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Standard and Modified Laparoscopic Sleeve Gastrectomy Techniques' Efficacy Influencing Factors in Patients with Primary BMI>40kg/m²

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Introduction

Morbid obesity is a serious health condition that requires understanding and proactive management. Seeking guidance from healthcare professionals is essential for developing an individualized plan that addresses both physical and emotional health needs. By taking early action, individuals can improve their quality of life and reduce the risks associated with morbid obesity. The effectiveness of surgery is determined not only by weight loss indicators, but also by obesity associated diseases' dynamics, the patients' life quality and is correlated with the type of surgery, the technique of performance and postoperative management strategy. There are a lot of specific factors, potentially impacting the QOL of the patients after bariatric surgery and affecting postoperative comorbidity. All mentioned above causes complex assessment of the bariatric outcomes' efficacy influencing factors [1, 2, 6, 7].

Aim of the study. The aim of this retrospective case control study was to evaluate the standard and modified LSG techniques' efficacy influencing factors in patients with BMI>40.

Material and Methods

Participants and study design

This retrospective case control, descriptive study was carried out between August 2015 and March 2024 in a sample of 20+ years old bariatric patients of “Shengavit” Medical Center. Patient selection criteria were as follows: performed Standard or Modified LSG, age >20 and identified BMI>40. The exclusion criteria of the study were as follows: active Helicobacter pylori infection, non-scared gastric ulcer, previous gastric resection or fundoplication, drug or alcohol abuse and mental health disorders, age <20 and BMI<40. Operations were performed by the same surgical team via laparoscopy.

A total of 497 cases of patients, admitted to the surgical department of the “Shengavit” Medical Center for bariatric surgery within the mentioned period, corresponding to the inclusion criteria, were included in the study. The selected participants were divided into 2 groups in accordance with the type of LSG performed. The first group (n = 246) were the patients managed with the Standard protocol of LSG and the second group (n = 251) included the patients treated with the modified protocol of the LSG.

Clinical research methods

BMI was calculated in accordance with the standard formula [5].

The laboratory investigations were performed in the Laboratory of the “Shengavit” Medical Center to diagnose the comorbid pathologies.

Bariatric Surgery Efficiency was assessed using a scale proposed by the author, which included indicators of weight reduction, comorbidity, quality of life, as well as the presence of immediate and remote postoperative complications, assessed at 2 years after the procedure (table).

Table

Integrated System for Assessing the Bariatric Surgery Effectiveness

Indicator	1 point	2 points	3 points
Weight reduction	<10%	10–19.9%	≥20%
Comorbidity improvement	<10%	10–19.9%	≥20%
Quality of life (according to SF-36 scale)	<10%	10–19.9%	≥20%
Number of early and late postoperative complications	>2	1	0
BAROS	Improvement <10%	Improvement 10–19.9%	Improvement ≥20%
GIQLI	Improvement <10%	Improvement 10–19.9%	Improvement ≥20%

Interpretation of results

1–6 points: Unsatisfactory, **7–12 points:** Moderate, **13–18 points:** Good to Excellent.

The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki as reflected in the approval by human research committee. The protocol was approved by the Ethics Committee of Yerevan State Medical University after M.Heratsi. All participants gave written informed consent to participate in the trial and to use their data.

Results and Discussion

Relationship between bariatric surgery outcome and social-demographic characteristics.

Group I:

The comparison of social-demographic characteristics and the distributive data of bariatric surgery outcomes in this group led to the rejection of the null hypothesis with a very high probability. The analysis provided robust evidence of a significant dependency between bariatric surgery outcomes and various socio-demographic categories, including age (Df=4, $\chi^2=0.003$, $p=0.015$), gender (Df=2, $\chi^2=13.597$, $p=0.001$), and educational level (Df=4, $\chi^2 = 9.970$, $p\text{-value} = 0.041$). Additionally, strong associations were found with smoking habits (Df=2, $\chi^2=18.693$, $p=0.00009$), marital status (Df=2, $\chi^2=10.069$, $p=0.007$), and income (Df=6, $\chi^2=18.213$, $p=0.001$), indicating their significant impact on the efficacy of bariatric surgery. The results also revealed a dominant dependence of poor bariatric outcomes among and smoking patients (49 respondents versus the expected 37). As anticipated, no significant associations were observed between bariatric surgery outcomes and categories such as residence area (Df=2, $\chi^2=0.013$, $p=0.994$), presence of children in the family (Df=2, $\chi^2=0.009$, $p=0.995$), and insurance or employment status (Df=2, $\chi^2=0.027$, $p=0.987$; Df=2, $\chi^2=0.005$, $p=0.997$ respectively).

