients had fever, 3 had paralytic ileus and 1 required the need of ICU due to arrhythmia. We found no significant difference in complication rates among different groups except for the fact that smokers showed more recurrent disc herniations.

## Discussion

Herniation of lumbar intervertebral disc is not uncommon in usual population. In majority of the cases, it is treated effectively for symptomatic relief with the aid of nonsurgical treatment options. But significant number of patients have persistent symptoms despite giving prolonged nonsurgical conservative therapy. Such patients are ideal candidates for surgical intervention. Since past few years lumbar microdiscectomy is one for the commonly employed surgical treatment for such type of patients. However, there is no strong conclusive evidence about optimal timing to opt for surgical approach which may result in even better outcomes in patients with lumbar microdiscectomy.<sup>9</sup> There are handful of clinical studies that have analyzed the effect of certain preoperative parameters which might affect the timing of surgery as well as its optimal outcomes. Although this study was hospital record based retrospective study, we analyzed various preoperative parameters, which in might have an impact on outcomes of lumbar microdiscectomy. Especially such type of data through single study was not available after thorough literature search. These parameters might be especially focused during patient counselling to decide on optimal timing to opt for lumbar microdiscectomy. Since there is no consistency in outcomes evaluation scoring tools for lumbar microdiscectomy, we utilized patient oriented ODI, VAS leg, and VAS back scores and MCID to evaluate the outcomes.

Various factors might play a crucial role in outcomes after lumbar spinal surgeries in patient with lumbar disc herniation. Some of the parameters, which play a crucial role in outcomes after lumbar microdiscectomy surgeries in patients were more optimal ODI score, were age group 18 to 30 years, male gender, symptom duration less than 6 months, nonsmokers, and disc herniation at the level of L3 to L4, L4 to L5. These factors were found to be significantly associated with better ODI scores in a clinical study done by Shreshta et al.<sup>3</sup> In our study, the number of cases at L3 to L4 level were significantly less than L4 to L5 and L5 to S1. Hence, the fact that surgery at L3 to L4 level presented with better prognosis may be an incidental statistical find due to our higher sample size. Another possible explanation for this finding is the reduced spinal canal cross-sectional area in upper lumbar spine that is associated with an increased probability of symptomatic disc herniation and greater intensity symptoms that indirectly would lead to better postoperative ODI and VAS scores.<sup>10</sup>

**Table 2** Operative findings in the patients of this study

Sr. no.	Category	Subcategory	Baseline operative findings		
			Operation duration (minutes)	Average blood loss (mL)	Duration of postoperative hospitalization hours
1	Age	18–30 years	45.9 ± 10.59	37.1 ± 8.94	27.1 ± 8.34
		31–50 years	45.2 ± 10.25	41.6 ± 9.02	30.1 ± 8.97
		51–85 years	45.1 ± 11.72	40.3 ± 8.4	25.3 ± 9.02
2	Sex	Male	42.2 ± 10.45	41.0 ± 11.17	25.2 ± 8.24
		Female	46.8 ± 9.82	39.9 ± 10.41	30.9 ± 8.79
3	BMI	18–24.9	44.3 ± 9.26	37.4 ± 11.11	33.8 ± 9.05
		25–30	40.1 ± 10.15	36.3 ± 10.53	33.9 ± 9.17
		> 30	45.5 ± 9.33	36.5 ± 9.70	33.6 ± 7.61
4	Addiction	Smokers	41.5 ± 10.80	39.3 ± 9.33	31.9 ± 8.02
		Nonsmokers	44.7 ± 11.14	42.0 ± 11.06	34.1 ± 8.04
		Alcoholic	42.0 ± 12.1	37.4 ± 10.27	28.3 ± 8.98
		Nonalcoholic	42.9 ± 10.89	38.8 ± 11.02	32.2 ± 8.46
5	Comorbidity	OM	42.3 ± 9.83	40.1 ± 10.64	29.5 ± 7.45
		HTN	43.8 ± 11.52	39.0 ± 10.14	27.7 ± 8.64
		None	46.6 ± 10.55	38.2 ± 10.96	28.1 ± 7.89
6	Duration of symptoms	< 6 months	43.2 ± 11.03	40.1 ± 11.08	26.9 ± 7.56
		6–12 months	44.5 ± 10.11	36.9 ± 10.39	25.1 ± 7.24
		> 12 months	46.3 ± 11.49	36.7 ± 10.83	26.0 ± 7.65
7	Preoperative physiotherapy	Yes	45.7 ± 11.79	42.1 ± 9.96	25.3 ± 7.92
		No	43.9 ± 11.92	37.4 ± 9.12	33.2 ± 8.87
8	Epidural steroid injection	Yes	45.6 ± 11.97	37.2 ± 8.57	30.3 ± 9.04
		No	43.0 ± 9.93	37.1 ± 9.11	29.1 ± 8.87
9	Level of disc herniation	L3–L4	42.5 ± 9.76	40.2 ± 10.25	31.2 ± 7.81
		L4–L5	43.4 ± 11.56	36.7 ± 11.15	31.6 ± 9.08
		L5–S1	41.6 ± 11.23	41.2 ± 10.13	30.6 ± 8.85

Abbreviation: BMI, body mass index.

