Research Article:

The Effects of Body Mass Index on Lumbar Microdiscectomy Outcomes

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ABSTRACT

Background and Aim: The incidence of obesity has steadily risen to epidemic proportions in numerous world regions. Surgeons often encounter problems in surgeries on obese patients. This study evaluated the effects of Body Mass Index (BMI) on the outcome of patients undergoing lumbar microdiscectomy.

Methods and Materials/Patients: This was primarily a case-series retrospective study of patients who underwent single-level lumbar microdiscectomy at our institution between January 2014 and April 2018. BMI was used to categorize our patients. Outcome measures were Oswestry Disability Index (ODI) and Visual Analogue Scale (VAS). The Patients were also analyzed according to the operative time, average blood loss during surgery, hematoma formation, wound infection, Cerebrospinal Fluid (CSF) leak, deep vein thrombosis, length of stay after surgery, recurrent disc herniation, and neurologic deficit. Analysis of Variance (ANOVA) and regression analysis methods was used to assess differences between the study variables.

Results: Five hundred patients (225 male & 275 female) with a Mean±SD age of 40.3±5.2 years (range: 19-70 y) who underwent single-level lumbar microdiscectomy were enrolled for the study. All patients were followed up for 24 months after surgery. The VAS and ODI were significantly improved in all patients. There was no significant difference between groups concerning the operative time, average blood loss during surgery, hematoma formation, wound infection, CSF leak, deep vein thrombosis, length of stay after surgery, recurrent disc herniation, and neurologic deficit.

Conclusion: The obtained findings indicated that BMI did not negatively impact the outcome of patients undergoing lumbar microdiscectomy.

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Highlights

- The incidence of obesity has risen steadily to epidemic proportions in many regions of the world
- Surgeons often encounter problems in surgeries on the obese patients.
- BMI does not have negative impact on outcome of patients undergoing lumbar microdiscectomy

Plain Language Summary

The incidence of obesity has been growing continuously, making it an epidemic across the world. Surgeons often encounter problems in surgeries on the obese patients. Our study aimed to evaluate the effect of body mass index on surgical results of five hundred patients who underwent lumbar microdiscectomy. Oswestry disabilty index and visual analogue scale were used for outcome assessment. Our study revealed that body mass index does not have negative impact on outcome of patients undergoing lumbar microdiscectomy.

1. Introduction

The incidence of obesity has steadily risen to epidemic proportions in numerous world regions [1, 2]. In the United States and other developed countries, morbid obesity has been particularly rapid in its increase. Among its numerous consequences, it has been associated with an increased incidence of spinal degenerative disc diseases [3]. Obesity may be related to disc degeneration of the lumbar spine [4]. In parallel with the increasing prevalence of obesity, patients' referral to spine surgeons is more likely to increase; thus, we need to know the answers regarding treatment cost and complication risk in this population [5]. Specific data related to these patients will be necessary to clarify both risks of surgical complications and overall hospital costs. Beyond healthcare costs, however, obesity seems to be related to higher surgical complications [6]. Two separate studies have shown that patients with elevated BMI have higher difficulties after spinal fusions [7, 8].

The results of previous studies on the link between obesity and spinal surgery outcomes are still debated. Our aim in this study was to evaluate the effect of BMI on the surgical outcomes of patients undergoing lumbar microdiscectomy.

2. Methods and Materials/Patients

A retrospective case-series study was conducted on patients who underwent single-level lumbar microdiscectomy at our institution between January 2014 and April 2018. Indications for surgery included severe or progressive neurological deficit and significant pain (Visual Analogue Scale equal to or greater than 4) [9] that is refractory to conservative management. Patients with: (1) recurrent herniation (2) comorbid disorders (diabetes mellitus, increased blood pressure, coronary artery disease) (3) malignant tumor (4) lumbar spine trauma (5) inherited anomalies (6) vertebral osteomyelitis (7) instability of the lumbar spine, were excluded from the study.

The senior spine surgeon performed all the surgical procedures using the standard surgical methods accepted by the neurosurgical community in general. We obtained ethical approval for our research from the Ethics Committee of Urmia University of medical sciences. Informed consent was obtained from all patients.

The steps of the procedure were conducted as follows: All patients were placed in the prone position (a) A 3-cm longitudinal skin incision was made, and tendinous insertions of paravertebral muscles were incised using subperiosteal dissection for access of the lamina; (b) The Caspar lumbar microdiscectomy retractor System was used to separate the edges of the incision; (c) radiographs obtained using C- arms to confirm the level of surgery (d) then, the operative microscope was used to visualize all tissues clearly; (e) small laminotomies were also performed and the ligamentum flavum was then removed (f) ipsilateral foraminotomy and medial facetectomy was performed for adequate decompression of exiting nerve root, the disc sequestrum or any loose disc fragments were removed; (h) epidural particulate steroids were not administered; (i) hemovac drains were placed in all cases; (j) wound closure was performed in a standard sequential manner.

