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Evaluating The Effectiveness Of Laparoscopic Longitudinal Gastric Resection Surgery On Early Postoperative Complications And Obesity-Related Comorbidities

A.S. Murodov[1], O.R.Teshaev[2], A.R.Mavlyanov[3]
Tashkent Medical Academy
[1]PhD, e-mail: dr.alimurod@mail.ru
[2]Doctor of Medical Sciences, professor, e-mail: tma.tor@mail.ru
[3]Doctor of Medical Sciences, professor, e-mail: olimboy.mavlyanov@gmail.com

Abstract: Studying of the corrective effect of longitudinal gastrectomy on concomitant diseases in patients with morbid obesity. This scientific work is based on the results of a comprehensive examination and treatment of 187 patients with MO who were treated in the our clinical bases from 2021 to 2023. The analysis of comorbidities in the compared groups showed that one or more comorbidities were detected in 72% of the control group, 77% of the main group. The main part of these patients was made up of patients with obesity of the III degree. The proposed modification of SG in morbidly obese patients improved the cardioesophageal function and the strength of the gastroduodenal staple line, eliminating the observed complication of staple line failure of 2.2%. It also led to a decrease in the symptoms of gastroesophageal reflux disease from 14% to 6.1%. In the longitudinal gastric resection procedure, the use of local hemostatic powder "HEMOBEN" along the gastric staple line reduced the bleeding complication from 3.2% to 1.1% and the duration of the procedure by an average of 15±3 minutes.In particular, if in the control and main groups, arterial hypertension was detected in 50 and 59.3% of patients before the surgical procedure, then 3 months after the surgical procedure, an increase in blood pressure was observed in 45.4 and 37% of the patients. After surgery, the clinical signs of arterial hypertension and arthralgia in patients with morbid obesity gradually disappeared with the elimination of obesity. In conclusion, these clinical signs were caused by obesity, and its elimination led to the disappearance of these clinical signs.
Keywords: morbid obesity; bariatric surgery; concomitant diseases; laparoscopic longitudinal gastrectomy

Obesity is a chronic, heterogeneous disease in etiology and clinical manifestations, characterized by an excessive accumulation of body fat with a progressive natural course. Morbid obesity is a condition in which there is an excessive accumulation of fat in the body, when the BMI is ≥40 kg/m2 or when the BMI is 35 kg/m2 and there are serious complications associated with obesity. Obesity and related metabolic diseases are an urgent problem of modern medicine, as they lead to the development of a number of serious and dangerous diseases [8,9,13]. The disease depends on the interaction of several factors, including genetic, endocrine, metabolic, environmental (social and cultural), behavioral and psychological components.

Currently, approximately 2.2 billion people worldwide are overweight, of whom about 1.5 billion are obese, and both indicators continue to grow [1, 16, 17].

The World Health Organization (WHO) defines obesity as an excess of body fat that impairs health and well-being, and its prevalence has been declared a “global epidemic” due to its alarming increase in prevalence [18].

Obesity is a worldwide health problem affecting children, adolescents, and adults, and is associated with comorbidities such as hypertension, dyslipidemia, type 2 diabetes, cancer, osteoarthritis, and sleep apnea. According to expert estimates, obesity is associated with a fourfold increased risk of death from cardiovascular disease and a twofold increased risk of death from cancer [11, 15].

A review of the treatment options for chronic obesity suggests that bariatric surgery is currently the only effective method for achieving long-term, sustainable weight loss and improvement of comorbidities in this group of patients [15, 23].

Although a healthy lifestyle is considered the ideal method for weight loss, surgical treatment remains the most effective and scientifically proven method for people with excess adipose tissue (grade II or III obesity). Bariatric surgery is recommended for patients with morbid obesity and obesity-related comorbidities [3, 4, 5, 6, 2, 22]. Laparoscopic gastric bypass is an important bariatric surgery used in the

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treatment of morbid obesity [21]. Gastric bypass has become the most widely used bariatric procedure in the past decade [7, 20]. Gastric sleeve, vertical, lateral or longitudinal resection is not only a bariatric procedure, but also a part of the proposed surgery for the treatment of duodenogastrobiliary reflux [10, 12, 19]. Due to its simple surgical technique, good early and long-term results, and relatively low complication rate, sleeve gastrectomy(SG) has become increasingly popular compared to Roux-en-Y gastric bypass and adjustable gastric banding [20, 14].