There are inconsistent evidences in literature regarding age as a prognosticator for lumbar microdiscectomy. In this study, it was found that age group 18 to 30 years was associated with better ODI score and more patients achieved MCID in ODI score, but no such trend was observed for VAS leg and VAS back score. Some studies found age as young age group as a factor associated with better ODI score.<sup>11,12</sup> However, Silverplats et al did not find age as predictor of better outcome in patients undergoing lumbar microdiscectomy.<sup>13</sup>

In this study, male gender was associated with better ODI score as compared with female sex. Some of the reasons cited for such finding in females are high threshold limit owing to high pain tolerance, which ultimately lead to deferral in consulting a doctor.<sup>3</sup> Some study findings corroborated with the findings of this study,<sup>14</sup> while few other studies have reported female gender to be associated with better outcome scores.<sup>15,16</sup>

In this study, we found that patients whose duration of symptoms was less than 6 months had a better ODI score as well as a greater number of patients achieved MCID for ODI score. Similar findings were reported by Basques et al<sup>17</sup> as well as Nygaard et al.<sup>18</sup> In a systematic review done by Schoenfeld and Bono, it was found that most suitable timing for opting lumbar discectomy is symptom duration of 6 months or less.<sup>19</sup> In a clinical study, the outcomes in patients undergoing lumbar discectomy found that patients having symptom duration of more than 10 months had worse ODI score at follow-up as compared with patients with shorter duration of symptoms.<sup>20</sup> These results indicate that early surgical treatment will improve the postoperative outcomes.

Smoking was associated with adverse ODI score as compared with nonsmokers; however, no such difference was noted on VAS leg and VAS back scores. Similar findings were seen in a study by Vogt et al, wherein smoking was

**Table 3** Changes in mean approximate ODI in age, sex, smoking, symptom duration, and level of disc herniation in this study

Category	Subcategory	Preoperative	Change in mean ODI score (~ ODI)		
			Immediate postoperative	6 months	12 months
Age	18–30 years	48.6 ± 18.1	27.2 ± 16.6	32.1 ± 15.1	37.4 ± 14.2
	31–50 years	49.1 ± 17.3	28.9 ± 18.2	31.2 ± 14.2	33.1 ± 14.4
	51–85 years	50.6 ± 19.1	19.5 ± 14.9	22.5 ± 14.6	27.3 ± 15.4
	p-Value	0.213	0.02	0.01	0.01
Sex	Male	49.9 ± 20.0	26.2 ± 13.9	34.8 ± 16.6	41.7 ± 13.9
	Female	50.1 ± 18.9	17.3 ± 14.2	27.1 ± 19.7	31.7 ± 14.6
	p-Value	0.324	0.01	0.04	0.01
Smoking	Yes	52.7 ± 4.6	20.1 ± 11.2	26.1 ± 14.5	30.8 ± 19.2
	No	53.2 ± 2.4	26.6 ± 15.2	35.1 ± 19.9	41.1 ± 21.1
	p-Value	0.235	0.01	0.02	0.001
Symptom duration	< 6 months	51.1 ± 19.9	25.5 ± 11.7	30.1 ± 14.7	34.6 ± 19.2
	6–12 months	52.4 ± 20.1	19.5 ± 12.1	24.3 ± 14.8	29.1 ± 15.2
	> 12 months	53.9 ± 18.8	18.8 ± 17.6	23.1 ± 12.7	26.8 ± 15.1
	p-Value	0.19	0.01	0.03	0.05
Level of disc herniation	L3–L4	53.2 ± 21.4	26.4 ± 14.5	30.2 ± 13.6	34.8 ± 15.4
	L4–L5	51.7 ± 21.2	29.5 ± 13.8	37.8 ± 14.4	39.1 ± 16.3
	L5–S1	52.2 ± 18.3	31.1 ± 12.2	39.3 ± 15.1	43.1 ± 17.4
	p-Value	0.299	0.05	0.05	0.05

Abbreviation: ODI, Oswestry Disability Index.