BMI was measured as body weight (kg) divided by the square of the patient's height (m). The patients were considered underweight if BMI <18.50 kg/m^2 (group 1), normal weight (BMI 18.5-24.9 kg/m^2) (group 2), pre-obesity (25-29.9 kg/m^2) (group 3), obese (≥ 30 kg/m^2) (group 4) [10].

The primary study parameters were Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI) before and two years after surgery. The 10 CM visual analog scale was used for our study [11].

ODI scale was used for assessing the severity of back pain and functional impairment of patients [12]. It comprises 10 questions with 6 probable answers. Variables include pain, self-care, lifting, walking, sitting, standing, sleeping, sexual activity, social interaction, and traveling. Values range from 0 to 5. The total score is measured and introduced on a scale from 0 to 100 as follows: 0 to 20 indicates minimal impairment; 21 to 40 equals moderate impairment; 41 to 60 refers to severe impairment; 61 to 80 indicates debilitating back pain; 81 to 100 indicates that the patient is bedridden [13]. The patients were asked to complete ODI and VAS forms before surgery and on the final visit.

The patients' medical records were carefully reviewed to extract data relevant to our study, including operative time, average blood loss during surgery, hematoma formation, wound infection, CSF leak, deep vein thrombosis, and length of stay after surgery neurologic deficit.

The Analysis of Variance (ANOVA) was used to assess meaningful differences between non-continuous variables; however, the regression analysis evaluated differences in continuous variables. Moreover, $P<0.05$ was considered significant. SPSS performed data analysis.

3. Results

We evaluated 500 patients who were eligible to enter the study; 275 were women, and 225 were men with a mean±SD age of 40.3±5.2 years (range: 19-70 y). Demographic and descriptive characteristics of patients are presented in Table 1. Surgical outcome measures (VAS, ODI) significantly improved postoperatively in all patients (Table 2). Concerning surgery-related parameters, no significant difference was found between study groups (Table 3).

4. Discussion

Obesity is more prevalent in the United States, compared with other countries [14]. Several studies have demonstrated a higher complication rate and wound problems in obese patients than non-obese patients who underwent spine surgery [15]. Various types of local changes, such as tissue ischemia and decreased resistance to infection, are considered responsible for these complications [16]. Fat tissue vascular insufficiency and more enormous wound wall may be linked to these complications. Longer operative time increases the chance of wound problems in obese patients [17].

Carragee et al. suggested an association between increased BMI and recurrent disc herniation [18]. It is also revealed by Djurasovic et al. that Obesity also increases the risk of surgical site infection, blood loss, and position-

Table 1. Demographic data of study population

Demographic Features		Underweight (n=10)	Normal (n=168)	Pre-Obesity (n=281)	Obese (n=41)	P
Age (y) (Mean±SD)		36±11.7	46.3±16.6	48.6±17	41.2±15.9	0.442
Gender, N	Female	4	75	166	30	0.121
	Male	6	93	115	11	
Laminotomy approach, N	Unilateral (Right/Left) Bilateral	9 (5/4) 1	159 (86/73) 9	271 (141/130) 10	36 (19/17) 5	0.373
Surgical level, N	L5/S1	2	50	84	11	0.439
	L4/L5	5	98	169	25	
	L3/L4	1	10	20	3	
	L2/L3	1	6	7	1	
	L1/L2	1	4	1	1	

Table 2. Pre-and post-operative outcomes were reported of patients.

Groups	Leg Pain VAS				Back Pain VAS				ODI			
	Mean±SD		Z Score	P	Mean±SD		Z Score	P	Mean±SD		Z Score	P
	Pre-op	Last Visit			Pre-op	Last Visit			Pre-op	Last Visit		
Under-weight	7.9±1.6	2.3±1.5	8.07	0.0001	6.8±1.9	4.9±0.8	2.91	0.003	56.4±2.2	28.3±3.1	23.37	0.0001
Normal	8.1±2.1	2.9±1.6	25.5	0.0001	5.9±1.8	4.7±2.1	5.62	0.0001	68.1±4.3	18.3±2.6	118.3	0.0001
Pre-obesity	8.9±1.5	2.0±1.6	48.08	0.0001	6.4±3.0	5.3±4.1	3.62	0.0002	59.2±1.8	20.1±1.7	264.7	0.0001
Obese	9.1±0.4	2.8±1.7	23.09	0.0001	7.1±2.5	5.2±1.3	3.87	0.0001	60.3±2.5	24.3±2.2	69.21	0.0001

VAS: Visual Analogue Scale; ODI: Oswestry Disability Index.

associated nerve palsies [19]. Operative time and hospital stay were significantly longer in obese patients [20].

Other studies have found different findings. Quah et al. concluded that obesity was not a risk factor for recurrent disc herniation following lumbar microdiscectomy [21]. Andreshak et al. [22], obese and non-obese patients were not significantly different regarding surgical complications and outcome. In a study performed by Yadla and colleagues [23], BMI did not affect surgical complications.

