MICROSURGICAL DISCECTOMY IN THE LIMBAR SPINE: EFFICIENCY, PAIN SYNDROME AND OBESITY

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Objective. To analyze the effectiveness and features of microsurgical discectomy of herniated intervertebral discs in patients with excessive body weight.
Material and Methods. A total of 104 patients (37 men and 67 women) aged 24—58 years with intervertebral disc hernias in the lumbar spine accompanied by compression of neural structures and radicular pain syndrome were operated on. The study group consisted of 48 obese patients who underwent microdiscectomy at the lumbar level. The control group included 56 non-obese patients operated in the same way. The level of the pain syndrome was assessed using the VAS and Oswestry's functional activity questionnaire.
Results. Preoperative pain intensity was slightly higher in patients with obesity than in those with normal body weight. Six weeks after the microdiscectomy, the radicular pain syndrome was arrested. The clinical effect of microdiscectomy persisted after 6 and 12 months. By the end of the follow-up period, some patients with excessive body weight had a tendency to have pain in the back and lower extremities. Also, patients with obesity had slightly greater intraoperative blood loss, the incidence of superficial infectious complications, the duration of the operation, and the length of hospital stay.
Conclusion. The overweight factor should be considered when planning anesthesia and microsurgical discectomy in the lumbar spine.
Key Words: lumbar pain, lumbar spine microsurgical discectomy, obesity, infectious complications, pain syndrome.

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Lumbar radiculopathy is a common problem that occurs at least once in a lifetime in 70—80 % of males and females [21]. Lumbar microdiscectomy is typically used to reduce pain and return the patient to normal life [5]. The situation is complicated in obese patients suffering from lumbar radiculopathy.

Obesity is determined using the body mass index (BMI). The person is considered obese when BMI is more than 30 kg/m^2. The average BMI values increased from 21.7 kg/m^2 (1975) to 24.2 kg/m^2 (2014) in males and from 22.1 kg/m^2 (1975) to 24.4 kg/m^2 (2014) in females. There were about 34 million obese males and 71 million obese females in 1975 and 266 million obese males and 375 million obese females in 2014. Furthermore, 58 million males and 126 million females have severe obesity [8, 15].

Obesity enhances the incidence of concomitant diseases, as well as and the risks accompanying anesthesia and operation during surgical treatment. Obese patients have higher anesthesia-related risk due to coronary artery disease, hypertension, diabetes, perioperative venous thrombosis, and thromboembolism of the pulmonary arteries. The time required for anesthesia is higher due to complications with intubation [18], insertion of venous catheters [14], more complicated transportation and positioning of the patient, more thorough examination and monitoring.

Surgery is also more complicated in obese patients: there are problems with adequate visualization, larger size of approach and operation depth; the instruments corresponding to these values are used. The incidence of surgical infections is higher by 33—50 % [4, 22]. When using minimally invasive discectomy [9] with an operating microscope (or endoscope) and tubular retractor (or tenaculum), clinical outcomes are quite favorable, especially compared to the conventional discectomy technique [6, 17].

Degenerative-dystrophic diseases in overweight patients are an urgent problem. The study on the problems of surgical treatment of degenerative-dystrophic diseases of the lumbar spine in overweight and obese patients have been previously published [1]. In this study, we continued to investigate the problem.

The study was aimed at analyzing the efficacy and features of microsurgical discectomy of herniated intervertebral discs in overweight patients. In particular, we tested the hypothesis based on our observations that obesity can be a significant factor associated not only with the incidence of perioperative complications, but also with the level of postoperative pain syndrome.

Material and Methods

In 2015—2016, 48 obese patients underwent microdiscectomy for herniated lumbar intervertebral discs accompanied by compression of neural structures and radicular pain syndrome. The control group included 56 non-obese patients, who were operated on in the same way for the same reason. A total of 104 patients were involved in the study (Table 1), including 37 males and 67 females aged 24—58 years (median, 45 years). The surgery was carried out by the same surgeon (the same team) under the same conditions (in the same operating room).

Indications for surgical treatment included pronounced radicular pain in the lower extremities in combination with nerve root compression with herniated lumbar disc as evidenced by MRI, as well as neurologic examination data demonstrating positive tension symptoms (both active and passive), motor and sensory disorders, hyporeflexia. The study included all patients admitted to the department who met the inclusion criteria. It should be note that all patients previously underwent conservative therapy, which turned out to be ineffective. After surgical treatment, the patients were followed and examined by the surgeon who carried out the operation. The level of postoperative pain syndrome was measured according to the time schedule consisting of three points: 6 weeks, 6 and 12 months.

