

UDC 616.33-089.87+616.89-008.441.13**[https://doi.org/10.32345/USMYJ.3\(157\).2025.17-24](https://doi.org/10.32345/USMYJ.3(157).2025.17-24)**

Received: April 08, 2025

Accepted: July 17, 2025

Characterization of anxiety level as a prognostic criterion for evaluating clinical outcomes of sleeve gastrectomy

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Abstract: studying the impact of the mental health component in patients with obesity on the clinical outcomes of metabolic bariatric intervention is a relevant task of modern medicine that requires further study. To characterize the anxiety level of patients in the long-term period after sleeve gastrectomy and its prognostic value for determining the clinical outcomes of metabolic bariatric intervention. We analyzed the clinical treatment outcomes of 93 patients with obesity who underwent sleeve gastrectomy for the period 2018-2022. The group included 69 (74.19%) women and 24 (25.81%) men. The average age of the subjects was 42.20 ± 11.09 years. The initial BMI of the subjects was $46.23 \pm 7.65 \text{ kg/m}^2$. Obesity staging was performed by calculating BMI (Quetelet, 1832). To characterize the clinical outcome of sleeve gastrectomy, we used the Swiss-Finnish BARIatric metabolic outcome score (SF-BARI Score) with an additional assessment of quality of life using the Moorehead-Ardelt QoL Questionnaire. For anxiety characterization, the GAD-7 (Generalized Anxiety Disorder) questionnaire was used. Differences were considered significant at $p < 0.05$. The total clinical result of sleeve gastrectomy corresponded to very good values – 129.77 ± 28.07 points. In 29 (31.18%) individuals, excellent clinical indicators were established, in 38 (40.86%) examined – very good, in 20 (21.51%) – good, in 6 (6.45%) – satisfactory (5 (5.38%) – poor + 1 (1.07%) – suboptimal). Analyzing the severity of anxiety disorder in the examined, the average total result according to the GAD-7 questionnaire was 6.29 ± 5.43 points and corresponded to a mild level of anxiety. In patients with a higher level of anxiety, established by the GAD-7 questionnaire, significantly worse clinical results of sleeve gastrectomy in the long-term postoperative period were proven, confirmed by the presence of a strong inverse correlation between the indicators ($\tau = -0.76$, $p < 0.00001$). The high prognostic value of patient anxiety indicators regarding the determination of clinical results of sleeve gastrectomy in the long-term period has been proven. In particular, the presence of a minimal level of anxiety in the examined is associated with significantly higher chances of forming excellent treatment results ($OR = 12.50$, $CI (3.36-46.51)$, $p = 0.000004$), while significantly higher chances of forming satisfactory results of sleeve gastrectomy were recorded in patients with a high level of anxiety ($OR = 140.00$, $CI (11.85-1654.42)$, $p = 0.000002$). Thus, the high clinical effectiveness of sleeve gastrectomy in treating patients with obesity and the high prognostic value of anxiety indicators for determining the clinical outcomes of metabolic bariatric intervention have been proven. An integral component of improving the effectiveness of treatment, we consider a comprehensive multidisciplinary approach that includes not only body weight control but also assessment of the psychoemotional state of patients after metabolic bariatric intervention.

Keywords: [Sleeve Gastrectomy](#); [Obesity](#); [Anxiety](#); [Metabolic Bariatric Surgery](#); [Postoperative Period](#); psychoemotional disorders.

Introduction

Obesity is a chronic, recurrent, multifactorial, neurobehavioral disease in which increased body fat contributes to adipose tissue dysfunction and abnormal physical force of adipose mass, leading to adverse metabolic, biomechanical, and psychosocial health consequences [1].

Obesity is a serious global healthcare problem. About 30% of the world's adult population has excess weight or obesity [2]. According to WHO data presented in the World Obesity Atlas (2022), the projected prevalence of obesity in 2030 will be one billion people, with a continuing trend of progressive growth [3]. The WHO European Regional Report on Obesity (2022) reports that excess weight and obesity affect nearly 60% of the adult population in the region, including 23% of individuals with obesity. In Ukraine, 17% of women and 15% of men are affected by obesity [1]. The growing proportion of patients with complex comorbid metabolic diseases in addition to the primary diagnosis leads to a significant increase in overall healthcare costs [4].

