

The Effectiveness of Modified Methods of Bariatric Surgery in Patients with Metabolic Syndrome on the Background of Gastroesophageal Reflux Disease

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Abstract A comparative assessment of long-term treatment results showed that, thanks to the use of our modified HDL in patients with metabolic syndrome with GERD, it increased the frequency of "excellent" results from an average of 11.1% to 23.3% of cases (2.1 times), and "good" results from 22.2% to 50% (2.25 times), completely avoid cases with "unsatisfactory" results of treatment of this disease, as well as reduce the frequency of repeated hospitalizations to the clinic by 3.9 times, and the number of bed days - by 3 times, which indicates an improvement in the results of treatment of patients, an increase in life expectancy and a reduction in the duration of disability.

Keywords Metabolic syndrome, Gastroesophageal reflux disease, Bariatrics

1. Introduction

WHO epidemiological research data clearly demonstrate that the development of obesity and MS have a direct impact on the development of GERD [10].

Worldwide, there is a progression of GERD and complications associated with the progression of this disease. It is developing with an exponentially growing problem of obesity [1,3].

Obesity, associated specifically with its abdominal form, which is the main component of MS, leads to the development of GCD primarily due to the presence of both intraabdominal and intragastric hypertension [2,4,6].

Bariatric surgery is currently one of the progressive methods of treating obesity and MS [5,7].

In this regard, laparoscopic longitudinal gastric resection is an important assessment of the effectiveness of widely used methods of surgical treatment of MS [3,5,10].

However, to date, such aspects of bariatric surgery as the effectiveness of breast cancer remain unexplored both in the presence of metabolic syndrome and gastroesophageal reflux disease [8,9].

One of the unresolved problems of bariatric surgery is the problem of gastroesophageal reflux [1,4]. Both acid GERD and alkaline (biliary) gastroesophageal reflux pose significant risks [4,9]. On the one hand, a decrease in body weight, volume of food consumed, intra-abdominal pressure, normalization

of anatomical relationships in the upper abdominal cavity helps to reduce the reflux of gastric contents into the esophagus [8,9]. On the other hand, elimination of the angle of His, a sharp decrease in the gastric reservoir, creation of a high gastroenteroanastomosis creates additional conditions for reflux into the esophagus of both acidic gastric and alkaline intestinal contents, mainly in the form of bile and trypsin. GERD most often develops (or persists) after SG, which is explained by the volume and type of intervention (reduction of the gastric reservoir against the background of destruction or deformation of the angle of His, increased intraluminal pressure) [2,3,4]. Bypass operations are considered more preferable in this regard. However, despite these advantages, concerns are expressed regarding the high risk of bile reflux gastritis and reflux esophagitis, which in turn increases the incidence of esophageal cancer [6,7]. Initially, the reason for this was seen as the formation of a single alimentary loop according to Bilroth II [1,20]. The works of the author of the technique R. Rutledge and his followers have proven that the correct and methodically reproduced original technique of performing MGB-OAGB is a fundamental mechanism for preventing and reducing the incidence of this complication [1,18,19]. Many surgeons offer additional options, such as the application of a spur to the adductor part of the small intestine, to prevent biliary reflux [1,16,17]. According to Salama et al., in a study of 50 cases of MGB-OAGB 18 months after surgery using fibrogastroscopy with biopsy and 24-hour pH-metry, reflux esophagitis was detected in 3 cases (6%), of which 2 cases (4%) had acid reflux and 1 case (2%) had biliary reflux. No endoscopic signs of dysplasia or metaplasia

were detected [2,14,15]. Saarinen et al., using hepatobiliary scintigraphy to study the frequency and causes of biliary reflux, found that 55.5% of patients in the study who underwent MGB-OAGB had transient bile reflux detected only in the distal part of the gastric stump, which is relatively physiological, and no reflux of bile contents into the esophagus was recorded [1,2,11,12,13].

Thus, the study of the frequency and causes of biliary reflux after MGB-OAGB, as well as the development of methods to protect against the entry of bile contents into the small ventricle and, most importantly, into the esophagus, are relevant.

The purpose of the study: improvement of the results of laparoscopic longitudinal gastric resection in patients with metabolic syndrome on the background of gastro-esophageal reflux disease.

2. Material and Methods

The clinical material consisted of 120 patients with MS on the background of GERD who were treated and examined at the multidisciplinary clinic of the Tashkent Medical Academy in 2020 to 2023. All patients were divided into 2 cohort groups: the control group (60 patients) who were treated and examined from 2020 to 2021 and the main group (60 patients) who were treated and examined from 2022 to 2023.

