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Evaluation of the Corrective Effect of Laparoscopic Longitudinal Gastrectomy on Metabolic Parameters and Concomitant Diseases in Patients with Morbid Obesity

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Abstract To study the corrective effect of laparoscopic longitudinal gastric resection (LLGR) on obesity-related metabolic disorders in morbidly obese patients. This scientific work is based on the results of a comprehensive examination and treatment of 187 patients treated for morbid obesity in our clinical bases from 2021 to 2023. Analysis of comorbidities in the compared groups showed that 64% of the comparison groups had metabolic disorders. The majority of these patients were patients with 3rd degree of obesity. Positive changes in lipidogram analysis were observed in patients after LOBR procedure. Also, when hemostasis indicators were studied, convincing positive changes were observed in the 1st and 3rd stages of coagulation hemostasis. In patients with chronic obesity, our recommended modification of LOBR increased cardio esophageal and gastric stapler line strength, eliminating the 2.2% stapler line failure observed in our control group in our main cohort. It also led to a reduction in gastroesophageal reflux disease symptoms from 14% to 6.1%. In conclusion, these pathological changes are closely related to obesity, and the elimination of obesity led to the elimination of these metabolic disturbances.

Keywords Metabolic syndrome, Morbid obesity, Bariatric surgery, Concomitant diseases, Laparoscopic longitudinal gastric resection

1. Introduction

Obesity is a chronic metabolic disease, manifested by excessive development of adipose tissue, progressing in its natural course, having a certain range of complications and having a high probability of relapse after completion of treatment [2]. The disease depends on the interaction of several factors, such as genetic, endocrine, metabolic, environmental (social and cultural), behavioral and psychological components [25]. Recently, obesity has become one of the most important public health problems worldwide in all age groups [23].

Obesity is the most dangerous and serious risk factor for the life of patients. More than 1 billion adults are overweight and at least 300 million people are obese (BMI over 30 kg/m^2) [22]. Morbid obesity is a condition characterized by excessive fat accumulation in the body, defined as BMI ≥40 kg/m^2 or BMI ≥35 kg/m^2, and the presence of serious obesity-related complications [30,14]. The disease depends on the interaction of several factors, such as genetic, endocrine, metabolic, environmental (social and cultural), behavioral and psychological components [16].

It has been scientifically proven that people with certain degrees of obesity (I, II or III) are at higher risk of obesity-related diseases, comorbidities, lower quality of life and increased mortality to a greater extent than people in the normal BMI range (18, 5–24,9) [4,27].

Morbid obesity and metabolic syndrome is a worldwide health problem that affects children, adolescents and adults and is accompanied by comorbidities such as hypertension, dyslipidemia, type 2 diabetes, cancer, osteoarthritis and sleep apnea [11,21]. Obesity, according to expert estimates, leads to a 4-fold increase in the risk of cardiovascular mortality and 2-fold increase in mortality due to cancer [13,17].

We know that prevention is the long-term solution to this vital public health problem, but prevention may not always be successful and sustainable. In addition, current conservative therapies, including non-drug and drug treatments, fall far short of the desired success in long-term weight loss [1,28].

Long-term results of conservative treatment of obesity remain unsatisfactory, and today the most effective and reliable methods of treating morbid obesity are surgical, both in terms of the achieved reduction in body weight and in the improvement of metabolic parameters [6,7]. Many authors

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have scientifically and clinically proven that bariatric surgery in adult morbidly obese patients may be the most appropriate treatment option for sustaining weight loss and obesity-related management [29].

Bariatric surgery is recommended in patients with morbid obesity and a combination of the above comorbidities [8,9,24,26]. Recently, the most frequent bariatric surgeries are laparoscopic sleeve gastrectomy (LSG), mini gastric bypass (MGB), Roux-en-Y gastric bypass (RYGB), and duodenal switch (DS). Laparoscopic sleeve gastrectomy can give results such as MGB, RYGB and DS without malabsorption problems [2,10,19]. Sleeve gastrectomy is an important bariatric operation used in the treatment of patients with morbid obesity [31]. Sleeve gastrectomy is a new, safe and effective method of surgical treatment of obesity with higher survival rates and low patient complication rates [3,28]. Initially, this operation was introduced into clinical practice as part of duodenal switch biliopancreatic diversion [12]. Sleeve gastrectomy is currently widely performed as an independent laparoscopic operation [15]. Since its first introduction in 2004 as a stand-alone laparoscopic procedure in bariatric surgery, LSG has proven to be effective in sustained, long-term weight loss and improvement in comorbidities [18].

Purpose of the study: Improvement of operative treatment results in patients with morbid obesity through the corrective effect of modified laparoscopic longitudinal gastric resection on existing metabolic disorders and comorbidities.

2. Materials and Methods

This scientific work is based on the results of examination and treatment of 187 patients with morbid obesity (MO), who were treated at the clinical bases of the Department of Surgical Diseases of Family Medicine of the Tashkent Medical Academy from 2021 to 2023. Depending on the treatment, the patients were conditionally divided into 2 groups: the 1st (control group) included 92 patients who underwent the traditional method of laparoscopic longitudinal gastrectomy; in group 2 (main group) there were 95 patients who underwent our proposed modified laparoscopic longitudinal gastrectomy [20,30]. When the distribution of the patients of our research group by age was studied, it was found that the main group of patients are young and middle-aged women. The average age of patients was 36±0.92 years in the control group, 34±0.7 years in the main group. 81.8% of patients aged 18 to 44, 15.5% from 45 to 59 years, 2.7% from 60 to 74 years. The analysis shows that the patients who underwent surgery are mostly under 45 years old, which is considered to be the working age (Fig. 1).