VAS scale (from 0 to 10 points) and Oswestry Disability Index indirectly assessing the level of pain syndrome (the higher the patient's score, the more pronounced disturbance of vital activity) were used to assess the level of pain syndrome before and after microdiscectomy.

Two subgroups were distinguished within the study group, depending on the severity of obesity: group 1 with the BMI of 30—35 kg/m^2 (grade I obesity) and group 2 with the BMI of 35—40 kg/m^2 (grade II obesity).

Surgical technique. Endotracheal anesthesia was used during the operation. The patient was in prone position with his/her limbs flexed in the hip and knee joints. The appropriate level of operative intervention was controlled by X-ray with an electron-optical converter. Skin incision from 15 to 30 mm in length was performed along the median line with a margin of 1.5—2.0 cm from the line of spinous processes followed by soft tissues dissection up to the vertebral arches using raspatory. A retractor for minimally invasive operations was then used. Resection of the yellow ligament was controlled using an operative microscope. Next, the root and dural sac were separated and mobilized and free or sub-ligamentous fragments of the intervertebral disc (up to 15—20 mm into the depth of the intervertebral space from the posterior longitudinal ligament) were removed. Bipolar electrocoagulator and resorbable material were used for hemostasis. The wound was sutures in layers with inserted tubular drainage using resorbable suture material and covered with an aseptic bandage. All patients received intravenous antibacterial drugs.

Statistical analysis was used to assess the difference in the pain level in the study groups taking into account the features of scoring data processing [2, 3], using both parametric (paired Student's test) and nonparametric (Wilcoxon signed rank test) methods. Mean values were reported along with mean square error. The calculations were carried out using the statistical package SAS 9.4.

Results

Radicular pain. Here we report the dynamics of pain level before and after microdiscectomy in the lower extremities in the groups of patients with obesity and without obesity.

1. Preoperative level of pain in the lower extremities was on the average slightly higher in the group of overweight patients compared to that in the control group: VAS score was 6.9 ± 2.1 vs 6.5 ± 1.9 points.

2. Microdiscectomy resolved radicular compression pain in both groups of patients. Clinically and statistically significant ($p = 0.001$) decrease in the average level of pain in the lower extremities was observed 6 weeks after the operation, up to 1.6 ± 1.0 points in obese patients and up to 0.8 ± 0.3 points in patients without obesity. The differences are statistically significant in nonparametric analysis (Fig.).

3. The achieved clinical effect of microdiscectomy remained stable in both compared groups of patients 6 months after surgery. At the end of the follow-up period (12 months after microdiscectomy), there was a tendency towards the development and increase in the intensity of the pain syndrome in the lower extremities in the group of obese patients. There was radicular pain recurrence associated with recurrent herniation of intervertebral discs in two study group patients and one control group patient: 2/48 (in the group of obese patients) versus 1/56 (in the group of patients without obesity).

Low back pain. Here we report the dynamics of pain level before and

Table 1
Sex and age distribution of patients, n

Age, years	Study group (n = 48)		Control group (n = 56)	
	Males	Females	Males	Females
24 to 35	5	13	7	8
35 to 58	12	18	13	28

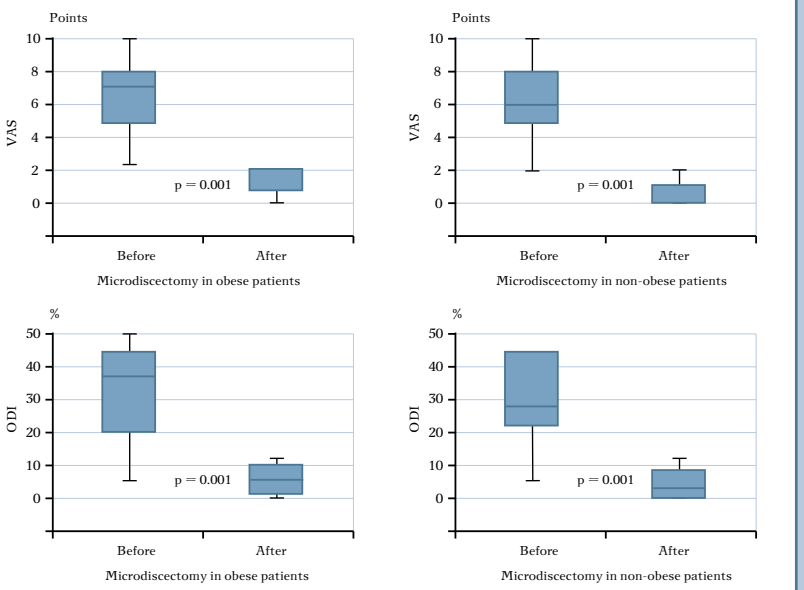

Fig.
Decrease in the level of radicular pain in the lower extremities as assessed by VAS score and the Oswestry Disability Index (ODI) 6 weeks after microdiscectomy

after microdiscectomy in the groups of patients with obesity and without obesity.