Purpose of the study: Improving the results of surgical treatment in patients with morbid obesity by selecting pathogenetically based treatment tactics and the nature of surgical intervention.

Materials and methods: Our scientific research was conducted in the clinics "Invivo" and "Medion", which are the bases of the Department of Surgical Diseases in Family Medicine of the Tashkent Medical Academy, based on the results of a comprehensive examination and treatment of 187 patients with morbid obesity during 2021-2023. For our scientific research, 95 patients out of 186 patients aged 18 to 63 years formed the main group and 92 patients - the control group. In the control group (92 patients), patients with morbid obesity underwent traditional SG. The main group (95 patients) consisted of patients who underwent a modified SG (No. IAP 07203) procedure proposed by us.

The indication criterias for bariatric surgery are as follows:

- BMI above 40 kg/m2;
- BMI above 35 kg/m2 and comorbidities and metabolic disorders associated with obesity;
- Patients older than 18 years and younger than 63 years of age;
- Patients with a history of morbid obesity who have undergone conservative (non-drug and drug) treatment ineffective;
- Desires and needs of a patient with morbid obesity
- Prediabetes combined with obesity;

When the distribution of patients in the study group of our research work by age and gender was studied, it was found that the main group of patients were young and middle-aged women.

In our study groups, 187 patients with morbid obesity with various body mass indices underwent surgery, of which 153 (81.8%) were patients aged 18 to 44 years. It was determined that there were 29 patients aged 45 to 59 (15.5%), and 5 patients aged 60 to 74 (2.7%).

In our control group, women accounted for 92.4%, and men for 8%. In our main group, women also made up the majority, accounting for 79% and 21%, respectively.

Data analysis shows that among morbidly obese patients, when their body mass index (BMI) was studied, it was noted that they applied for bariatric surgery mainly with obesity of the III degree (77% in the main group, 59% in the control group) and II degree (23% in the main group, 41% in the control group) (Fig. 1).

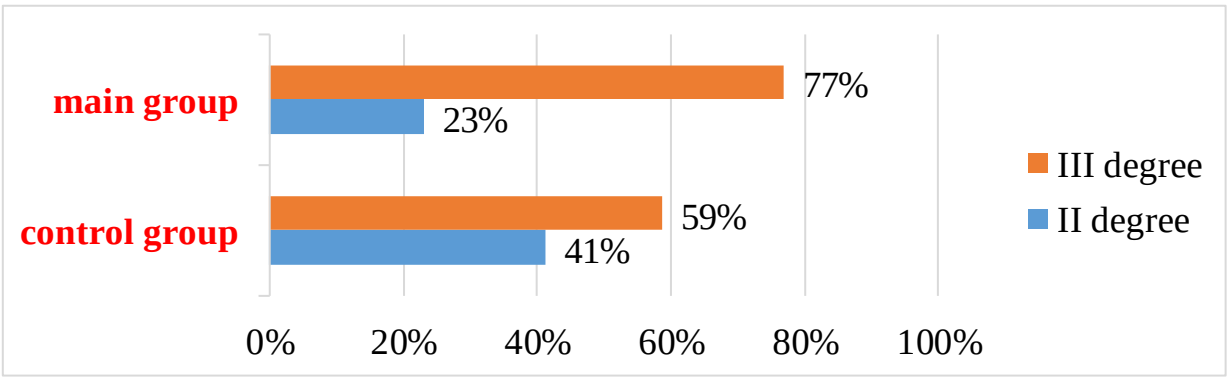

Figure 1. Distribution of patients with MO in groups according to the degree of obesity (WHO, 1997)

The preoperative weight analysis of patients with morbid obesity in our research groups showed that the maximum body weight of the patients was 209 kg, the minimum weight was 98 kg, and the average weight was 126 kg.