When studying the distribution of patients by gender, there were 85 (92.4%) women in the control group, 7 (7.6%) men in the main group, 75 (79%) women and 20 (21%) men in the main group.

Analysis of the preoperative weight of morbidly obese patients showed that the minimum weight in the control group was 85 kg and the maximum weight was 186 kg, in the main group this indicator was 85 kg and 209 kg, and the average weight in the comparison groups was 115±1.0 kg, respectively.

The data analysis shows that in patients with morbid obesity, when their body mass index (BMI) was studied, it was noted that mainly III-degree (68%) and II-degree (32%) obesity applied for bariatric practice.

It is known that dyslipidemia is the main biochemical marker of morbid obesity. Because lipid metabolism is related to its location, fat accumulation in the visceral part of the body, high amount of triglycerides and low concentration of cholesterol in high-density lipoproteins (HDL XS) are interrelated [17,26,28]. Understanding the mechanism of development of dyslipidemia in morbid obesity, helps to determine the importance of these markers in evaluating the effectiveness of gastric resection. It is known that in morbid obesity, high amounts of triglycerid activate the production of large amounts of low-density lipoproteins (LDL) from the liver [15,45]. Also, due to insulin resistance developed as a result of obesity, high insulin inhibits the process of lipolysis in adipose tissue and causes UAG and LDL to be stored in high concentration by enhancing lipogenesis. In addition, according to the results of some studies, the synthesis and secretion of chylomicrons is increased in obese patients, which is probably related to high dietary lipid intake [16,21].

In order to study the effect of bariatric procedures on metabolic processes, after 6 months we again determined blood lipid parameters. In particular, it was found that the amount of triglyceride decreased by 2.14 ($P<0.001$) and 1.56 ($P<0.05$) times in the blood serum of the main and control group patients 6 months after surgery (Table 1). In this case, the amount of triglyceridedecreased by 2.14 ($P<0.001$) and 1.51 ($P<0.05$) times in patients with 2nd-degree of obesity, and 2.02 ($P<0.001$) and 1.59 ($P<0.05$) in patients with 3rd-degree of obesity. <0.01) times decrease was observed. It should be noted that the proposed surgical procedure resulted in a 1.42 ($P<0.05$) and 1.27 ($P<0.05$) times stronger reduction of triglyceride in the blood serum of patients with 2nd and 3rd degree obesity compared to the control group.

In the blood serum of the main and control group patients, 6 months after surgery, total cholesterol content was found to decrease by 1.24 ($P<0.05$) and 1.18 ($P<0.05$) times. In this case, in patients with obesity of the 2nd degree, total cholesterol content decreased by 1.16 ($P<0.05$) and 1.17 ($P<0.05$), while in patients with obesity of the 3rd-degree, it was 1.21 ($P<0.05$) and A decrease of 1.18 ($P<0.05$) times was observed. It is worth noting that the proposed and conventional bariatric procedures had approximately the same effect on patients' serum total cholesterol. It is worth saying that if hypercholesterolemia was preserved in 4 (8.9%) patients after traditional bariatric, this indicator did not differ from the norm in all patients after the proposed method.