Group II:

In the second group, the analysis of the relationship between social-demographic characteristics and bariatric surgery outcomes again revealed a significant association with gender (Df=2, $\chi^2=10.691$, $p=0.005$), educational level (Df=4, $\chi^2=12.950$, $p=0.012$), and smoking habits (Df=2, $\chi^2=15.280$, $p=0.0005$). Notably, a strong association was found between smoking and poor surgical outcomes (34 respondents versus the expected 22).

Similarly to Group I, there was no significant association found between bariatric surgery outcomes and residence area (Df=2, $\chi^2=0.0024$, $p=0.999$), presence of children in the family (Df=2, $\chi^2=0.0016$, $p=0.999$), insurance (Df=2, $\chi^2=0.012$, $p=0.994$), or employment status (Df=2, $\chi^2=0.003$, $p=0.998$). In contrast to Group I, no significant dependence was observed between age Df=4, $\chi^2=0.003$,

p=0,10), marital status (Df=2, $\chi^2=0.003$, p=0.999) and educational level (Df=4, $\chi^2=0.168$, p=0.997) and income (Df=6, $\chi^2=0.55$, p=0.999) with surgery outcomes.

The obtained data also allowed us to conclude about the dominant association of smoking habit with poor outcome of bariatric association (49 vs the expected 37).

Relationship between bariatric surgery outcome and clinical characteristics.

Comparison of clinical characteristics of participants (BMI, history of any operative intervention, etc.) and distributive data of bariatric surgery outcomes in first group rejected the null hypothesis with a very high probability.

Group I: The comparative analysis demonstrated strong evidence of dependence between data categories concerning baseline BMI with the bariatric surgery outcomes (DF = 2, $X^2 = 9.611$, p = 0.008 for BMI). Another strong relationship was discovered in data categories regarding the presence of T2DM, dyslipidemia, stressful lifestyle and motivation degree with the efficacy of bariatric surgery (DF = 2, $X^2 = 8.904$, p = 0.012 for T2DM and DF = 2, $X^2 = 6.963$, p = 0.031 for dyslipidemia, DF = 2, $X^2 = 10.554$, p-value = 0.0005 for stressful life and DF = 2, $X^2 = 10.49$, p = 0.005 for motivation degree). No evidence of association between the history of another operation, family history of morbid obesity, health status (by self-estimation), and the presence of hypertension with the bariatric surgery outcomes (DF = 2, $X^2 = 0.038$, p = 0.981 for history of another operation, DF = 2, $X^2 = 0.002$, p = 0.999 for family history of morbid obesity, DF = 4, $X^2 = 0.0056$, p = 0.100 - for health status, DF = 2, $X^2 = 0.005$, p = 0.998 for hypertension). The data obtained also allowed us to conclude that poor outcomes were predominantly associated with frequent stressful situations (64 vs. the expected 54), as well as with the presence of dyslipidemia (80 vs. the expected 72).

Group II: The comparative analysis demonstrated strong evidence of dependence between data categories concerning T2DM with the bariatric surgery outcomes (DF = 2, $X^2 = 7.115$, p = 0.029). The presence of stressful lifestyle, and motivation with the efficacy of bariatric surgery (DF = 2, $X^2 = 36.349$, p <.001 for stressful life and DF = 2, $X^2 = 24.25$, p <.001 for motivation degree). No evidence of association was found between the history of another operation, family history of morbid obesity, health status (by self-estimation), and the presence of hypertension with bariatric surgery outcomes ($X^2 = 0.100$, DF = 2, p = 0.995 for history of another operation, $X^2 = 0.005$, DF = 2, p = 0.998 for family history of morbid obesity, $X^2 = 0.024$, DF = 2, p = 0.988 for hypertension). Contrary to Group I, no strong dependence was revealed between BMI (DF = 4, $\chi^2 = 0.022$, P-value = .989) and dyslipidemia (DF = 2, $X^2 = 4.220$, p = 0.121) and surgery outcome. The obtained data also allowed us to conclude about the dominant association between lack of motivation and positiveness (36 vs. the expected 21) with poor bariatric surgery outcomes as well as between stressful life (48 vs. the expected 30) with poor bariatric surgery outcomes.