Analysis of the body weight indicators before the operation of patients with morbid obesity who underwent SG showed that in the control group the maximum weight was 186 kg, the minimum was 85 kg,

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the average weight was 115 kg, and in the main group this indicator was 209 kg, 85 kg and 116 kg, respectively.

As can be seen from the anamnesis, 117 (63%) patients had a hereditary predisposition to obesity, and 109 (58.5%) patients had received various types of conservative treatment.

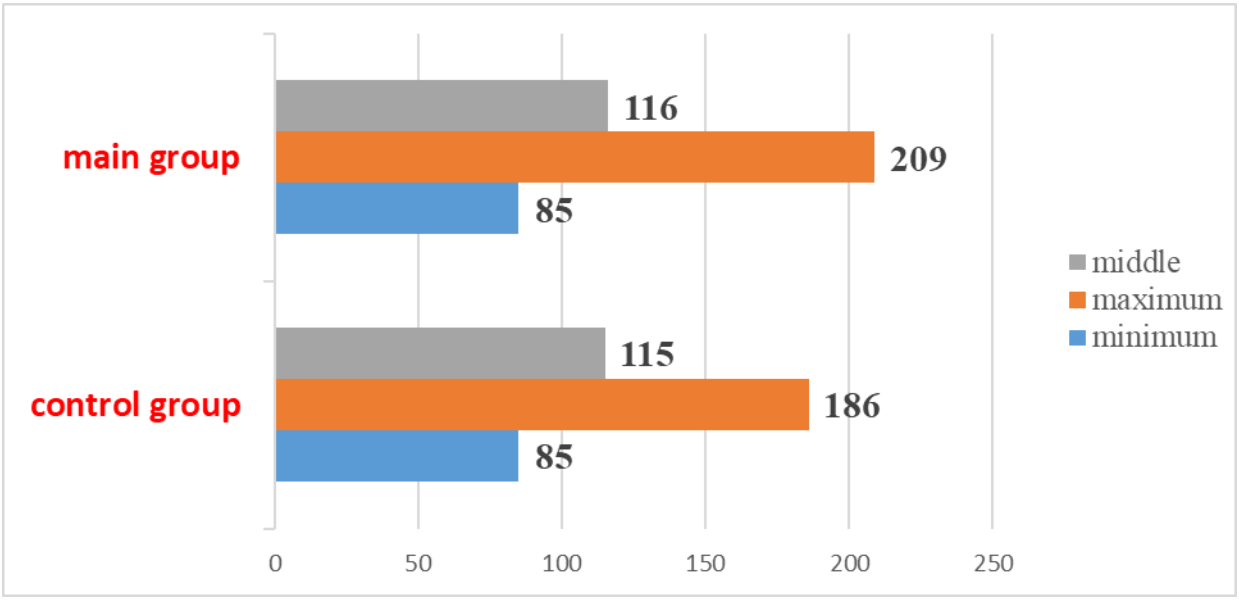

Figure 2. Analysis of body weight indices of patients with MO in control groups before SG procedure

In morbidly obese patients, the most common history of obesity was 10 years (47.6% in the study group, 43.9% in the control group), obesity up to 5 years (28.6% in the study group, 32.9% in the control group), and obesity up to 15 years (23.8% in the study group, 23.2% in the control group).

Analysis of comorbidities in patients with MO showed that 109 (58.2%) patients had one or more co-morbidities. The structure of co-morbidities, according to nosology, is arterial hypertension 108 (57.7%), locomotor system diseases 81 (43.3%), depressive state in patients 63 (33.7%), gastroesophageal reflux 32 (17.1%), gallstone disease 19 (10.1%), diaphragmatic esophageal hernia 17 (9.1%) and diabetes 9 (4.8%).