The main difference between the patients of the control and the main groups was that in the patients of the control group, we used the traditional version of laparoscopic longitudinal gastric resection as a variant of bariatric surgery, and in the patients of the main group, we developed a modified laparoscopic longitudinal gastric resection, which provided for the creation of conditions that would eliminate the possibility of developing gastroesophageal reflux disease in patients with metabolic a syndrome. Female patients prevailed (74.2%), with an average age of 37.7 ± 7.85 years.

To identify MS patients, anthropometric research methods were performed (measurement of the patient's weight (kg); measurement of the patient's height (m); calculation of body mass index (≥ 30 kg/m²); measurement of waist circumference (cm); measurement of hip circumference (cm). To identify MS patients, anthropometric research methods were performed (measurement of the patient's weight (kg); measurement of the patient's height (m); calculation of body mass index (≥ 30 kg/m²); measurement of waist circumference (cm); measurement of hip circumference (cm); calculation of the waist/hip circumference ratio (units)), clinical and laboratory studies (measurement of blood pressure (BP $\geq 140/90$ mmHg), as well as determination of blood levels of triglycerides (≥ 1.7 mmol/L), high-density lipoprotein cholesterol (< 1.0 mmol/L), lipoprotein cholesterol low density (> 3.0 mmol/L), fasting glycemia (> 6.1 mmol/L) and after carbohydrate loading (from 7.8 mmol/L to 11.1 mmol/L). In

the presence of obesity and 2 or more clinical and laboratory signs, the diagnosis of metabolic syndrome was established.

Diagnosis of GERD was carried out by conducting: clinical research methods: characteristic complaints were the presence of heartburn, acid regurgitation, which occurred more often after eating and when the patient's body position changed (when the torso was tilted), as well as at night; cardiac, pulmonary, otorhinolaryngological and gastric symptoms were characteristic of extraesophageal forms; X-ray contrast studies esophagus; endoscopic examination of the esophagus; daily monitoring of esophageal pH; functional examination of the distal esophageal sphincter.

The immediate results of treatment were evaluated according to our improved methodology ("Scale for evaluating the immediate results of bariatric surgery in patients with metabolic syndrome on the background of gastroesophageal reflux disease", by gradating the indicators into "excellent", "good", "satisfactory" and "unsatisfactory". The assessment scale included: the class of postoperative complications, which was determined by the Clavien-Dindo method (2004); fasting glycemia level; total cholesterol level; triglyceride level; low-density lipoprotein level; the level of systolic blood pressure; the severity of clinical signs of gastroesophageal reflux disease and the data of endoscopic examinations, which were carried out strictly according to personalized indications.

The evaluation of long-term results of bariatric surgery in patients with metabolic syndrome on the background of gastroesophageal reflux disease was carried out in a comprehensive program format according to the method we developed: "Scale for evaluating long-term results of bariatric surgery in patients with metabolic syndrome on the background of gastroesophageal reflux disease". The evaluation of long-term results of bariatric surgery in patients with metabolic syndrome on the background of gastroesophageal reflux disease was carried out in a comprehensive program format according to the method we developed: "Scale for evaluating long-term results of bariatric surgery in patients with metabolic syndrome on the background of gastroesophageal reflux disease", characterized by the inclusion of specific criteria of).

The immediate results of treatment of patients with metabolic syndrome on the background of gastroesophageal reflux disease were evaluated in dynamics on 3, 7, 14 and 30 days after the surgical period, and the long-term results of treatment of patients were evaluated in dynamics 3, 6 and 12 months after the surgical period.

The reliability of the differences between the samples, which were close to the norm in terms of distribution, was determined by the Student's parametric criterion with a 95% reliable probability interval. The criterion of statistical reliability of the obtained conclusions was considered to be the generally accepted value in medicine, $p < 0.05$.

3. The Results and Their Discussion

The analysis of studies in patients of the control group revealed an improvement in the glycemic profile of the blood.

The glucose concentration in the postoperative period gradually decreased from 6.5 to 2.2 mmol/l on the 3rd day of the postoperative period to 5.4 to 0.3 mol/l on the 30th day of the postoperative period ($p < 0.05$).

Later, in the long-term period after surgery, patients in the control group showed a statistically significant decrease in blood glucose levels, but not as dynamically as in the early postoperative period. The same results were obtained in other studies, where there was a significant decrease in blood glucose and a decrease in insulin resistance in HOMA-IR.