The leading approaches to obesity treatment include lifestyle modification, pharmacotherapy, and surgical techniques. Lifestyle modification and pharmacotherapy have limited treatment effects, especially in severe clinical cases [5]. Metabolic bariatric surgery (MBS) methods are considered most effective in cases of severe obesity and its complications, but questions about choosing the optimal intervention, procedure safety, and duration of clinical outcome maintenance remain debatable. Key factors in selecting the metabolic bariatric surgery method include physical characteristics such as body mass index (BMI), age, comorbidity burden, and others. The impact of the mental component on metabolic bariatric treatment outcomes is insufficiently studied, although restoring mental health is a critical factor in achieving a clinically significant effect of metabolic bariatric intervention that prevents disease recurrence in the long term [6-9].

Therefore, studying the impact of the mental health component in patients with obesity on the clinical outcomes of metabolic bariatric intervention is a relevant task of modern medicine that requires further study.

Aim

The aim to characterize the anxiety level of patients in the long-term period after sleeve gastrectomy and its prognostic value for determining the clinical outcomes of metabolic bariatric intervention.

Materials and methods

We analyzed the clinical treatment outcomes of 93 patients with obesity who underwent sleeve gastrectomy at the Department of Surgery, Anesthesiology, and Intensive Therapy of Postgraduate Education at Bogomolets National Medical University and the Surgical Department of Modern and Innovative Technologies of Kyiv City Clinical Hospital No. 1 for the period 2018-2022. The group included 69 (74.19%) women and 24 (25.81%) men. The average age of the subjects was 42.20 ± 11.09 years.

At initial presentation, the average BMI of the subjects was 46.23 ± 7.65 kg/m². Obesity staging was performed by calculating BMI (Quetelet, 1832).

To characterize the clinical outcome of sleeve gastrectomy, we used the Swiss-Finnish BARIatic metabolic outcome score (SF-BARI Score), which evaluates weight change, comorbidity, and surgical complications. Additionally, for quality of life assessment, we used the Moorehead-Ardelt QoL Questionnaire. The total result established by the SF-BARI QoL questionnaire can range from -130 to 230 points: higher questionnaire values are associated with better clinical treatment outcomes.

Anxiety symptoms were assessed using the GAD-7 (Generalized Anxiety Disorder) questionnaire, which includes 7 items, each of which can be rated in the range from 0 to 3 points. The total result of the questionnaire can vary in the range from 0 to 21 points. A total result of 0-4 points was evaluated as absence of anxiety, 5-9 points as moderate anxiety, 10-14 points as pronounced anxiety, and 15-21 points as severe anxiety.

The study was conducted in accordance with the principles and norms of the 7th revision of the Helsinki Declaration on Human Rights (2013), the Council of Europe Convention on Human Rights and Biomedicine, as well as the relevant laws of Ukraine.

Analysis of the obtained results was carried out using nonparametric statistical methods. Statistical processing of indicators was performed using the software package StatSoft Inc. STATISTICA 13. For quantitative indicators, arithmetic mean values (M) and standard deviations (SD) were calculated. Data are presented in the format $M \pm SD$. Differences in quantitative indicators in the formed groups were evaluated using the Kruskal-Wallis test. The relationship between the studied parameters was assessed using Kendall's rank correlation coefficient τ . The prognostic value of anxiety severity indicators for the clinical outcome of sleeve gastrectomy was determined based on the binary logistic regression model, calculating odds ratios (OR) and 95% confidence intervals (CI). Differences were considered statistically significant at $p < 0.05$.

Results

The average total clinical outcome of treatment in the study group in the long-term period after sleeve gastrectomy corresponded to very good values – 129.77 ± 28.07 points. Excellent clinical indicators were established in 29 (31.18%) individuals in the group, very good results were observed in the majority – 38 (40.86%) of the examined, good values were recorded in 20 (21.51%) patients, poor in 5 (5.38%), and in 1 (1.07%) examined the results were defined as suboptimal. Clinical data of patients with poor and suboptimal values, due to their low frequency, were combined into a group with satisfactory sleeve gastrectomy results, which included indicators of 6 (6.45%) examined. Thus, considering the total indicators of the clinical result of metabolic bariatric intervention, 4 clinical groups were formed among the examined.

The average treatment result according to the SF-BARI QoL questionnaire in patients with excellent indicators was 155.15 ± 6.74 points, in individuals with very good values – 135.24 ± 8.15 points, 103.65 ± 15.08 points in patients with good clinical indicators, 59.48 ± 16.32 points in those examined with satisfactory results of metabolic bariatric intervention. When comparing the total indicators in the formed groups, their statistically significant difference was proven ($p < 0.00001$).