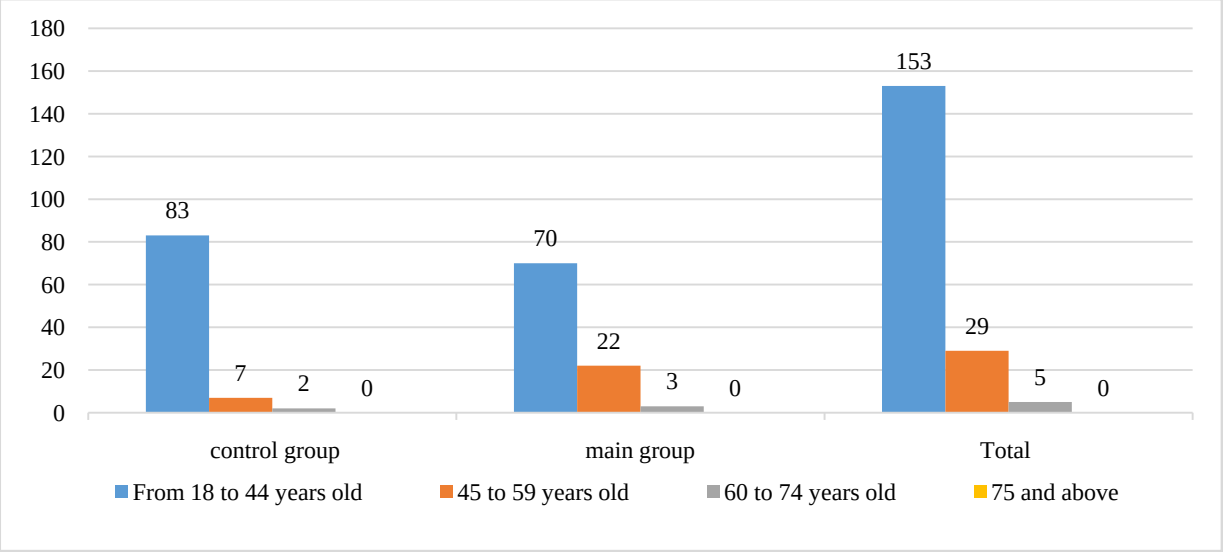

Figure 1. Distribution of patients by age

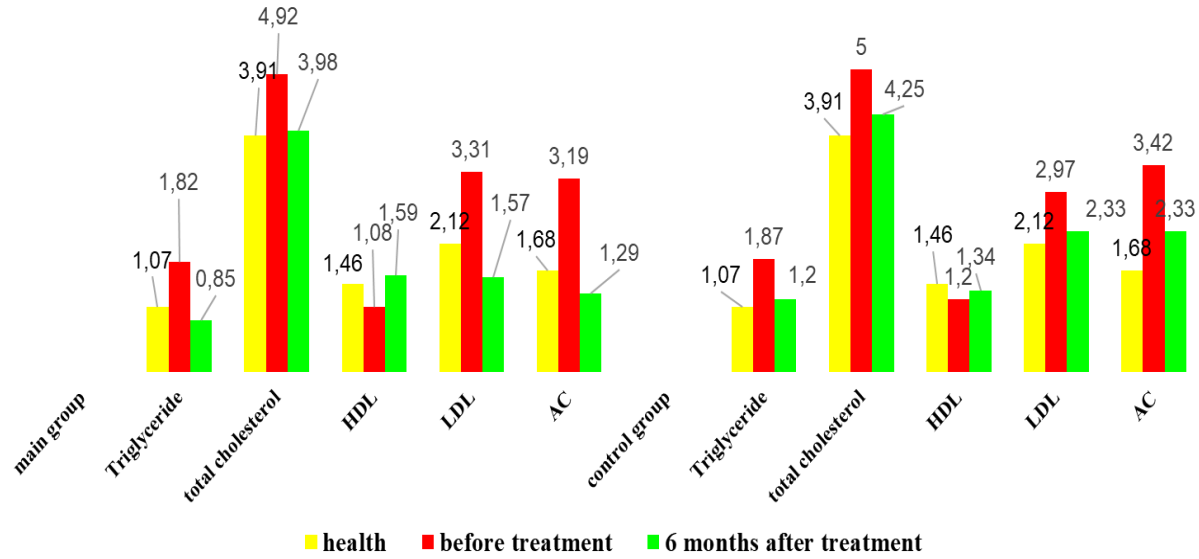

Figure 2. Serum lipid metabolism indicators after LOBR surgery in control groups, M±m

In the blood serum of the main and control group patients, 6 months after surgery, total cholesterol content was found to decrease by 1.24 (P<0.05) and 1.18 (P<0.05) times. In this case, in patients with obesity of the 2nd degree, total cholesterol content decreased by 1.16 (P<0.05) and 1.17 (P<0.05), while in patients with obesity of the 3rd-degree, it was 1.21 (P<0.05) and A decrease of 1.18 (P<0.05) times was observed. It is worth noting that the proposed and conventional bariatric procedures had approximately the same effect on patients' serum total cholesterol. It is worth saying that if hypercholesterolemia was preserved in 4 (8.9%) patients after traditional bariatric, this indicator did not differ from the norm in all patients after the proposed method.

Traditional bariatric practice did not significantly affect the amount of XS in serum HDLs, although the proposed practice led to an increase of this indicator by 1.47 (P<0.05) times after 6 months (Fig. 2). Similar changes were observed in patients with 2nd degree of obesity, that is, if in the blood of control group patients there was a tendency to increase the low amount of XS in HDLs, in the blood serum of patients in the main group this indicator increased 1.41 (P<0.05) times. This indicator increased by 1.20 (P<0.05) and 1.50 (P<0.05) times in patients with 3rd degree obesity of the main and control groups. It is worth noting that the proposed surgery resulted in a statistically significant increase in serum total cholesterol in patients at all levels of obesity compared to the control group.

Traditional bariatric procedures tended to decrease the high concentration of XS in LDLs in the blood serum of patients with 2nd degree obesity, while in 3rd degree obesity,

we reduced it by a statistically significant 1.31 (P<0.05) times. Recommended bariatric treatment resulted in a 1.72-fold (P<0.01) and 1.81-fold (P<0.01) reduction of this index in patients with 2nd and 3rd degree obesity, respectively. It is worth saying that the proposed surgical operation in the blood serum of patients. In general, if the amount of XS in HDLs in the control group decreased by 1.27 (P<0.05) times compared to the initial value, after the proposed operation it was 2.11 (P<0.001) times decreased, that is, the difference between the main and control groups was 1.66 (P<0.01) organized. It should be noted that hypoalphaproteinemia was not observed after treatment in either the main or control groups, while hyper-β-lipoproteinemia was not observed in the main group, and it remained in 4 (8.9%) patients in the control group.

As we noted above, the atherogenic index was higher in obese patients. After different types of bariatric surgery, this coefficient decreased by 2.47 (P<0.001) and 1.47 (P<0.05) times in the main and control groups, and 1.29±0.06 and 2.33±0.11 organized. If its indicator decreased by 2.34 (P<0.001) and 1.44 (P<0.05) times to 1.30±0.08 and 2.34±0.14 in patients with 2nd degree obesity, then in 3rd degree obesity this decrease is 2.8 (P<0.001) and 1.43 (P<0.05) times decreased, and was 1.29±0.08 and 2.32±0.17 (Fig. 3).