The physical condition of morbidly obese patients was classified using the scale proposed by the American Society of Anesthesiologists (ASA I–VI) (Fig. 1.6.). In the study groups, 18 (15.2%) and 20 (18.4%) of the control group had ASA I - the first category of physical condition (healthy patients). 64 (69.5%) and 67 (70.5%) of the main group had ASA II - the second category of physical condition (patients with mild systemic diseases), respectively. 10 (10.8%) and 8 (8.4%) of the third category of ASA III (severe systemic diseases, but not life-threatening). There were no patients in the fourth and fifth categories in our study groups.

Table 1.
Distribution of patients according to the presence of comorbidities.

	Comorbidities Total	**n (%)**
1.	Arterial hypertension	108(57,7%)
2.	IChD. Angina.	27(14,4%)
3.	Musculoskeletal system diseases (arthralgia and vertebralgia)	81(43,3%)
4.	Impaired glucose tolerance (prediabetes)	17(9,1%)
5.	Gastroesophageal reflux	32(17,1%)
6.	Gallstone disease. Chronic stone cholecystitis	19(10,1%)
7.	Diaphragmatic hiatal hernia	17(9,1%)
8.	Depressive state	63(33,7%)
9.	Sleep apnea syndrome	22(11,7%)
10.	Decreased libido	23(12,3%)
11.	Ovarian cyst	8(4,2%)
12.	Varicose veins of the legs	28(14,9%)

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13.	Hernia of the anterior abdominal wall	7(3,7%)

Taking into account the complications that may occur after longitudinal gastric resection, in order to reduce the risk of cardioesophageal zone staple line failure and bleeding complications, a modified method of practice was recommended in our clinic, and an invention patent was obtained from the Ministry of Justice of the Republic of Uzbekistan for the modified SG practice entitled “Method of working with the cardioesophageal zone staple line in longitudinal gastric resection” (IAP 07203, registered on 08.09.2022).

When suturing the stomach, it is important to create a “sleeve” of the gastric tube of the same diameter (about 1 cm) along its entire length. We complete the gastric resection strictly in the area of its angle. In this case, during the process of reworking the cardio-esophageal zone, which is the most common area of suture insufficiency, the stapler is left 1.0 - 1.5 cm wider in this area. Then, this area is sutured with a continuous sero-serous suture with V-Loc thread. Then, the cardiac part of the gastric tube is fixed to the left pedicle of the diaphragm with a single-knot suture. Fixing the proximal part of the gastric tube to the left pedicle of the diaphragm helps to reshape the physiological angle of Hiss, preventing the expansion and sagging of the remaining fundal part of the stomach.

The modified SG method proposed in our research work primarily improves the early postoperative period, the development of certain pathological conditions after the operation largely depends on the early postoperative period, in turn, a milder course of the early postoperative period leads to an improvement in long-term postoperative results.

Analysis of early specific complications observed after SG in patients with MO showed that dyspeptic disorders were 38.5% in the control group, and this indicator was 24.6% in the main group. Vomiting was observed in 31.2% and 22.4%, bile duct obstruction in 24% and 18%, wound suppuration in 5.4% and 3%, staple line bleeding in 3.2% and 1.1%, and staple line failure in 1.1% of the control group only.

The results show that the proposed preoperative preventive measures and the use of the modified SG method in our main group significantly reduced the likelihood of early specific complications after surgery in patients. Of the 92 patients in the control group, only 22 (23.9%) did not have the above-mentioned comorbidities, while the remaining 70 (76.1%) patients had comorbidities (see table). Of the patients in the subgroup without comorbidities, 16 (72.7%) had grade 2 obesity, and 6 (27.2%) had grade 3 obesity.

Of the remaining 70 patients in the control group with comorbidities, 19 (27.2%) had grade 2 obesity, and 51 (72.8%) had grade 3 obesity. Similar changes were observed in the main group. In particular, the number of patients without comorbidities was 30 (31.5%), while the number of patients with comorbidities was 65 (69.5%).