The average BMI determined at initial presentation was 46.23 ± 7.65 kg/m² and corresponded to grade 3 obesity. Before treatment, the average BMI in patients with excellent results was 45.90 ± 7.57 kg/m², 44.69 ± 6.82 kg/m² in those examined with very good values, 47.71 ± 10.33 kg/m² in patients with satisfactory results of metabolic bariatric intervention, the highest values were recorded in individuals with good indicators – 49.20 ± 8.08 kg/m². When comparing the initial BMI values considering the long-term clinical result of metabolic bariatric intervention, a statistically significant difference was not proven ($p=0.11$), a significant correlation between the indicators is absent ($\tau=-0.03$, $p=0.66$).

Analyzing the indicators determined in the long-term period after sleeve gastrectomy, the average BMI was 28.90 ± 4.83 kg/m². The highest values of the indicator were observed in individuals with satisfactory and good treatment results – 32.98 ± 6.52 kg/m² and 32.84 ± 5.21 kg/m² respectively, which corresponded to grade 1 obesity. In patients with excellent results of metabolic bariatric intervention, the average BMI was 26.56 ± 3.73 kg/m², 27.96 ± 3.37 kg/m² in individuals with very good clinical indicators. The average values of patients with excellent and very good sleeve gastrectomy results indicated the absence of obesity, but the maintenance of excess body weight. When comparing the average BMI values considering the clinical result of metabolic bariatric intervention, a statistically significant difference in indicators was proven ($p < 0.00001$). In patients with lower BMI values, significantly better long-term clinical results of sleeve gastrectomy were proven, confirmed by the presence of a moderate inverse correlation between the studied features ($\tau=-0.36$, $p=0.0000004$).

The average total body weight change indicator in the examined was $37.09 \pm 6.80\%$. The highest values of the indicator were recorded in patients with excellent treatment results – $41.60 \pm 5.95\%$, $36.96 \pm 5.15\%$ in individuals with very good results, $32.79 \pm 6.87\%$ in those examined with good values, and $30.40 \pm 5.66\%$ in the presence of satisfactory indicators. When comparing the values of body weight change in

groups formed considering the clinical result of metabolic bariatric intervention, a statistically significant difference in indicators was proven ($p<0.00001$). The presence of higher values of body weight change in the long-term period after sleeve gastrectomy is associated with significantly better clinical treatment results, confirmed by a direct moderate correlation between the indicators ($\tau=+0.48$, $p=0.000000000009$).

The next stage evaluated the severity of anxiety disorder in the examined, considering the clinical results of sleeve gastrectomy. The average total result according to the GAD-7 questionnaire was 6.29 ± 5.43 points and corresponded to a mild level of anxiety. In those examined with excellent results of metabolic bariatric intervention, the average total result was 1.93 ± 2.59 points, in patients with very good values – 4.82 ± 2.47 points, 11.80 ± 2.84 points in individuals with good clinical indicators, the highest indicators were recorded in patients with satisfactory treatment results – 18.33 ± 2.58 points, the difference is statistically significant ($p<0.00001$) (Table 1).

In patients with a higher level of anxiety, established by the GAD-7 questionnaire, significantly worse clinical results of sleeve gastrectomy in the long-term postoperative period were proven, confirmed by the presence of a strong inverse correlation between the indicators ($\tau=-0.76$, $p<0.00001$) (Fig. 1).

In the majority of those examined – 51 (54.84%), a minimal level of anxiety was established. Questionnaire values of 0-4 points were recorded in the majority of patients with excellent and very good treatment results – 25 (86.20%) and 25 (65.79%) respectively,

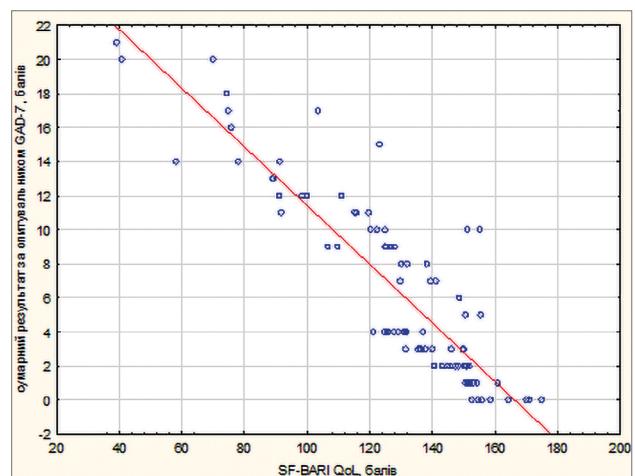


Fig. 1 Scatter diagram of total GAD-7 values considering the clinical result of sleeve gastrectomy

as well as in 1 (5.00%) patient with good clinical indicators, the difference is statistically significant ($p<0.00001$). In patients with a minimal level of anxiety, significantly better results of sleeve gastrectomy in the long-term postoperative period were proven ($\tau=+0.51$, $p=0.000000000005$).