It is worth saying that if the atherogenic coefficient in the main group does not differ much from the normative indicators, in the control group they are statistically reliable in the general group, 1.37 in 2nd and 3rd- degree obesity (P<0.05); 1.39 (P<0.05) and 1.38 (P<0.05) times remained high 1.80 (P<0.001) compared to the main group indicators; 1.81 (P<0.001) and 1.80 (P<0.001) times higher.

Therefore, the proposed surgical procedure leads to a decrease in the atherogenic coefficient and prevents dyslipoproteinemia. As a proof of this, hypo-a-lipoproteinemia, type IIb of dyslipidemia and type IV of dyslipidemia were not detected in the main group of patients, while hypo-a-lipoproteinemia was not detected in the control group, type IIb of dyslipidemia - 8.9%, and type IV of dyslipidemia - in 2.2% of patients. was preserved. Thus, a statistically reliable change in lipid profile and glucose concentration indicators was observed in the main and control group patients after surgery. Interestingly, in the main group compared to the control group, there was a positive change in the dynamic change of HDL, atherogenic coefficient and plasma glucose concentration indicators, higher than that of the control group, on the other hand, no statistically significant change was detected in the indicators of the control group compared to the main group.

Carbohydrate metabolism-specific studies were performed in obese primary (proposed gastric resection) and control (conventional resection) group patients according to degree of obesity. It is known that one of the causes of obesity is carbohydrate products. Obesity is often accompanied by prediabetes and type 2 diabetes.

In our study, healthy donors had a blood glucose level of 4.72±0.12 mmol/l, while obese patients tended to increase glucose levels, but these values were around the upper limit of normal values. It is known that the effectiveness of bariatric surgery is not observed in the early stages. In order to study the effect of bariatric procedures on metabolic processes, we determined the parameters of carbohydrate metabolism again after 6 months. The obtained results showed that after 6 months in the main group, all 20 patients with 2nd degree obesity (100%) were overweight, while in the control group 4 out of 25 patients (16%) had 1st degree obesity, 1 (4%) had normal weight and 20 (80 %) overweight was observed.

Surgery in the main and control groups resulted in a 1.23 (P<0.05) and 1.29 (P<0.05) fold reduction in blood glucose after 6 months. This indicator was 1.22 (P<0.05) and 1.29 (P<0.05) times in patients with 2nd- degree obesity, 1.38 (P<0.05) and 1.3 (P<0.05) in 3rd-degree obesity. <0.05) times decrease was found.

So, bariatric procedures prevent hyperglycemia. In this case, good positive results were observed in the practice of the proposed longitudinal resection of the stomach. When the aforementioned indicators were compared with the results of a meta-analysis, it was observed that a positive change in the carbohydrate profile occurred in patients as a result of various resections of the stomach.

The decrease in stomach volume after surgery in the main and control groups is caused by malabsorption of dietary nutrients. It is important not only to reduce the efficiency of digestion of nutrients in the stomach, but also to reduce the time of storage of digested mass in the stomach. After all, in this case, the undigested mass in the stomach is transferred to the intestines at a higher frequency, which causes a decrease in the efficiency of the digestive process in the small intestine.

Coagulation factors are of great practical importance in evaluating the effectiveness of surgical procedures performed in the main and control groups in patients with morbid obesity. To study the vascular platelet stage of hemostasis, we counted the number of platelets in the blood analysis. The study showed that in the control group this indicator was 244±38.9 x109/l, while the average amount of platelets in the patients in the main and control groups was 390±125 x109/l. The obtained results showed that thrombocytosis develops to a certain degree in obesity and that this indicator depends on the degree of obesity. This showed an increase in platelet function and a tendency to hypercoagulability in patients.

Coagulation hemostasis consists of a cascade of reactions involving plasma factors. In the group of healthy donors, APTT was 32.1±0.93 seconds, while in the main and control group of patients suffering from obesity, the APTT time in plasma was 21.82±0.50 (P<0.01) and 24.98±0.57 (P<0.01) was observed to be reduced to seconds. Reduction of APTT index in obese patients compared to healthy donors indicated a hypercoagulable shift in the first stage of plasma hemostasis.