Table 2.
Specific early complications after SG in patients with MO

	Specific complications	**Investigation groups**	
		Control group(n=92)	**Main group(n=95)**
1.	Nausea, vomiting	31,5%	24,2%
2.	heartburn	22,8%	13,7%
3.	Metabolic acidosis	5,4%	2,1%
4.	Wound purulent-inflammation	5,4%	3,1%
5.	Bleeding	3,2%	1,1%
6.	Stapler line failure	2,2%	-

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7.	Mesenteric venous thrombosis	1,1%	-
8.	Pulmonary artery thromboembolism	2,2%	-
9.	Anemia	14%	11,5%
10.	Hypoproteinemia	13%	11,5%
11.	Hypovitaminosis	19,5%	17,9%
12.	Deficiency of microelements	10,5%	10,9%

In the subgroup of patients without comorbidities, grade 2 obesity was detected in 19 (63.4%) patients, and grade 3 obesity was detected in 11 (36.6%). In the subgroup of patients with comorbidities, grade 2 obesity was detected in 16 (24.6%) patients, and grade 3 obesity was detected in the remaining 43 (45.4%) patients. The presented data showed that patients with comorbidities are characterized by a high incidence of severe morbid obesity.

The results of treatment after SG surgery in patients with MO were evaluated taking into account weight loss, changes in comorbidities, and the dynamics of metabolic disorders. In our research groups, the changes of these indicators after 3 months, 6 months, 12 months, 18 months and 24 months after SG surgery were studied.

In our study groups, BMI changes are consistent with body weight dynamics during similar types of surgery in the respective groups. Thus, in our study groups, a significant decrease in BMI was observed in patients after surgery. The maximum intensity of BMI reduction is observed in the first 6 months. In the control group, BMI before surgery averaged 43kg/m2, maximum 63kg/m2, minimum 32kg/m2. In dynamic monitoring after 3 months - 37.5±4.8 kg/m2 and after 12 months - 30.5±3.9 kg/m2 (Table 3). The following results were obtained in the main group: BMI before surgery was found to be average - 46.87 kg/m2, maximum - 74.90 kg/m2, minimum - 35.0 kg/m2. After 3 months, it decreased to 36.6±4.6 kg/m2 and after 12 months, to 29.0±3.5 kg/m2, indicating that the patients were not morbidly obese, but overweight. The indicators in our groups at 18 and 24 months were relatively stable, continued to decline. Data on the change in BMI in our study groups are presented in the table (Table 3).

The effectiveness of weight loss after surgery, measured as the percentage of total weight loss (% TWL) at 3, 6, 12, 18, and 24 months, was 12.5%, 17.3%, 29.5%, 33.3%, and 34.2% in the control group, respectively. 3%, 38.2%, and in our main group it was 14.0%, 15.4%, 28.6%, 31.6%, 33.0%. This indicator was higher in the main group compared to the control group in the same period of months. In the group, it is better by 2.5%, 1.1%, 3%, 1.3%, 1.4%. This indicates that the main group of patients showed a maximum decrease in the percentage of weight loss in the first 3 months compared to the control group due to the improvement of early postoperative indicators, and this indicator was also found to be relatively better in the main group of patients in the following months.

After the SG procedure, the "percentage of excess weight loss" (When analyzing the EWL indicator, it was found that patients in the control groups lost excess weight intensively in the first 3.6 months, reaching the maximum indicator at 12 months, with a better result of 69.2% in our control group and 6.3% in our main group, reaching 75.5%. did. At our 18 and 24-month follow-ups, the “excess weight loss percentage” stabilized somewhat, reaching 75.8% and 78.9% in our control group, and 80.5% and 84.9% in our main group, respectively.

Table 3.
Dynamics of reduction of body weight indicators in months after SG practice.