A mild level of anxiety was observed in 16 (17.20%) patients in the group, particularly in 2 (6.90%) examined with excellent results, 12 (31.58%) patients with very good indicators, and 2 (10.00%) individuals with good values. When comparing the frequency of the studied indicator, a statistically significant difference was proven considering the clinical result of metabolic bariatric intervention ($p=0.02$), but a significant relationship between the features is absent ($\tau=-0.03$, $p=0.72$).

In 18 (19.36%) patients of the group, a moderate level of anxiety was established. Total values of 10-14 points were recorded in the vast

Table 1. Characterization of anxiety in the examined patients considering the clinical result of sleeve gastrectomy

GAD-7 Indicator	Clinical Results of Metabolic Bariatric Intervention				p
	excellent	very good	good	satisfactory	
M±SD	1.93 ± 2.59	4.82 ± 2.47	11.80 ± 2.84	18.33 ± 2.58	$<0.00001^*$
0-4 points	25 (86,20 %)	25 (65,79 %)	1 (5,00 %)	0 (0,00 %)	$<0.00001^*$
5-9 points	2 (6,90 %)	12 (31,58 %)	2 (10,00 %)	0 (0,00 %)	0,02*
10-14 points	2 (6,90 %)	1 (2,63 %)	14 (70,00 %)	1 (16,67 %)	$<0.00001^*$
15-21 points	0 (0,00 %)	0 (0,00 %)	3 (15,00 %)	5 (83,33 %)	$<0.00001^*$

*Note. Statistically significant difference of indicators proven at $p\le0.05$.

majority – 14 (70.00%) of those examined with good values, as well as 2 (6.90%) individuals with excellent indicators, 1 (2.63%) patient with very good results, and 1 (16.67%) patient with satisfactory clinical indicators, the difference is statistically significant ($p<0.00001$). In addition, in patients with a moderate level of anxiety, significantly worse clinical results of metabolic bariatric intervention in the long-term period were proven, confirmed by the presence of a moderate inverse correlation between the studied features ($\tau=-0.36$, $p=0.0000003$).

A high level of anxiety was recorded in 8 (8.60%) of those examined in the group. Questionnaire values of 15-21 points were established in the vast majority of patients with satisfactory treatment results – 5 (83.33%) and 3 (15.00%) patients with good values. In patients with excellent and very good sleeve gastrectomy results, a high level of anxiety was not recorded in any case. When comparing the studied frequency indicators considering the long-term treatment result, a statistically significant difference was proven ($p<0.00001$). In addition, it was proven that the presence of a high level of anxiety is significantly associated with worse clinical treatment results, confirmed by an inverse moderate correlation between the indicators ($\tau=-0.36$, $p=0.0000003$).

Analyzing the prognostic value of anxiety indicators in determining the clinical result of sleeve gastrectomy, we proved that the presence

of a minimal level of anxiety in the examined and accordingly GAD-9 questionnaire values of 0-4 points is associated with significantly higher chances of forming excellent treatment results in the long-term period ($OR=12.50$, $CI (3.36-46.51)$, $p=0.000004$) and a lower risk of developing good clinical indicators ($OR=0.02$, $CI (0.003-0.18)$, $p\leq0.00000001$) (Table 2). Higher chances of forming very good results of metabolic bariatric intervention were recorded in those examined with GAD-9 questionnaire values of 5-9 points and accordingly a mild level of anxiety ($OR=5.88$, $CI (1.70-20.39)$ $p=0.002$). The presence of a moderate level of anxiety and accordingly GAD-9 questionnaire indicators of 10-14 points is associated with significantly lower chances of forming excellent ($OR=0.10$, $CI (0.01-0.85)$, $p=0.005$) and very good ($OR=0.06$, $CI (0.007-0.49)$, $p=0.0002$) results of metabolic bariatric intervention and a higher risk of developing good clinical indicators in the long-term period after sleeve gastrectomy ($OR=57.50$, $CI (12.65-261.45)$ $p\leq0.00000001$). Significantly higher chances of forming satisfactory results of sleeve gastrectomy were recorded in patients with a high level of anxiety and accordingly in the presence of total GAD-9 questionnaire values in the range of 15-21 points ($OR=140.00$, $CI (11.85-1654.42)$, $p=0.000002$).