The improvement of the carbohydrate system after LPH is closely related to weight loss and adipose tissue. Recent studies show that changes in carbohydrate metabolism occur a few days after breast cancer.

We believe that this is caused by neurohormonal changes in the digestive tract. Resection of most of the stomach leads to the removal of ghrelin-producing cells (mainly on the fundus). According to studies, ghrelin levels decrease by about 40-50% compared to preoperative levels.

Reducing ghrelin concentration reduces appetite, lowers glucose levels, increases insulin secretion, and improves insulin resistance.

An additional mechanism explaining the process of improving carbohydrate metabolism is the regulation of hormones called incretins. The effect of bariatric procedures on glucose normalization is explained by the hindgut hypothesis, according to which the contents of the digestive system come into contact with the large intestine faster, which leads to increased secretion of GLP-1 and PYY. The physiology of this process has been studied in LVHR, but it is still unclear in LVHR.

We have not identified significant differences in the frequency of clinical signs of GERD. Subsequently, starting from the 14th day of the postoperative period, the clinical signs of GERD return to the initial statistical level of the preoperative period. All this may directly indicate the low effectiveness of traditional breast cancer in patients with MS on the background of GERD, even with the use of cranoraphy and antireflux position of the stomach.

We believe that it should be noted that unfortunately, we have not been able to fully solve the problem in the treatment of GERD under the conditions of using traditional prostate cancer.

In the postoperative period, 69 postoperative complications were noted, which accounted for an average of 1.15 pathologies per 1 patient. This was due to a combination of several complications in the same patient.

According to the medical history, 9 types of postoperative complications were identified in the control group of patients. At the same time, according to the Clavien-Dindo classification, 3 (33.4%) pathologies were in class I, 4 (44.4%) pathologies in class II and 2 (22.2%) pathologies in class III-A.

Paroxysmal atrial fibrillation (class II, 15 cases – 21.7%), exacerbation of chronic laryngitis (class II, 11 cases – 15.9%), postoperative wound hematoma (class I, 9 cases – 13%), saphenous vein thrombophlebitis (class II, 8 cases – 11.6%), bronchopneumonia (class II, 7 cases – 10.1%), exudative

pleurisy (class III-A, 7 cases – 10.1%), inflammatory infiltrate of the wound (class I, 5 cases – 7.2%), seroma of the wound (class I, 5 cases – 7.2%) and acute urinary retention (III-A class, 2 cases – 2.9%).

Thus, an analysis of the dynamics of changes in the incidence of postoperative complications showed that in patients of the control group, after the use of traditional breast cancer, complications with a direct or indirect connection with GERD prevailed throughout the study (up to 30 days). It should be noted here that in this case, first of all, we are talking about extraesophageal forms of GERD. Cardiological and otorhinolaryngological forms of the lesion, which in the postoperative period were manifested by rhythm disturbances and exacerbation of chronic laryngitis. Subsequently, it was these patients who, due to the prevailing favorable conditions, developed bronchopneumonia against the background of damage to the vagus nerve and larynx, and in severe cases, exudative pleurisy.

Overall, an assessment of the effectiveness of traditional laparoscopic longitudinal gastric resection in patients with MS with GERD revealed low values of "excellent" and "good" treatment outcomes both in the immediate (9.6% and 22.5%) and in the long-term (11.1% and 22.2%) postoperative treatment periods due to the high the frequency of postoperative complications (in the early period up to 1.15 units per 1 patient) and recurrence of GERD. All this required repeated hospitalizations of patients to the clinic with an extension of treatment time (up to 15 days), which indicates a decrease in the patients' life expectancy while maintaining the components of MS.

The listed reasons for the unsatisfactory treatment results of patients in the control group may indicate the need for more effective solutions to the surgical problem associated with the technical side of performing breast cancer.

The modification of the LVL was based on the principle of creating an anti-reflux cuff, which, along with the techniques of creating an anti-reflux position of the stomach, would block the flow of gastric contents into the esophageal cavity.

The LPRF we modified was performed as follows: At the first stage, access to the abdominal cavity was carried out by installing trocars. After the revision of the abdominal organs, access was made to the omentum sac, with the mobilization of the stomach along the large curvature and along the gastro-diaphragmatic ligament. After installing an intragastric calibration probe 36 Fr, sleeve resection of the stomach was performed along it using a suturing device. After achieving hemostasis of the stapler line, anterior and then posterior crorography was performed. Next, the free part of the large omentum was mobilized on a vascular pedicle of sufficient length to be transferred to the diaphragmatic surface of the abdominal cavity. Using the mobilized part of the large omentum, a cuff was formed around the abdominal part of the esophagus. This cuff from the large omentum was tightly sewn around the abdominal part of the esophagus on a calibration probe 36 Fr. The subsequent stages of the operation were standard: drainage of the abdominal cavity, removal of the severed part of the stomach and suturing of trocar

wounds.