Indicators / groups	Control group	Main group
BMI before	44,5±5,4	46,8±5,8

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BMI after 3 month	37,5±4,8	36,6±4,6
BMI after 6 month	34,8±4,5	33,2±4,2
BMI after 12 month	30,5±3,9	29,0±3,5
BMI after 13 month	29,4±3,4	28,8±3,3
BMI after 24 month	29,2±2,4	28,2±2,6
% TWL after 3 month	12,5	14,0
% TWL after 6 month	17,3	15,4
% TWL after 12 month	29,5	28,9
% TWL after 18 month	33,3	31,6
% TWL after 24 month	34,2	33,0
% EWL after 3 month	32,5	36,5
% EWL after 6 month	42,5	56,1
% EWL after 12 month	69,2	75,5
% EWL after 18 month	75,8	80,5
% EWL after 24 month	78,9	84,9

In the study groups, the percentage of patients who lost weight after SG surgery was 80.5% and 84.9%, respectively. The analysis of complications showed that in our main group of patients, early complications significantly decreased after the modified SG procedure. This, in turn, led to a decrease in the number of late complications.

The proposed modification in the procedure of SG in patients with morbid obesity increased the cardioesophageal function and the strength of the gastric tube staple line, eliminating the observed complication of staple line failure of 2.2%. It also led to a decrease in the symptoms of gastroesophageal reflux disease from 14% to 6.1%.

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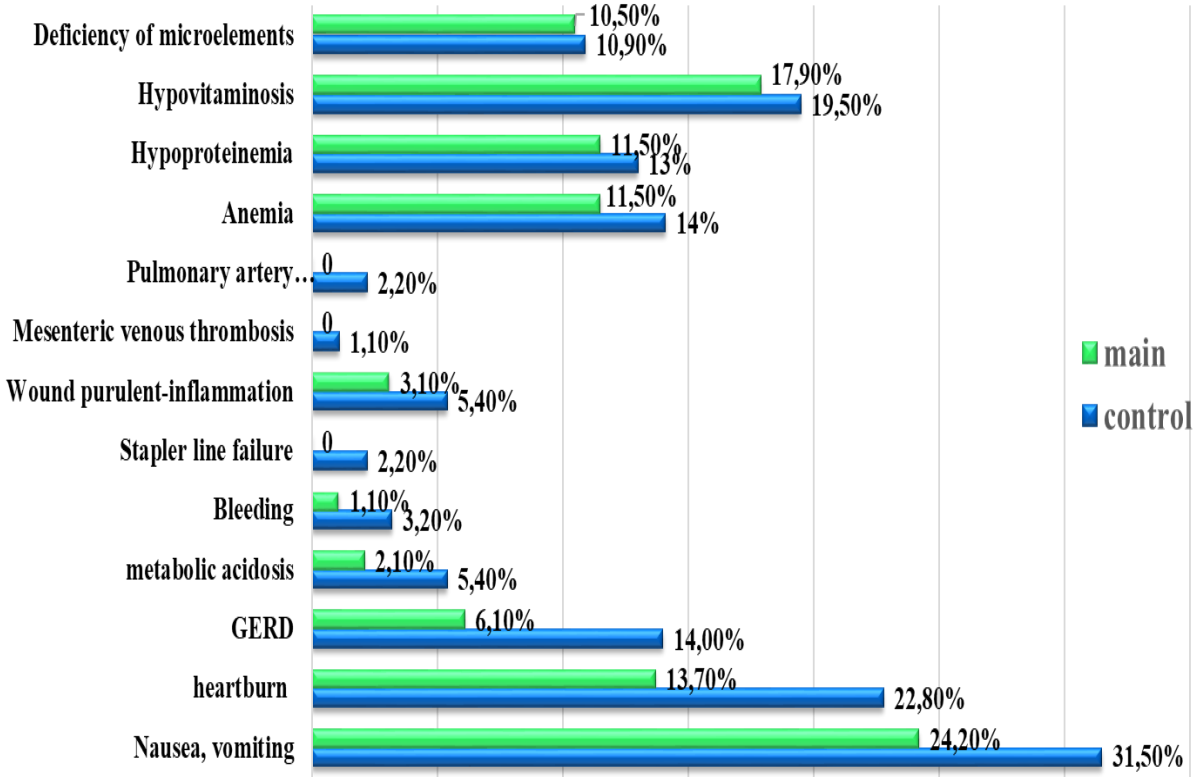

Picture 3. Specific complications encountered in the postoperative period in our comparison group patients

In the procedure of longitudinal gastric resection, the use of local hemostatic powder "HEMOBEN" along the gastric tube staple line reduced the complication of bleeding from 3.2% to 1.1% and the duration of the procedure by an average of 15±3 minutes.