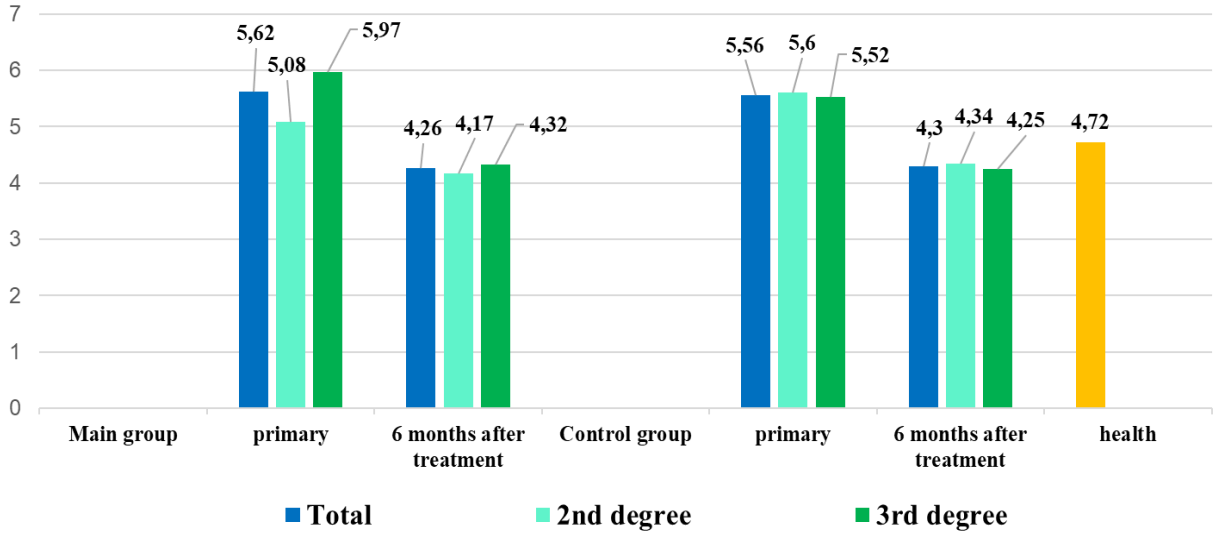

Figure 3. Indicators of carbohydrate metabolism in blood serum after LOBR surgery in control groups, M±m

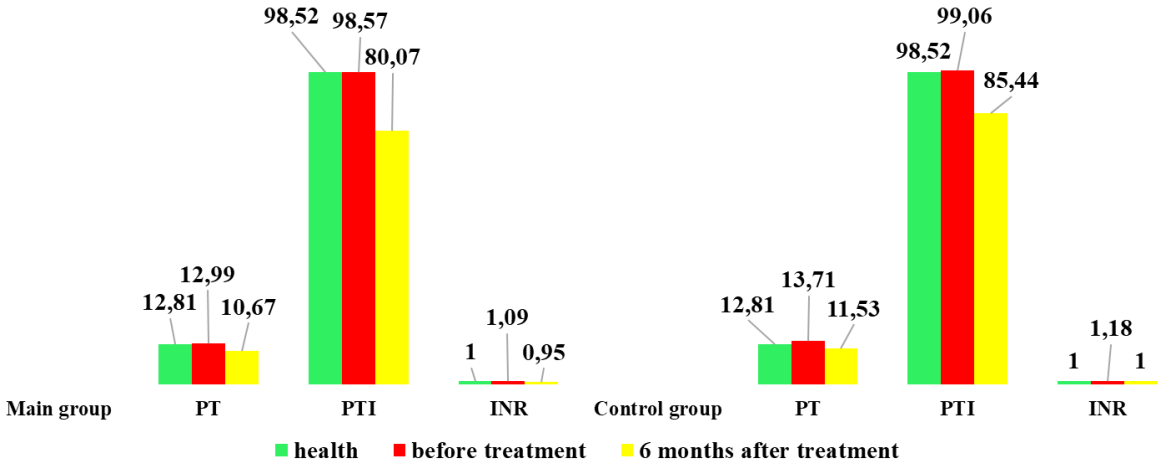

Figure 4. Changes in hemostasis indicators in our patients of the comparison group

The amount of fibrinogen was determined to characterize the third stage of blood clotting. The study of the amount of fibrinogen showed a significant increase in the concentration of fibrinogen, which indicated the existence of a hypercoagulable shift in the third stage of blood clotting coagulation hemostasis. In particular, in patients in the main and control groups, the amount of fibrinogen increased by 1.66 (P<0.01) and 1.47 (P<0.015) times compared to the standard values, 482.00±21.66 and 426.98±16.83 mg% The amount of fibrinogen in the 2nd degree of obesity was 1.65 (P<0.01) and 1.33 (P<0.05) times increased to 480.60±31.31 and 386.00±15.88 mg% in the main and control groups the increase was 1.66 (P<0.01) and 1.65 (P<0.01), and these indicators It increased to 483.12±28.81 and 478.20±29.10 mg%. In the group of healthy donors, this indicator was 290.4±60.5 mg%.

Similarly, changes in coagulation parameters depending on the level of obesity as a result of longitudinal resection of the stomach performed in the main group during the study were investigated. When analyzing the first stage of coagulation hemostasis, 6 months after surgery, there was a tendency to prolong the APTT in the main and control groups. No differences were found between the groups, and all scores remained statistically significant short of the norm. In particular, the time of APTT in the plasma in patients of the main and control groups was shorter by 1.32 (R<0.05) and 1.27 (R<0.05) compared to the standard indicators. In 2nd degree obesity they are 1.29 (R<0.05) and 1.28 (R<0.05) times, and in 3rd degree obesity they are 1.34 (R<0.05) and 1.26 (R<0.05) was found to be short compared to standard indicators. The obtained results show that the tendency to hypercoagulability remains in the first stage of plasma hemostasis.

The parameters of the second stage of plasma hemostasis in the main and control groups were not significantly different from their pretreatment values after surgery. It was found that prothrombin time, PTI and INR shifted in the positive direction in hypercoagulable state observed in morbid obesity (Fig. 4).