1. Preoperative intensity of low back pain was on the average slightly higher in the group of obese patients compared to that in the control group: 8.6 ± 2.3 versus 7.2 ± 2.0 points.

2. Microdiscectomy resulted in clinically and statistically significant (p = 0.001) decrease in the average level of low back pain 6 weeks after the surgery in both groups of patients: up to 1.7 ± 1.3 points in obese patients and up to 1.1 ± 0, 3 points in patients without obesity.

3. Taking into account preoperative level (normalization to the preoperative level), the average decrease in back pain was by 15.3 % lower in obese patients than in patients with normal body weight.

4. Clinical effect remained in general stable 6 months after microdiscectomy. At the end of the follow-up period (12 months after surgery), overweight patients (mostly grade II obesity) showed a tendency towards progression of pain syndrome (Table 2).

Functional impairment as assessed by Oswestry questionnaire. Here we report the dynamics of functional impairment in the groups of patients with and without obesity (Table 3).

1. Preoperative level of functional impairment was on the average by 13% higher in the group of obese patients compared to that in the control group: 66 % versus 53 %.

2. There was statistically significant (P = 0.001) improvement in the level of functional impairment measured 6 weeks after surgery due to pain relief as a result of microsurgical discectomy, on the average by 56 % in obese patients and by 49 % in non-obese patients.

3. Twelve months after microdiscectomy, obese patients (mostly grade II obesity) demonstrated decrease in functional activity by 7 %.

It should be noted that 2 obese patients received long-term (up to 4 months) analgesic therapy and another 2 patients received a combination of two drugs. Long-term administration of analgesics in the postoperative period was required only in one patient from the control group.

There were no significant sex or age related features in the dynamics of pain syndrome.

Discectomy-related complications. The total number of complications was higher in the group of overweight patients: 7 vs 2 (Table 4). Two obese patients required reoperation 2 months after the first discectomy in connection with relapse. One control group patient was reoperated in 6 months for the same reason. In both cases, clinical effect was achieved after reoperation. There were 3 episodes of dural injury in the obesity group and 1 episode in the control group. All situations were resolved by dura mater suturing. These complications did not manifest in the postoperative period. There were no cases of superficial infectious complications in patients with normal body weight and 2 cases in obese patients. Both patients suffered from severe obesity: BMI was 37.8 and 39.4 kg/m^2. Infectious processes were successfully stopped with antibacterial therapy.

Characteristics of the operation. Only the time of the surgical stage (disregarding the time of anesthesia) was included in the duration of the surgical intervention. The duration of surgery was on the average half an hour longer in the group of obese patients: 94 minutes versus 62 minutes in the group without obesity (p = 0.05). The level of intraoperative blood loss was also higher in the group of obese patients: 140 ml (80—270) vs 90 ml (50–220) in the group without obesity (p = 0.07).

The duration of hospital stay. More than a half of overweight patients stayed at the hospital for 4—5 days, 17 patients — 5—6 days. Patients with normal body weight (except for seven patients) stayed at the hospital for 3—4 days (the difference between the groups in the duration of hospital stay is statistically significant at the level of p = 0.07). Additional anesthesia was required in both groups.

Table 2
Dynamics of pain level as assessed by VAS score in the study and control group patients, points

Duration	Lower limbs			Lumbar spine		
	Study group		Control group	Study group		Control group
	Grade I obesity	Grade II obesity		Grade I obesity	Grade II obesity	
Before microdiscectomy	6.6	7.2	6.5	8.4	8.8	7.2
In 6 weeks	1.3	1.9	0.8	1.4	1.9	1.1
In 6 months	1.7	1.7	0.1	2.2	2.7	1.0
In 12 months	1.9	2.1	0.2	4.1	4.4	0.8

Discussion

According to the literature [10, 13] and conducted research, lumbar microdiscectomy is an effective method of treatment of radicular pain in the lower extremities associated with herniated discs. Andreshak et al. [4] found that microdiscectomy is equally effective in patients with normal body weight and obesity (in this study, various types of surgical manipulations on the spine were combined into one group and evaluated together). The results of our more differentiated study showed statistically and clinically significant efficacy of microdiscectomy in patients with excessive and normal body weight. However, we also found some features of the surgery and management of overweight patients, which is outlined in the Rihn et al. [20].

