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# GASTROESOPHAGEAL REFLUX DISEASE AFTER SLEEVE GASTROPLASTY IN CLINICAL PRACTICE: A LITERATURE REVIEW

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Denis Melnikov<sup>1</sup> , Harutyun Abovyan<sup>2</sup>,  
Aram Sarkisyan<sup>2</sup>, Aleksandr Rogut<sup>2</sup> ,  
Vera Lyapina<sup>2</sup>, Vyacheslav Mykhaylichenko<sup>3</sup> ,  
Dmitry Parshin<sup>4</sup> 

<sup>1</sup> RZD-Medicine Clinical Hospital, Rostov-on-Don, Russia

<sup>2</sup> Rostov State Medical University, Rostov-on-Don, Russia

<sup>3</sup> S.I. Georgievsky Medical Academy, Simferopol

<sup>4</sup> Astrakhan State Medical University, Astrakhan, Russia

✉ [parshin.doc@gmail.com](mailto:parshin.doc@gmail.com)

**ABSTRACT** — This article focuses on the most effective and reliable method of obesity treatment — bariatric surgery. Laparoscopic sleeve gastrectomy is one of the most popular methods, due to which patients eat less food, thanks to a decrease in stomach volume as well as some humoral mechanisms. The most common complication of laparoscopic sleeve gastrectomy is gastroesophageal reflux disease. In this article, the authors offer a literature review, which presents data on the etiology, pathogenetic mechanisms, as well as modern and advanced methods of diagnosis and treatment of gastroesophageal reflux disease after laparoscopic sleeve gastrectomy.

**KEYWORDS** — laparoscopic sleeve gastrectomy; morbid obesity; gastroesophageal reflux disease; endoscopic antireflux treatments for GERD; cruroplasty.

The increasing prevalence of obesity is associated with an increase in the incidence of the complications of this condition. The most common diseases associated with obesity are type 2 diabetes mellitus, arterial hypertension, pathology of the musculoskeletal system, sleep apnea syndrome, varicose veins of the lower extremities. There is also evidence of an increased risk of developing gastroesophageal reflux disease (GERD) in obese patients [1]. Conservative treatments (low calorie diet and exercise) have been used successfully for weight loss over a long period of time. However, despite initial weight loss, as a rule, of 5% to 10% in the first 6 months, most of the weight is recovered. Various drugs, like orlistat, lorcaserin and phentermine, can in some cases be an alternative to diet and exercise, but they have a significant risk of side effects (pulmonary hypertension, valvulopathy, etc.) without significant weight loss and long-term improvement in metabolic

syndrome [2]. Bariatric surgery has proven to be worthwhile and is recommended for obese patients with BMI (body mass index) above 40 or above 35 with concomitant diseases (metabolic syndrome, type 2 diabetes mellitus, non-alcoholic fatty liver disease, hyperlipidemia and hypertension, sleep apnea) [3]. Currently, the following methods of surgical treatment of obesity are widely used: intragastric balloon placement; gastric banding; Roux-en-Y gastric bypass; biliopancreatic diversion (SADI); mini gastric bypass; laparoscopic sleeve gastrectomy [4].

Intragastric balloon placement and gastric banding have a large number of side effects with relatively low efficacy in terms of weight loss and lasting result. The main disadvantage of these techniques is the lack of neurohumoral changes, which can achieve a greater effect in the treatment of obesity and affect the complications of this disease. Complications of bypass surgery can be divided by the time of occurrence into early (occurring in the first 30 days after surgery) and distant. The most common early complications observed in patients are staple line failure and intra-abdominal bleeding. Distant complications include GERD, dumping syndrome, and gastric stump stenosis [5].

Laparoscopic sleeve gastrectomy (LSG) is gaining traction as a bariatric procedure with proven efficacy for weight loss and obesity-related diseases [6]. LSG is becoming more widespread due to its effectiveness in terms of combination of restrictive and hormonal effects [7]. The stomach after LSG has a significantly lower volume than normal, which can significantly reduce the amount of food consumed (and therefore calories). In addition, the fundus cells that produce ghrelin are removed, which leads to a decrease in appetite [6]. Some data published by Chopra et al. showed a high percentage of resolution of concomitant diseases: 84% for diabetes mellitus, 49.99% for hypertension, 90% for asthma, 90.74% for obstructive sleep apnea [8]. Another advantage of this operation is its relative technical simplicity.

Many authors believe that LSG also has a number of complications, the most common of which is gastroesophageal reflux disease. According to other data, the incidence of this pathology after performing LSG reaches 27%. However, it should be noted

that postoperative GERD has a multifactorial nature. Cases of persistent remission of GERD in 25% after LSG have also been described [9, 10]. GERD is a rather serious pathology that leads to a large number of complications: reflux esophagitis, esophageal strictures, peptic ulcers of the esophagus, metaplasia of the mucous membrane (Barrett's esophagus), adenocarcinoma. DuPree CE et al. analyzed the effect of LSG on patients with GERD and compared the results with gastric bypass surgery (GB). Of the 4832 patients who underwent LSG, 44.5% had pre-existing GERD. 84.1% of them persisted with GERD symptoms after LSG, and only 15.9% had resolution of GERD. In LSG without symptoms of GERD before surgery, 8.6% developed de novo GERD after surgery. In comparison, GB resolved GERD in the majority of patients (62.8%) within 6 months after surgery ( $P < 0.001$ ) [11]. Another study by Rebecchi F et al. in 71 patients showed that LSG improves symptoms and controls reflux in the majority of morbidly obese patients with preoperative GERD, but the cohort was small. DeMeester and total acidity (% pH <4) decreased from  $39.5 \pm 16.5$  to  $10.6 \pm 5.8$ ,  $P < 0.001$ ; % pH <4 from  $10.2 \pm 3.7$  to  $4.2 \pm 2.6$ ,  $P < 0.001$ , and de novo symptoms of GERD were observed in 5.4% of patients [11, 12, 13].