A statistically significant decrease of 1.46 (R<0.05) and 1.34 (R<0.05) was observed in the main and control groups after 6 months of surgery, which represents the 3rd stage of coagulation hemostasis (Table 1). In the 2nd degree of obesity, fibrinogen content decreased by 1.35 (P<0.05) and 1.32 (P<0.05) times in the groups, compared to the values before treatment, while in patients with the 3rd degree of obesity, it decreased by 1.59 (P< 0.01) and 1.36 (P<0.01). Plasma fibrinogen content remained statistically significantly higher than that of the healthy donor group.

As we mentioned above, morbid obesity is accompanied by co-morbidities. They mainly include arterial hypertension, ischemic heart disease, osteoarthrosis (arthralgias) and reflux esophagitis. Of course, they can influence the course of morbid obesity, biochemical and hemostasiological indicators, and curative surgery. Therefore, our next task was to study the effect of comorbidities observed in morbid obesity. To do this, we divided the patients from the control and main groups into subgroups with comorbidities and those without.

Only 22 (24.1%) of the 92 patients in the control group did not have the above-mentioned comorbidities, and the remaining 70 (75.9%) patients had comorbidities (table 1). 11 (32.3%) of patients in the group without accompanying diseases had 2nd degree obesity, 6 (10.3%) had 3rd degree obesity. 23 (67.7%) of the remaining 70 patients with comorbidities of the control group had the 2nd degree of obesity, and 52 (89.7%) had the 3rd degree of obesity.

Table 1. Distribution of patients in the control and main groups according to the presence of comorbidities and degree of obesity

Groups	Total		Obesity Rate			
			2nd		3rd	
	n	%	n	%	n	%
control group, n=92						
Comorbidities-no	22	24,1	11	32,3	6	10,3
Comorbidities-yes	70	75,9	23	67,7	52	89,7
main group, n=95						
Comorbidities-no	29	31,5	11	28,2	7	12,5
Comorbidities-yes	66	69,5	28	71,8	49	87,5

Similar changes were also observed in the main group. In particular, 29 (31.5%) of those who did not have comorbidities, 66 (69.5%) of those who had comorbidities. In the group of patients without accompanying diseases, 2nd degree obesity was detected in 11 (28.2%) patients, while 3rd degree obesity was observed in 7 (12.5%) patients. In the group with concomitant diseases, 2nd degree obesity was detected in 28 (71.8%) patients, and 3rd degree obesity was detected in the remaining 49 (87.5%) patients.

The cited data showed that patients with concomitant diseases are characterized by a high incidence of severe morbid obesity.

Analyzing the frequency of comorbidities, we can see that genetic predisposition, arterial hypertension, reflux esophagitis, gallstone disease and chronic bronchitis are of high importance in aggravating morbid obesity. If we consider the effect of each of them, having a genetic predisposition activates the center of "ochopathy" in the brain, causing the leptin receptor to malfunction due to the mutation of the main genes that control the metabolism. In the development of arterial hypertension, not only the activation of the sympathetic-adrenal system and cortisol production, but also the development of hypercholesterolemia, the development of endothelin 1 production, and the development of systemic atherosclerosis are observed due to lipid metabolism disorders.

At the same time, hypercortisolemia observed in patients causes increased appetite and overeating. At the same time, we observed that in patients with morbid obesity, impaired lung ventilation leads to the development of interstitial pneumonia, respiratory failure, and the development of chronic hypoxia, which leads to the deterioration of the patient's condition. According to the opinion of many scientists, the above-mentioned accompanying diseases are not only caused by obesity, but also cause the origin and acceleration of obesity, that is, a "dangerous cycle" is formed. In our opinion, the combination of genetic predisposition, arterial hypertension, reflux esophagitis, gallstone disease and chronic bronchitis in morbid obesity can lead to disease progression.

In fact, we have proven its importance in the development of the main pathognomonic symptoms (nocturnal (sleep) apnea, decreased libido and depressive state) caused by obesity in patients with comorbidities. In particular, in patients with morbid obesity, if in the group without accompanying diseases, the incidence of apnea, decreased libido and depression is 11.5; It was observed in 7.7 and 11.5% of patients, 22.4 in the group with concomitant diseases; It was observed in 22.4 and 18.4% of cases, that is, it was 2-3 times higher. This leads to a decrease in the quality of life of patients, and the increase in depression causes the acceleration of bulimia.

In our study, arterial hypertension was detected in most (59.2%) patients with morbid obesity. According to the literature, the observation of arterial hypertension in morbid obesity is associated with increased synthesis of the factor that activates the renin-angiotensin-aldosterone system in adipocytes [15,16].

Arterial hypertension is characterized by "dangerous circulation" due to endothelial dysfunction and leads to various diseases in the vascular system (hemorrhagic and ischemic heart attacks and strokes). But arterial hypertension itself causes the development of atherosclerosis and obesity.

Our next task was to study the effect of co-occurrence of comorbidities on the results of surgery in morbid obesity. Re-examinations were carried out 1, 3, 6 and 12 months after surgery. Studies have shown that patients' TMI gradually decreases in all groups. As can be seen from the figure, primary TMI was slightly higher in the groups of patients with concomitant diseases in morbid obesity than in the control and main groups.