As we could expect, minimally invasive spine surgeries have lower complication rates than the conventional type, and it could be an alternative for obese patients [24]. Endoscopic lumbar discectomy does not have more significant complications and recurrent disc herniations in obese than non-obese patients [25]. In a study performed by Barber et al. [26], tubular microdiscectomy and open microdiscectomy for lumbar disc herniations had similar outcomes. Ruan et al. [27] conducted a study to compare the outcome of percutaneous endoscopic lumbar discectomy and open lumbar microdiscectomy. Percutaneous endoscopic lumbar discectomy did not offer an advantage over open lumbar microdiscectomy regarding the clinical outcome.

We designed a retrospective case series study to determine in a real-world setting whether patients with different BMI had any difference in clinical outcome and surgery-related parameters following lumbar microscopic discectomy.

Table 3. Surgery-related parameters

Groups	Operative Time (min)	Blood Loss (ml)	Hema-toma	Wound Infection	CSF leak	DVT	Hospital Stay (Days)	Recurrent disc Her-niation	Neurologic Deficit
Under-weight	40-160 (mean: 106.8)	135-420 (mean:275.6)	1(10%)	1(10%)	2(20%)	2(20%)	2-11 (mean:5.8)	1(10%)	1(10%)
Normal	48-183 (mean:100.6)	95-540 (mean:332)	8(4.76%)	5(2.97%)	11(6.54%)	7(4.16%)	2-11 (mean:4)	13(7.7%)	9(2.97%)
Pre-obesity	56-167 (mean:121.3)	140-600 (mean:406)	13(4.62%)	9(3.20%)	16(5.6%)	13(4.62%)	3-14 (mean:8.2)	17(6.04%)	13(2.84%)
Obese	71-191 (mean:135.2)	200-700 (mean:399.2)	5(12.1%)	3(7.31%)	5(12.1%)	3(7.31%)	2-18 (mean:10.8)	3(7.31%)	3(4.85%)
Statistical results	P=0.720 β=0.05 95%CI: -0.244,0.344	P=0.585 β=0.04 95%CI: -0.347,0.427	P=0.204 95%CI: -0.454,13.9	P=0.372 95%CI: -1.25,10.2	P=0.158 95%CI: -2.02,19.2	P=0.136 95%CI: -2.16,19.2	P=0.262 β=0.03 95%CI: -0.214,0.417	P=0.882 95%CI: -2.5,19.50	P=0.792 95%CI: -1.34,14.34

CSF: Cerebrospinal Fluid; DVT: Deep venous thrombosis.

This study and former analytical research indicated dramatic improvement in pain, disability, and health quality in obese and non-obese patients. In another study over the elderly (older than 65 years), Gepstein et al. [25], lumbar decompression was equally effective in pain relief and disability in obese and nonobese patients.

In analytical research, Rihn et al. [28] concluded no correlation between obesity and outcome measures after lumbar spinal canal stenosis surgery. The meta-analysis findings performed by Jin Jiang et al. [29] revealed that increased BMI is associated with higher surgical complications. McGuire et al. [30] performed a subgroup analysis study found that infection rate and operative time were more significant in morbidly obese patients.

In the current study, no association was found between obesity and other surgical and health-related complications, including the operative time, mean blood loss during surgery, hematoma formation, wound infection, CSF leak, deep vein thrombosis, length of stay after surgery, recurrent disc herniation and neurologic deficit. A prospective study designed by Rosen et al. [31] showed that BMI did not influence the outcome measures, operative time, and hospital stay. Contrarily, Telfeian et al. [32] mentioned that outcome measures were dramatically related to BMI.

Comorbid disorders such as ischemic heart disease and diabetes mellitus are more prevalent in Obese patients undergoing spine surgery, i.e., independent predictors of surgical complications [33]. To investigate the effect of just BMI on the outcome, we excluded patients with comorbid disorders. Our reason to exclude those with comorbidities is that complications from underlying comorbidities may be incorrectly attributed to the BMI. Our results do not support the hypothesis that obesity is associated with worse outcomes after lumbar microdiscectomy [34, 35]. At the 24-month follow-up evaluation, the obese and nonobese patient population showed significant mean improvements in all outcome measures.

5. Conclusion

Even with the limitations mentioned above, we can conclude that the findings from this study showed that BMI does not adversely impact the outcome of patients undergoing lumbar microdiscectomy. This study has some limitations which have to be pointed out. The small patient population (especially in the underweight group) and the retrospective nature of the survey with its limitations including Inferior level of evidence in contrast to prospective studies, subject to confounding (other risk factors may be present, i.e., not measured), cannot assess causality, just correlation.

Ethical Considerations

Compliance with ethical guidelines

We obtained approval from the ethics committee of Urmia University of Medical Sciences, West Azarbaijan, Iran (Code: IR.UMSU.REC.1399.307). Written informed consent was obtained from all patients.

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Authors' contributions

All steps of the study were performed by Dr. Amir Abbas Ghasemi.

Conflict of interest

The author declared no conflict of interest.

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