Discussion

The results of the conducted study indicate the high effectiveness of the sleeve gastrectomy

Table 2. Prognostic value of anxiety severity in determining the clinical result of sleeve gastrectomy

GAD-7 Value	Clinical Results of Metabolic Bariatric Intervention			
	excellent	very good	good	satisfactory
0-4 points	OR=12,50 CI (3,36-46,51) $p=0,000004$	$p=0,08$	OR=0,02 CI (0,003-0,18) $p\leq0,00000001$	$p=0,002$
5-9 points	$p=0,07$	OR=5,88 CI (1,70-20,39) $p=0,002$	$p=0,26$	$p=0,13$
10-14 points	OR=0,10 CI (0,01-0,85) $p=0,00$	OR=0,06 CI (0,007-0,49) $p=0,0002$	OR=57,50 CI (12,65-261,45) $p\leq0,00000001$	$p=0,86$
15-21 points	$p=0,01$	$p=0,003$	$p=0,32$	OR=140,00 CI (11,85-1654,42) $p=0,000002$

method in treating patients with obesity. It was found that higher values of body weight change are significantly associated with better treatment outcomes ($\tau=+0.48$, $p=0.000000000009$). The obtained data indicate that weight change is an important predictor of the success of sleeve gastrectomy. It is worth noting that the initial BMI level is not a reliable predictor of clinical outcome ($\tau=-0.03$, $p=0.66$), whereas BMI determined in the long-term postoperative period has a significant impact on the effectiveness of treatment ($\tau=-0.36$, $p=0.0000004$).

An equally important prognostic criterion for determining the clinical outcome of metabolic bariatric intervention is the state of mental health, particularly the level of anxiety in patients. Anxiety is a common comorbid condition in patients who have undergone metabolic bariatric interventions, which is confirmed by the results of numerous studies (Alqifari et al (2024), Suliman et al (2024), Paczkowska et al (2022)).

According to our data, the majority of those examined – 54.84% had a minimal level of anxiety, 17.20% – mild, 19.36% – moderate, in 8.60% of patients the level of anxiety disorder was assessed as high.

Similar results are presented in the studies by [6-8]. In the work of Alshammari et al. (2022), researchers analyzed the anxiety level of 367 patients who underwent metabolic bariatric interventions. The researchers found that the average anxiety indicator in patients after metabolic bariatric surgery was 5.05 ± 5.34 points, which indicated a low level of anxiety in the patients) [7]. The average total result established by us according to the GAD-7 questionnaire also corresponded to a mild level of anxiety and was 6.29 ± 5.43 points. According to [7], most patients had a low level of anxiety, 20.7% – mild, 11.2% – moderate, 8.7% – high, which is comparable with our indicators [6]. Similar values were established in the study by [6], who recorded a minimal level of anxiety in 67.6% of participants, in 20.9% – a mild degree of anxiety disorder, in 6.6% – moderate, in 4.9% of cases severe forms of the disease were observed [6].

According to our results, patients with a higher level of anxiety had worse clinical indicators of sleeve gastrectomy, confirmed

by a strong inverse correlation ($\tau=-0.76$, $p<0.00001$). In particular, in patients with a minimal level of anxiety, excellent results of metabolic bariatric intervention were more often recorded (OR=12.50, CI (3.36-46.51), $p=0.000004$), while a high level of anxiety was associated with a significantly higher risk of forming satisfactory clinical indicators (OR=140.00, CI (11.85-1654.42), $p=0.000002$). The results of our study confirm previous scientific conclusions about the significant role of psychological support and postoperative monitoring of the mental health component of patients after metabolic bariatric intervention. Routine psychological assessment before and after surgery is recommended for preventing the development of potential complications and improving treatment results [10-13]. An integral component of improving the effectiveness of treatment, we consider a comprehensive multidisciplinary approach that includes not only body weight control but also assessment of the psychoemotional state of patients after metabolic bariatric intervention.

Conclusions

Thus, the high clinical effectiveness of sleeve gastrectomy in treating patients with obesity has been proven.