Table 4. Severity of complications after SG surgery (according to Clavien-Dindo)

Severity of postoperative complications		**Control group**	**Main group**
1	I degree	2,9 %	1,5%
2	II degree	6,6%	4,4%
3	IIIa degree	1,1%	-
4	IIIb degree	3,3%	1,1%
5	IVa degree	-	-
6	IVb degree	-	-
7	V degree	-	-
8	Overall	13,9%	7%

When we classified the complications after SG by severity (according to Clavien-Dindo), in our control group this indicator was 13.9%, and in our main group, a better result was achieved twice and amounted to 7%.

Table 5. Repeated surgical procedures performed due to complications after SG

Volume of repetitions		**Control group**	**Main group**
1	Relaparoscopy, blood stop	2(2,2%)	-
2	Relaparoscopy, stitching a stapler line	1(1,1%)	

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3	Relaparoscopy, drainage	1(1,1%)	1(1,1%)
4	Diagnostic laparoscopy	-	-
5	Overall	4(4,4%)	1(1,1%)

Analysis of repeated surgical procedures performed due to complications after SG surgery revealed that in our control group - 4.4%, in our main group - 4 times better results were recorded, and in - 1.1% of cases, the need for repeated operations was observed.

Dynamics of comorbidities associated with morbid obesity in patients 18 months after SG - arterial hypertension in 58%, arthralgia in 50%, dyslipidemia in 48%, prediabetes in 71%, sleep apnea syndrome in 78% - complete remission was observed.

Table 6. Dynamics of comorbidities associated with morbid obesity in patients after SG.

№	Comorbidities after 18 months	Complete remission		Improvement		No change		Worsening	
		C	M	C	M	C	M	C	M
1	Arterial hypertension	46,8%	58%	49%	39,9%	3,2%	2,1%	-	-
2	Arthralgia and vertebralgia	45,2%	49,2%	44.4%	48%	10,4%	2,8%	-	-
3	Dyslipidemia	43%	48%	57%	52%	-	-	-	-
4	IDH. Angina pectoris	36%	38%	58%	60%	6%	2%	-	-
5	Prediabetes	68%	71%	32%	29%	-	-	-	-
7	Depressive state	65%	71%	35%	29%	-	-	-	-
8	Sleep apnea syndrome	73%	78%	27%	22%	-	-	-	-
9	Decreased libido	55%	58%	38%	37%	7%	5%	-	-
10	GERK	68%	73%	26,8%	27%	5,2%	4,2	-	-

Conclusion:

1. 64% of morbidly obese patients have metabolic disorders, which complicate the course of obesity in these patients and increase the risk of early death.
2. 75.9% of morbidly obese patients have one or more obesity-related comorbidities, accompanied by profound metabolic changes, which in turn complicate the course of obesity, increase the cost of treatment for this category of patients, increase the risk of preoperative anesthesia, and reduce the patient's quality of life.
3. The proposed modification of the SG procedure in morbidly obese patients improved the functioning of the cardioesophageal field and the strength of the gastric tube staple line, eliminating the observed complication of staple line failure in 2.2%. It also leads to a decrease in the symptoms of gastroesophageal reflux disease from 14% to 6.1%.
4. In the operation of longitudinal gastric resection, the use of local hemostatic powder "HEMOBEN" along the gastric tube stapler line reduced the bleeding complication rate from 3.2% to 1.1% and the duration of the operation by an average of 15±3 minutes.

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