Bariatric surgery is currently considered as the most efficacious intervention for weight reduction and the decrease of related comorbidities, demonstrating sustained long-term effectiveness. However, addressing the complications and adverse outcomes associated with bariatric surgery presents a significant challenge, as the diseases resulting from obesity and the surgery itself are both etiopathogenetically and clinically intertwined. Despite advancements in modern medical technologies that have contributed to a reduction in the incidence of these complications, a comprehensive and well-defined strategy for managing them remains elusive. Furthermore, aspects concerning the quality of life post-surgery are still inadequately explored and require further investigation. This study was undertaken with the aim to evaluate the influencing factors and complex efficacy of primary LSG performed with standard and modified LSG techniques in patients with BMI >40 according to the Bariatric Surgery complex efficacy grading system.

A Bariatric surgery complex efficacy grading system was developed and patients who had BMI >40kg/m² and applied to our Medical Center for operative treatment were assessed 2 year after operation. The system consisted of six parts. Every grade was to verify dynamic changes of indicators of weight reduction, comorbidity, quality of life, immediate and long-term postoperative complications. The summary result is graded into 3 efficacy grades: poor, intermediate and good to excellent.

The data obtained allowed us to conclude that strong association was found in both groups between smoking and poor surgical outcomes (49 vs the expected 37 for 1st group and 34 respondents versus the expected 22 for 2nd group).

The poor outcomes in patients of 1st group were predominantly associated with frequent stressful situations (64 vs. the expected 54), as well as with presence of dyslipidemia (80 vs. the expected 72). For group II the dominant association was revealed between lack of motivation and positiveness (36 vs. the expected 21) with poor bariatric surgery outcomes as well as between stressful life (48 vs. the expected 30) with poor bariatric surgery outcomes.

Our results are complying with the conclusions of systematic review, highlighting the significance of understanding these challenges and the requirement for a multidisciplinary strategy to be used in the care of these patients [7].

In spite of the fact that the implementation of laparoscopic sleeve gastrectomy (LSG) does not definitely result in the anticipated clinical outcomes. The efficacy of this surgical intervention should not be assessed only by weight reduction, but also by its impact on comorbid pathologies, indicators of quality of life (QoL). It is influenced by multiple factors such as the surgical approach, procedural technique, and postoperative care strategies. Moreover, specific postoperative complications can significantly diminish QoL and contribute to an increased burden of comorbidity. It is important to notice, that surgical techniques, providing significant weight loss do not always enhance QoL adequately, often due to a spectrum of adverse postoperative events [7]. The inconsistency in the reporting of bariatric surgery-related complications, can result in overestimation of

these procedures' safety profile [3, 4]. These challenges underscore the necessity for innovative methodologies in the structuring of postoperative care and monitoring protocols following LSG, with the goal of optimizing both clinical and patient-oriented surgery outcomes.

Conclusion

The study demonstrated that the overwhelming majority of the patients operated with standard technique demonstrated intermediate results of the LSG outcomes. Analysis of the influencing factors in these patients has demonstrated strong evidence of dependence between social-demographic data categories concerning age, gender, educational level, smoking habit, marital status and income with the efficacy of bariatric surgery. The poor bariatric outcome was dominantly revealed in the female and smoking patients. There was no enough association in categories of residence area, presence of children in family, insurance and employment statuses with bariatric surgery outcome.

Most of patients operated with modified LSG technique demonstrated "good to excellent" results of the LSG outcomes. The level of LSG efficacy was strongly associated with clinical data categories of baseline BMI level, presence of T2DM, dyslipidemia, stressful lifestyle and motivation degree in first group, while the modified LSG efficacy was associated only with presence of T2DM, stressful lifestyle and motivation degree.

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Факторы, влияющие на эффективность стандартной и модифицированной продольной резекции желудка у пациентов с исходным ИМТ > 40 кг/м²

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Многочисленные специфические факторы могут влиять на состояние здоровья пациентов после бариатрического вмешательства и способствовать развитию послеоперационных сопутствующих заболеваний. Эти соображения требуют всесторонней и многофакторной оценки факторов, влияющих на общую эффективность бариатрических операций.

Целью данного ретроспективного исследования «случай-контроль» было оценить факторы влияния и комплексную эффективность первичной лапароскопической продольной резекции желудка (ПРЖ), выполненной по стандартной и модифицированной методикам, у пациентов с ИМТ > 40 кг/м².

Пациенты (497) были разделены на 2 группы в соответствии с типом выполненной лапароскопической рукавной гастрэктомии. Первая группа (n = 246) состояла из пациентов, лечившихся по стандартному протоколу ПРЖ, а вторая группа (n = 251) включала пациентов, лечившихся по модифи-

цированному протоколу ПРЖ. ИМТ был рассчитан и сравнен в группах. Для всех факторов, потенциально влияющих на результаты ПРЖ в обеих группах, были рассчитаны критерий χ^2 , p и 95% доверительный интервал.