In order to achieve excellent clinical results of sleeve gastrectomy, we recommend paying special attention to the early diagnosis of psychoemotional disorders, particularly anxiety, since in patients with a higher level of anxiety, significantly worse clinical results of metabolic bariatric intervention in the long-term postoperative period have been proven ($\tau=-0.76$, $p<0.00001$).

The high prognostic value of patient anxiety indicators regarding the determination of clinical results of sleeve gastrectomy in the long-term period has been proven. In particular, the presence of a minimal level of anxiety in the examined is associated with significantly higher chances of forming excellent treatment results (OR=12.50, CI (3.36-46.51), $p=0.000004$), while significantly higher chances of forming satisfactory results of sleeve gastrectomy were recorded in patients with a high level of anxiety (OR=140.00, CI (11.85-1654.42), $p=0.000002$).

Funding

This study did not receive funding.

Conflict of interests

None of the authors received research grants, speaker's fees from any companies and is not a member of commissions.

Consent to publication

Consent to publication All authors have read and approved the final version of the

manuscript. All authors have agreed to publish this manuscript.

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A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval of article.

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Характеристика рівня тривожності як прогностичного критерія оцінки клінічних результатів рукавної резекції шлунка

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Анотація: дослідження впливу стану ментального компоненту здоров'я у пацієнтів з ожирінням на клінічні результати баріатричного втручання є актуальним завданням сучасної медицини, яке потребує подальшого вивчення. Мета охарактеризувати рівень тривожності пацієнтів у віддаленому періоді після рукавної резекції шлунка та його прогностичну цінність щодо визначення клінічних результатів баріатричного втручання. Проведено аналіз клінічних результатів лікування 93 пацієнтів з ожирінням, яку було виконано рукавною резекцією шлунка за період 2018-2022 років. До групи включено 69 (74,19 %) жінок та 24 (25,81 %) чоловіків. Середній вік обстежених складав $42,20 \pm 11,09$ років. Первинний IMT обстежених складав $46,23 \pm 7,65$ кг/м². Стадіювання ожиріння виконували шляхом розрахунку IMT (Quetelet, 1832). Для характеристики клінічного результату рукавної резекції шлунка використовували шкалу Swiss-Finnish BARIatric metabolic outcome score (SF-BARI Score) з додатковою оцінкою якості життя за опитувальником Moorehead-Ardelt QoL Questionnaire. Для характеристики тривоги використовували опитувальник GAD-7 (Generalized Anxiety Disorder). Значущими вважали відмінності встановлені при $p < 0,05$. Сумарний клінічний результат рукавної резекції шлунка відповідав дуже хорошим значенням – $129,77 \pm 28,07$ балів. У 29 (31,18 %) осіб встановлено відмінні клінічні показники, у 38 (40,86 %) обстежених – дуже хороши, у 20 (21,51 %) – хороши, у 6 (6,45 %) – задовільні (5 (5,38 %) – погані + 1 (1,07 %) – субоптимальні). Аналізуючи вираженість тривожного розладу у обстежених середній сумарний результат за опитувальником GAD-7 складав $6,29 \pm 5,43$ балів та відповідав слабкому рівню тривожності. У пацієнтів з вищим рівнем тривожності, встановленим за опитувальником GAD-7, доведено достовірно гірші клінічні результати рукавної резекції шлунка у віддаленому післяопераційному періоді, що підтверджено наявністю зворотного сильного кореляційного зв'язку між показниками ($t = -0,76$, $p < 0,00001$). Доведено високу прогностичну цінність показників тривожності пацієнтів щодо визначення клінічних результатів рукавної резекції шлунка у віддаленому періоді. Зокрема наявність мінімального рівня тривоги у обстежених асоційована з достовірно вищими шансами формування відмінних результатів лікування ($OR = 12,50$, $CI (3,36-46,51)$, $p = 0,000004$), натомість значущо вищі шанси формування задовільних результатів рукавної резекції шлунка зафіксовано у пацієнтів з високим рівнем тривожності ($OR = 140,00$, $CI (11,85-1654,42)$, $p = 0,000002$). Таким чином, доведено високу клінічну ефективність рукавної резекції шлунка в лікуванні пацієнтів з ожирінням та високу прогностичну цінність показників тривожності щодо визначення клінічних результатів баріатричного втручання. Невід'ємною складовою підвищення ефективності лікування вважаємо комплексний мультидисциплінарний підхід який включає не лише контроль маси тіла, а й оцінку психоемоційного стану хворих після баріатричного втручання.

Ключові слова: рукавна резекція шлунка, ожиріння, психоемоційні порушення, тривога, баріатрична хірургія.



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