In general, it can be noted that the optimal option for laparoscopic longitudinal gastric resection in patients with metabolic syndrome with gastroesophageal reflux disease is a technically feasible option for creating an anti-reflux position of the stomach with the formation of an anti-reflux cuff around the abdominal part of the esophagus by tightly stitching the mobilized part of the large omentum on the calibration probe 36 Fr.

On the 3rd day of the postoperative period, positive treatment results were found to be "excellent" in 4 (6.7%) and "good" in 14 (23.3%) patients. After another 3 days, these indicators increased to 5 (8.3%) and 22 (36.7%), respectively. Evidence of the presence of positive postoperative dynamics should be considered a decrease in "unsatisfactory" treatment results from 19 (31.7%) cases on the 3rd day of the postoperative period to 1 (1.7%) cases on the 7th day, respectively.

On the following day of the postoperative period, the leaders were "excellent" (58.3% of cases on the 30th day of the postoperative period) and "good" (73.3% of cases on the 14th day of the postoperative period).

A total of 44 cases of postoperative complications were reported in the main group of patients. On average, there were 0.73 postoperative complications per 1 patient in the main group, which was 1.6 times less than among patients in the control group ($p < 0.05$).

In the comparative aspect, a certain mechanism of development of a number of postoperative complications was established, which were directly related to extraesophageal forms of GERD in patients of the control group. In particular, the incidence of acute laryngitis and, subsequently, bronchopneumonia and exudative pleurisy were on average 2.28 times higher among patients in the control group. This also includes the difference in the incidence of cardiac arrhythmias (1.9 times higher in patients in the control group) associated with vagus nerve irritation and the effects of the cardiogenic form of GERD and its continuation.

We intentionally state this fact, since the use of modified HDL in patients of the main group led to a decrease in the incidence of such postoperative complications, which is proof of the effectiveness of our improved method of BO in patients with MS on the background of GERD.

During the 30-day postoperative period, we revealed a tendency towards normalization of laboratory parameters of carbohydrate and lipid metabolism. There was a decrease in fasting glycemia from 6.9 to 2.13 mmol/l on the 3rd day of the postoperative period to 5.8 mmol/l on the 30th day ($p < 0.05$); total blood cholesterol from 6.1 mmol/l to 3.9 mmol/l ($p < 0.05$); triglycerides from 1.8 mmol/L to 0.18 mmol/L ($p < 0.05$) and LDL cholesterol from 3.1 mmol/L to 2.16 mmol/L ($p < 0.05$).

Signs of GERD in the postoperative period were noted in 97 cases, and on average there were 0.4 signs of the disease per 1 patient, which was 3.2 times less than among patients in the control group.

A decrease in the clinical signs of MS on the background of GERD in patients of the main group led to a reduction in

the number of inpatient hospital stays after modified breast cancer to an average of 7.2 and 2.2 bed days, which was 2.3 times less than in patients of the control group.

Thus, a comparative assessment of the immediate treatment results showed that, thanks to the use of our modified laparoscopic longitudinal gastric resection in patients with metabolic syndrome on the background of gastroesophageal reflux disease, it increased the frequency of "excellent" results from an average of 9.6% to 24.2% of cases, that is, 2.5 times, "good" results – from 22.5 to 42.9%, that is, by 1.9 times, and to reduce the frequency of "unsatisfactory" treatment results for this disease from 17.9% to 8.3%, that is, by 2.2 times. The use of modified LVH made it possible in the early postoperative period, by improving the condition of patients, to reduce the number of inpatient bed days from 16 to 7.2 bed days, that is, 2.3 times.

An analysis of the results on body weight changes in patients in the main BAROS-1 group over the long-term period after modified breast cancer showed that after 3 months 75% of patients had %EWL (0-24), 14 patients had %EWL (25-49), and 1 patient had %EWL (50-74). 6 months after surgery, 2 patients had weight loss at the level of %EWL (75-100), 31 patients – at the level of %EWL (50-74), 21 patients – at the level of %EWL (25-49) and 6 patients – at the level of %EWL (0-24). 12 months after surgery, 49 patients already had a weight loss rate of %EWL (75-100), which was significantly higher than among patients in the control group and may indicate the intensity of the processes occurring in the postoperative period.