Исследование показало, что подавляющее большинство пациентов, оперированных по стандартной методике, продемонстрировали промежуточные результаты по сравнению с исходами ПРЖ. Анализ факторов, влияющих на этих пациентов, выявил убедительные доказательства зависимости между социально-демографическими категориями данных, касающихся возраста, пола, уровня образования, привычки курения, семейного положения и дохода, и эффективностью бариатрической операции. Относительно плохие результаты бариатрической операции были преимущественно выявлены у женщин и курящих пациентов. Не было выявлено достаточной связи между категориями места жительства, наличием детей в семье, наличием страхования и занятости с результатами бариатрической операции. У большинства пациентов, прооперированных с использованием модифицированной методики ПРЖ, были отмечены «хорошие» или «отличные» результаты. В первой группе эффективность ПРЖ была тесно связана с клиническими показателями, такими как исходный уровень ИМТ, наличие сахарного диабета 2 типа, дислипидемия, стрессовый образ жизни и уровень мотивации, тогда как эффективность модифицированной ПРЖ была связана только с наличием сахарного диабета 2 типа, стрессовым образом жизни и уровнем мотивации.

Ստամբուլի երկայնակի մասնահատման ստանդարտ և մոդիֆիկացված եղանակների արդյունավետության վրա ազդող գործոնները ՄՁՑ>40 կգ/մ² հիվանդների շրջանում

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Մեծաքանակ հետազոտությունները փաստել են, որ առկա են բարիատրիկ վիրահատությունից հետո հիվանդների կյանքի որակի և հետվիրահատական կոմորբիդության վրա ազդող բազմաթիվ գործոններ:

Սույն ուսումնասիրության նպատակն էր ՍԼԵՄ-ի արդյունավետության վրա վերոնշյալ գործոնների համալիր գնահատումը ՄՁԻ> 40 կգ/մ² ունեցող հիվանդների մոտ (ըստ բարիատրիկ վիրահատության համալիր արդյունավետության գնահատման համակարգի):

Համաձայն կիրառված ՍԼԵՄ-ի տեխնիկայի՝ հետազոտությանը մասնակցող 497 հիվանդների ընտրանքը բաժանվել է 2 խմբի: Առաջին խումբը ($n = 246$) ներառում էր ՍԼԵՄ-ի ստանդարտ, իսկ երկրորդը ($n = 251$)՝ մոդիֆիկացված ընթացակարգով վարվող հիվանդներին: Միջամտական երկու

խմբերի համար հաշվարկվել և համեմատվել են Բարիատրիկ վիրահատության գնահատման ինդեքսի, ինչպես նաև վերջինիս վրա ազդող գործոնների χ^2 - թեստ, p -արժեք և $C195\%$ ցուցանիշները:

Ուսումնասիրության արդյունքները հաստատեցին ՍԼԵՄ-ի արդյունավետության «միջին» արդյունքները ստանդարտ տեխնիկայով վիրահատված հիվանդների ճնշող մեծամասնության շրջանում: Վերջիններիս մոտ ազդող գործոնների համեմատական վերլուծությունը գրանցեց կախվածություն սոցիալական-դեմոգրաֆիկ տվյալների կատեգորիաների՝ տարիքի, սեռի, կրթական մակարդակի, ծխելու սովորության, ամուսնական կարգավիճակի, եկամուտների և բարիատրիկ վիրահատության արդյունավետության միջև: Անբավարար բարիատրիկ արդյունքը գերակշռում էր կանանց և ծխող հիվանդների շրջանում: Հավելենք, որ բնակության տարածքի, ընտանիքում երեխաների առկայության, ապահովագրության և աշխատանքային կարգավիճակի կատեգորիաների և բարիատրիկ վիրահատության արդյունքների միջև բավարար կապ չի արձանագրվել: ՍԼԵՄ-ի մոդիֆիկացված տեխնիկայով վիրահատված հիվանդների մեծ մասի մոտ գրանցվել են «լավից գերազանց» արդյունքներ: ՍԼԵՄ-ի արդյունավետության մակարդակը հստակորեն կապված էր ելակետային ՄՁԻ-ի, շաքարային դիաբետի, դիալիպիդեմիայի, սթրեսային ապրելակերպի և մոտիվացիայի աստիճանի կլինիկական տվյալների կատեգորիաների հետ առաջին խմբում, մինչդեռ մոդիֆիկացված ՍԼԵՄ-ի խմբում միջամտության արդյունավետությունը փոխկապակցված էր միայն շաքարային դիաբետի, սթրեսային ապրելակերպի և մոտիվացիայի աստիճանի հետ:

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