Preoperative level of pain was somewhat higher in obese patients both in the lower extremities and lower back (more pronounced). Microdiscectomy resulted in clinically and statistically significant radicular pain relief in all patients regardless of obesity factor (as assessed 6 weeks after surgery), and this result remained fairly stable in both groups in 6 months and a year. By the end of the follow-up period, some manifestations of pain syndrome were observed mostly in patients with grade II obesity. All patients demonstrated regression of neurological symptoms. Tension symptoms resolved or significantly decreased (at least to 60°). There was a positive dynamics in the motor and sensory function. Residual postoperative pain syndrome was mainly associated with reflex-algesic and muscular-tonic syndromes in the lower back and lower extremities. Local painful points (myofascial trigger points) were palpated in the muscles of the lower extremities and back. Residual effects were resolved or reduced to an acceptable level within 1—2 months.

The relative recurrence rate of herniated intervertebral discs within a year-long follow-up period after discectomy was twice higher in the group of obese patients compared to the group without obesity: 2/48 versus 1/56.

Obese patients complained of back muscle pain that was not directly related to herniated disc in preoperative and postoperative periods, and the same effect was observed in other studies [11].

The proportion of complications in patients with normal body weight observed in our study is consistent with the literature data [7, 12, 20, 23]. The incidence of dural injury ranges from 3 to 5 % in patients with normal body weight [17], and it is about 9 % in obese patients [6]. However, there is a study where these values do not differ [20]. In our study, this complication was detected in 3 (6 %) study group patients and in 1 (2 %) control group patient. In obese patients, dural injury may be associated with deeper surgical wound, which complicates visualization, and dense surrounding commissures. In should be noted that dural injury is a rare phenomenon and does not lead to long-term consequences.

According to available studies, the risk of developing infectious complications during spinal surgery in obese patients ranges from 33.0 [19, 22] to 100.0 %. [4, 19]. In our study, it was 4.2 % (there were no complications in the control group). The increased risk of developing infectious complications in obese patients is associated with impaired glucose tolerance (diabetes mellitus) and impaired blood supply due to vascular pathology. The latter circumstance led to immunodeficiency, disorders of wound healing and delivery of antibacterial drugs to the postoperative wound. According to the studies [16, 19], BMI above 35 kg/m2 is associated with increased risk of developing infectious complications. This was confirmed in both patients in our study: BMI was 39.4 and 37.8 kg/m2.

Blood loss during microdiscectomy was minimal in all patients (except for one). On the average, blood loss was

Table 3
Dynamics of functional impairment according to the Oswestry questionnaire in the study and control group patients, %

Duration	Study group		Control group
	Grade I obesity	Grade II obesity	
Before microdiscectomy	63	69	53
In 6 weeks	9	10	4
In 6 months	12	15	5
In 12 months	18	22	3

Table 4
Complications of microdiscectomy in patients with excessive body weight, n

Complication	Study group	Control group
Recurrence	2	1
Injury to dura mater	3	1
Infection	2	0
Plexopathy	9	0
Total	16	2

by 50 ml higher in the study group. Increased blood loss did not affect hemodynamics, but obscured visualization of the operating field, which contributed to prolongation of the operation and development of complications, such as dural injury. In one case, intraoperative blood loss was about 400 ml, which resulted in mild decrease in hemoglobin level, but did not necessitated blood transfusion.

Varicose vertebral venous plexuses were significantly more common (in 37 of 48 patients) in the group of obese patients. Injury to varicose vertebral venous plexuses complicated visualization of the wound and increased intraoperative blood loss and surgery time due to hemostatic measures.

Every second study group patient demonstrated degenerative changes in the facet joints accompanied by vertebral canal stenosis.

Postoperative positional plexopathies were detected in two study group patients and neuropathy of the lateral cutaneous femoral nerve were detected in seven study group patients; the cases of upper limb neuropathy were rare. These phenomena are apparently associated with pressure of excessive body weight on the operating table despite the same positioning in all patients.

The following factors associated with overweight increased the complexity and, therefore, the duration of surgery, which is confirmed by the literature data [12]: deep operating field increasing the duration of approach and necessitating the use of appropriate tools; the need for resection of altered facet joints causing spinal canal stenosis; blood loss from varicose veins impeding visualization, as well as navigation problems due to the smoothness of the anatomical structures.

Conclusion

Microsurgical discectomy is an effective method for elimination of radicular pain syndrome associated with herniated intervertebral discs that leads to normalization of activity regardless of patient's body weight.

By the end of a year-long follow-up period after discectomy, overweight patients demonstrated a tendency to development and increase in pain in the lower extremities and lower back.

Preoperative correction of body weight is advisable to reduce spine load; special attention should be payed to positioning of obese patients on the operating table, careful hemostasis during approach, adequate visualization of the wound and its tight suturing.

Spinal stabilization methods should be probably applied to improve clinical outcomes in overweight patients.

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