In the control group without comorbidities, after 6 months, TMI decreased from 36.63+1.24 to 27.91+0.77, and after 12 months, this indicator decreased to 26.22+0.66, i.e., it decreased 1.4 times. In the group with morbid obesity and concomitant diseases, TMI decreased from 42.87 + 1.04 to

31.73 + 0.82 by the 6th month, and to 28.43 + 0.59 after 1 year, that is, this decrease was 1.51 time. In the main group without comorbidities, after 6 months, TMI decreased from 41.71+1.49 to 30.86+1.08, and after 12 months, this indicator decreased to 27.91+0.72, i.e. 1.49 times. In the group with morbid obesity and concomitant diseases, TMI decreased from 43.56 + 0.99 to 31.53 + 0.63 by the 6th month, and to 28.34 + 0.48 after 1 year, that is, this decrease was 1.54 times.

It should be noted that comorbidity of morbid obesity in the control and main groups led to a gradual decrease. 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 (fig. 5). After 6 months, this indicator was found in 27.3 and 14.8% of patients, after 12 months - in the control group, it was found in 9.1% of patients, while in the main group, no increase in blood pressure was observed.

Therefore, surgical procedures used in the treatment of morbid obesity lead to a decrease not only in morbid obesity, but also in arterial hypertension. In this case, the surgical procedure we offer has shown to be more effective than the traditional one.

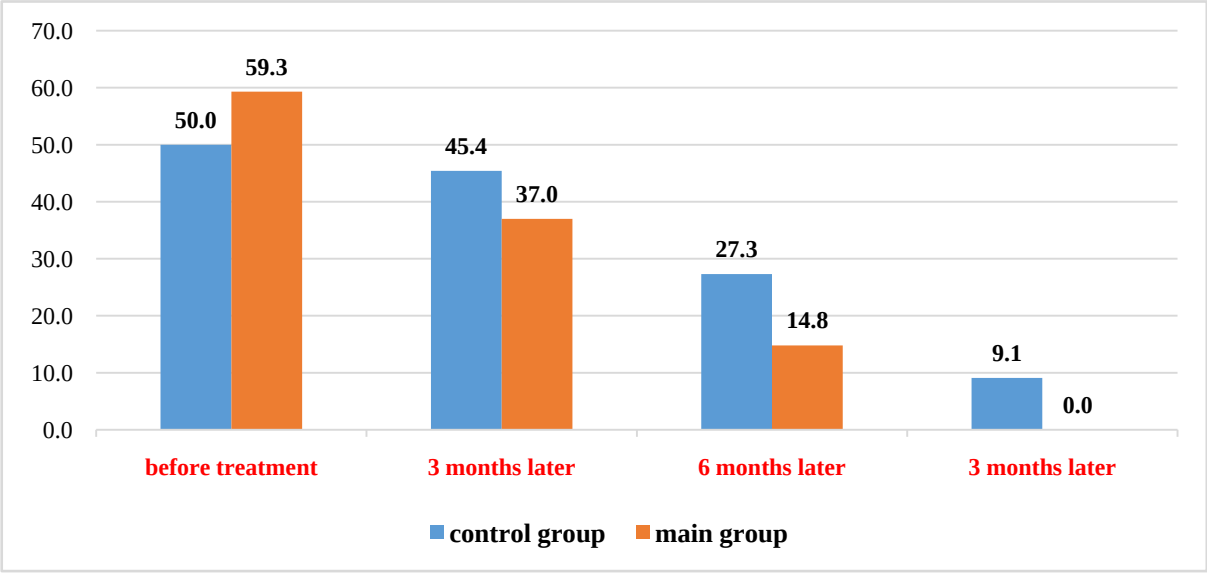

Figure 5. Dynamic changes in the incidence of concomitant arterial hypertension with morbid obesity in the control and main groups 3, 6 and 12 months after surgery