Thus, a comparative assessment of the effectiveness of modified HDL in terms of body weight dynamics revealed a more intensive weight loss process among patients in the main group, which led to a decrease in the number of obese patients and, consequently, with MS.

During the entire long-term period after modified BPH, we did not notice any deterioration in the course of MS and GERD among patients in the main group. Clinical signs of GERD and laboratory signs of MS persisted in 6.7% of patients in the main group only after 3 months of the postoperative period, which was 3.7 times less than among patients in the control group ($p < 0.05$).

In the remaining periods of the study after modified breast cancer, we no longer noted such cases among patients in the main group, whereas among patients in the control group they were registered after another 6 (18.3%) and even 12 (6.7%) months after breast cancer.

Thus, the analysis carried out and the clinical examples provided indicate that the use of the modified HDL developed by us against the background of achieving positive results with respect to both MS and GERD.

The use of the BAROS-3 questionnaire, which in its average value showed a significant increase in all parameters of the quality of life of patients after the use of modified breast cancer compared with patients with traditional methods of surgery.

In the main group of patients, repeated hospitalization of patients to the clinic due to a deterioration in the condition of

patients was in isolated cases, and was more associated with the effects of GERD (nausea, frequent vomiting, the need for infusion therapy) with an average inpatient treatment of 5.2 bed days, whereas On average, patients in the control group were re-admitted to the clinic 3.1 times, which led to an increase in the average value of inpatient treatment to 15.6 bed days with an extension of disability and quality of life.

Thus, a comparative assessment of long-term treatment results showed that due to the use of our modified HDL in patients with metabolic syndrome on the background of GERD, it allowed to increase the frequency of "excellent" results from an average of 11.1% to 23.3% of cases (2.1 times), "good" results - from 22.2% to 50% (in 2.25 times), completely avoid cases with "unsatisfactory" results of treatment of this disease, as well as reduce the frequency of repeated hospitalizations to the clinic by 3.9 times, and the number of beds-days - by 3 times, which indicates an improvement in the results of treatment of patients, an increase in life expectancy and a reduction in the duration of disability.

4. Conclusions

1. The reasons for the unsatisfactory treatment results of patients after the use of traditional laparoscopic longitudinal gastric resection, characterized by low values of "excellent" and "good" treatment results, both in the immediate (9.6% and 22.5%, respectively) and in the long-term (11.1% and 22.2%) periods, are the development of a high incidence of postoperative complications (up to 1.15 units per 1 patient) and recurrence of gastroesophageal reflux disease. All this required repeated hospitalizations of patients to the clinic (an average of 3.2 ± 0.9 times) with an extension of treatment time (up to an average of 15.6 ± 0.3 bed days), which in turn caused a decrease in the quality of life of patients against the background of the preservation of the components of the metabolic syndrome.
2. The best option for laparoscopic longitudinal gastric resection in patients with metabolic syndrome on the background of gastroesophageal reflux disease is a technically feasible option for creating an anti-reflux position of the stomach with the formation of an anti-reflux cuff around the abdominal part of the esophagus by tightly stitching the mobilized part of the large omentum on the calibration probe 36 Fr.
3. The use of modified laparoscopic longitudinal gastric resection in patients with metabolic syndrome on the background of gastroesophageal reflux disease improved the results of immediate treatment results in the form of an increase in the frequency of "excellent" results from an average of 9.6% to 24.2% of cases, that is, 2.5 times, "good" results – from 22.5% to 42.9%, that is, by 1.9 times, and also to reduce the frequency of "unsatisfactory" treatment results from 17.9% to 8.3%, that is, by 2.2 times. The effectiveness of the

modified laparoscopic longitudinal gastric resection made it possible in the early postoperative period to reduce the number of inpatient bed days from 16.6 ± 3.5 to 7.2 ± 2.2 bed days, that is, by 2.3 times.

4. The use of modified laparoscopic longitudinal gastric resection in patients with metabolic syndrome on the background of gastroesophageal reflux disease improved the results of long-term treatment results in the form of an increase in the frequency of "excellent" results from an average of 11.1% to 23.3% of cases, that is, 2.1 times, "good" results - from 22.2% to 50%, that is by 2.25 times, to completely avoid cases with "unsatisfactory" results of treatment of this disease, as well as to reduce the frequency of repeated hospitalizations to the clinic by 3.9 times, and the number of beds-days - by 3 times, which indicates an improvement in the results of treatment of patients, an improvement in the quality of life and a reduction in the duration of disability.

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