associated with adverse outcomes in patients with lumbar disc herniation who underwent lumbar discectomy.<sup>21</sup> However, Dewing et al did not find any association of smoking and adverse ODI score in their study. Several hypotheses have been put forward regarding adverse outcome of smoking in patients with lumbar disc diseases like accentuation of bone loss, disturbance of bone microarchitecture leading to instability at spine, and increased rate of intervertebral disc degeneration by affecting the metabolism in disc cells.<sup>21</sup> Alcoholism and BMI were not associated with adverse outcomes in this study. Similar findings were seen in a study done by Shi et al, who analyzed long-term outcomes in patients who underwent lumbar discectomy.<sup>22</sup>

In this study, no association of diabetes mellitus or hypertension with adverse outcome score was found. Similarly, Onyia and Menon et al had reported that comorbidities are not associated with adverse outcomes following lumbar discectomy.<sup>23</sup> Simpson et al reported that diabetes is associated with frequent postoperative infections and prolonged hospital stay.<sup>24</sup> In another study, it was found that the recurrence of lumbar disc herniations was more in diabetic patients as compared with nondiabetics.<sup>25</sup> It was reported in one study that hypertension was associated with adverse outcome following lumbar spinal surgery. The probable reason cited was compromised blood supply in disc area owing to atherosclerosis development secondary to hypertension.<sup>26</sup>

In this study, preoperative physiotherapy or epidural steroid injection was not found to be associated with

adverse postoperative outcome. Fekete et al evaluated the effect of preoperative epidural steroid injection and found that these are not associated with adverse outcome score.<sup>4</sup> However, there are studies that have reported adverse outcomes in patients who were given preoperative epidural injections.<sup>27–29</sup> In this study, disc herniation at the level of L3 to L4 was associated with better ODI score and a greater number of patients achieved MCD for ODI that was not correlating the findings that were reported by Shrestha et al.<sup>3</sup>

This study was not without limitations. Due to its retrospective design, the risk of bias cannot be negated. Psychosocial factors were not considered in this study that also might play a role in surgical outcome. Furthermore, such studies should be done at multiple centers so that findings of this study can be compared and assessed.

## Conclusion

Our study identifies that young age group, male gender, and nonsmoking were associated with better outcomes score. It is evident that outcomes are expected to be better if lumbar microdiscectomy is opted with symptom duration of less than 6 months. Setting realistic expectations with respect to patient factors in terms of functional outcome of this surgery is essential to ensure optimum postoperative recovery. The findings of this study will help to properly counsel the patient with regard to the factors mentioned above so as to set realistic expectations and also help to improve the outcomes.

**Table 4** Patients achieving minimum clinically important difference/MCID (%)

Variables	Subcategory	Scores		
		ODI	VAS leg	VAS back
Age	18–30 years	24 (83%)	23 (79%)	20 (70%)
	31–50 years	50 (64%)	53 (68%)	51 (66%)
	51–85 years	55 (54%)	62 (61%)	61 (60%)
	p-Value	0.001	0.213	0.327
Sex	Male	84 (84%)	78 (79%)	69 (69%)
	Female	70 (65%)	74 (69%)	66 (61%)
	p-Value	0.01	0.136	0.425
BMI	18–24.9	91 (81%)	89 (80%)	82 (73%)
	25–30	53 (74%)	51 (71%)	50 (71%)
	> 30	17 (70%)	16 (65%)	16 (65%)
	p-Value	0.361	0.336	0.445
Addiction	Smokers	28 (83%)	26 (77%)	24 (71%)
	Nonsmokers	115 (66%)	120 (69%)	108 (62%)
	p-Value	0.01	0.292	0.218
	Alcoholic	44 (79%)	43 (77%)	38 (68%)
	Nonalcoholic	108 (71%)	104 (68%)	90 (59%)
	p-Value	0.326	0.436	0.331
Duration of symptoms	< 6 months	85 (84%)	78 (77%)	68 (67%)
	6–12 months	54 (68%)	55 (69%)	48 (61%)
	> 12 months	16 (58%)	18 (66%)	16 (59%)
	p-Value	0.001	0.217	0.218
Level of disc herniation	L3–L4	26 (82%)	24 (74%)	13 (64%)
	L4–L5	69 (69%)	66 (68%)	57 (59%)
	L5–S1	47 (60%)	47 (61%)	44 (56%)
	p-Value	0.03	0.152	0.353

Abbreviations: BMI, body mass index; ODI, Oswestry Disability Index; VAS, visual analog scale.

**Table 5** List of complications

Complications	Number	Percentage
Dural injury	2	0.95
Recurrent herniation	9	4.30
Surgical site infection	3	1.43
Other	8	3.82
Total	22	10.52

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None.

**Conflicts of Interest**

None declared.

**Ethics Approval**

Approval was taken from institutional review board prior to the start of the study.

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