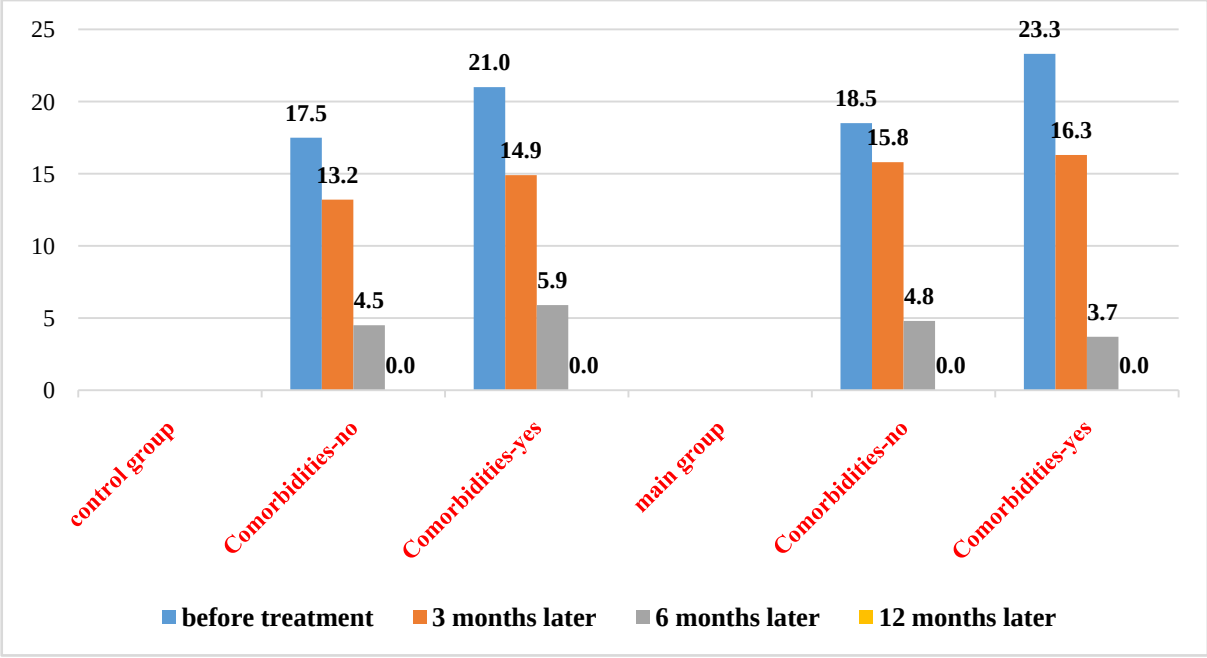

Figure 6. Dynamic changes in the incidence of arthralgia associated with morbid obesity in control and main groups 3, 6, and 12 months after surgery

At the same time, we also analyzed the occurrence of arthralgia, one of the concomitant diseases in morbid obesity (fig. 6). In particular, in the control group, arthralgia was detected in 17.5% of patients in the group without concomitant diseases, 13.2% after 3 months of surgery, 4.5% after 6 months, and not detected after 12 months. In the control group with morbid obesity, arthralgia was detected in 21% of patients, after 3 months in 14.9%, after 6 months in 5.9% of patients, and after 12 months, this complaint was not detected in patients.

In the main group, arthralgia was not observed with accompanying diseases, and 18.5 and 23.3% of the patients of the combined groups had arthralgia, which decreased after 6 months and 4.8 and 3.7% were observed after 12 months, and this clinical sign was not detected after 12 months.

So, 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.

As we noted above, the main pathognomic complications caused by obesity are high and lead to a decrease in the quality of life of patients. Indeed, in the control group without concomitant diseases, decreased libido, depression was not observed, apnea was observed in 9.3%, reflux esophagitis was observed in 28.6% of patients (table 2). Reflux esophagitis did not change after conventional surgery and remained in 28.6% of patients. Decreased libido, depression, apnea, and reflux esophagitis in the control group with accompanying diseases in morbid obesity 22.7; 18.2; It was found in 22.7% and 27.3% of patients, 2.49 after surgery; 3.95; 2.49 and decreased by 2 times to 9.1; 4.6; 9.1 and 13.6% of patients were preserved.

Table 2. The effect of surgery on the main pathognomonic symptoms caused by obesity (%)

Comorbidities	libido	depression	apnea	Reflux esophagitis
control group, n=92				
no, n=22	0,0 0,0	0,0 0,0	9,3 3,1	28,6 28,6
yes, n=70	22,7 9,1	18,2 4,6	22,7 9,1	27,3 13,6
main group, n=95				
no, n=29	10,5 0,0	15,8 0,0	15,8 5,3	31,6 0,0
yes, n=66	22,2 7,4	18,5 3,7	22,2 3,7	25,9 7,4

Note: the figure shows the results before the treatment, the denominator shows the results after the treatment.

Decreased libido, depression, apnea and reflux esophagitis in the main group without comorbidities 10.5; 15.8; observed in 15.8 and 31.6% of patients. The proposed surgery resulted in complete resolution of her libido, depression, and reflux esophagitis symptoms. Apnea decreased 3 times and remained in 5.3% of patients. In morbid obesity, concomitant diseases include decreased libido, depression, apnea, and reflux esophagitis 22.2; 18.5; It was found in 22.2% and 25.9% of patients, after surgery 3; 5; 6 and 3.5 times decreased to 7.4; 3.7; 3.7 and 7.4% of patients were preserved. The proposed surgical procedure effectively eliminated the pathognomonic symptoms of obesity compared to the indicators of the control group.

3. Conclusions

1. After 6 months of bariatric treatment, total cholesterol, cholesterol in LDLs, atherogenic coefficient, and especially triglycerides decreased, cholesterol increased in HDLs, and such positive changes were clearly identified in the main group of patients. If hypo-a-lipoproteinemia, type IIb of dyslipidemia and type IV of dyslipidemia were not detected after the proposed method, hypo-a-lipoproteinemia was not detected in the control group, type IIb of dyslipidemia remained in 8.9%, and type IV of dyslipidemia remained in 2.2% of patients left.
2. As a result of the corrective effect of gastric longitudinal resection on existing metabolic indicators in patients suffering from morbid obesity, it improves the course of patients in the early period and concomitant diseases, and has a positive effect on the clinical course of not only prediabetes, but also diabetes.
3. Significant statistically significant positive changes were observed in the 1st and 3rd-stages of coagulation hemostasis after longitudinal resection of the stomach compared to the hemostasis parameters of the control group. Surgery performed in the main group showed that the treatment was effective regardless of the degree of obesity in patients.
4. In morbid obesity, the combination of concomitant diseases (arterial hypertension, reflux esophagitis, gallstone disease and chronic bronchitis) leads to a high incidence of severe obesity, a 2-3 times increase in the development of pathognomic symptoms, and the formation of a "dangerous circulation".
5. In morbid obesity, the addition of concomitant diseases leads to further deepening of metabolic disorders, increased changes in blood vessels and the development of serious complications for the patient's life.

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