The clinical picture and diagnosis of GERD after LSG has no significant features. The diagnosis of GERD is established on the basis of typical clinical manifestations (heartburn and belching), supported by the response to empiric therapy with proton pump inhibitors (PPIs) [14]. Presence of corresponding symptoms (dysphagia, weight loss, anemia), atypical manifestations (chest pain, laryngeal symptoms) or lack of response to empiric PPI therapy require endoscopic examination with biopsy [15]. In addition, manometry, 24-hour pH monitoring and pH impedancemetry can be used to confirm the diagnosis and exclude other pathologies.

It has been proven that obesity is an independent risk factor for GERD development associated with mechanical changes in the gastroesophageal junction due to excessive relaxation of the lower esophageal sphincter and, as a consequence, return of food into the esophagus [16]. It is also known that overweight patients have an increase in the gradient of intra-abdominal pressure and intragastric pressure during the inspiratory phase, which influences the occurrence of persistent reflux [17]. According to the authors Edoardo Savarino et al., in patients with morbid obesity, in 70% of cases, there is a deterioration in esophageal motility due to the failure of the esophageal-gastric sphincter [18], which also leads to the appearance of GERD and reflux esophagitis. This may be due to the

presence of a hiatal hernia. Some studies have shown that in patients with pre-operative GERD, after LSG, symptoms intensified; and in patients without signs of GERD, in the preoperative period, the first symptoms (heartburn, belching) appeared after surgery [19]. Hanaa Dakour Aridi et al. report that 73% of patients undergoing LSG developed lower esophageal sphincter insufficiency due to resection of a part of the muscle fibers during the surgery. Also, during the formation of the gastric *sleeve* it may be excessively narrowed, intragastric pressure increases and, as a result, motility of the stomach and lower esophagus is impaired [20]. In this regard, some authors believe that a timely transition from LSG to Roux-en-Y gastric bypass is the best option when choosing a tactic for GERD control.

In order to prevent postoperative GERD in bariatric patients, careful selection of LSG candidates is recommended (contraindications are large hiatal hernia, severe esophagitis, or severe long-term symptoms of GERD) as well as careful adherence to the surgery technique in combination with posterior cruroplasty (simple or reinforced). This guarantees efficacy with an overall relapse rate of 10.7% over 5 years. According to Cristian Eugeniu Boru et al. [21], the outcomes of LSG combined with posterior cruroplasty were satisfactory in all patients. The general trend confirms that reinforced cruroplasty is highly effective in a specific subgroup of patients with a "moderate" hiatus defect (4 to 8 cm<sup>2</sup>), without the side effects or complications associated with the use of a fully absorbable synthetic mesh. At the same time, an acceptable rate (80%) of GERD symptom control has been achieved with regression in relation to short-term results, while no patient had a single case of Barrett's esophagus after 60 months on EGD. The selection of patients for LSG should be patient-specific, taking into account all individual characteristics. To date, there are publications on new antireflux surgeries and modifications in obesity surgery. For example, da Silva et al. describe Sleeve-Collis-Nissen Laparoscopic Gastropasty (LSCNG), a relatively new, technically feasible operation with a low incidence of related complications [22]. However, further prospective studies are needed to assess the real impact of this and a range of other treatments on improving GERD symptoms.

In order to reduce the severity of symptoms and improve the quality of life, a lifestyle change is recommended at the first stage of treatment. However, it is important to note that most studies have shown insufficient effectiveness of lifestyle and dietary changes in GERD [23, 24]. It has been shown that the elevated position of the head end of the bed reduces the effect of acid on the esophageal mucosa and the speed of pas-

sage through the esophagus, followed by a decrease in GERD symptoms [25]. In addition, it is recommended to minimize or eliminate factors affecting the incidence of transient lower esophageal sphincter relaxation.

These include smoking, excessive alcohol consumption, heavy dinner, nighttime snacks, and high levels of fat in the diet. In addition, all patients with GERD should avoid non-steroidal anti-inflammatory drugs (NSAIDs) because of their role in impairing the physiological mechanisms of mucosal defense.

Drug therapy for GERD aims to reduce symptoms and minimize mucosal damage from acid reflux. Although acid suppression is a successful strategy in the treatment of GERD, there appears to be no clear association between the severity of GERD and high gastric acid levels, with the exception of Zollinger-Ellison syndrome [26]. Major acid suppressants include proton pump inhibitors (PPIs) and H<sub>2</sub> blockers. H<sub>2</sub> blockers reduce gastric acid secretion by inhibiting mast cell histamine stimulation. PPIs reduce the amount of acid released from the parietal cells into the stomach lumen. H<sub>2</sub> blockers have been shown to have some symptomatic benefits over placebo, but PPIs are the most effective in persons without contraindications [27]. There is no clear role of prokinetic agents, such as metoclopramide, in the treatment of GERD [28]. PPIs are the most effective class of antacids. They should be taken once or twice a day 30–60 minutes before meals. Most patients experience recurrence of symptoms after discontinuation of PPI treatment, therefore lifelong therapy is often required [28]. Recently, there has been increased concern about PPIs, which are thought to contribute to bone fractures, electrolyte deficiencies, infections (eg, *Clostridium difficile* pneumonia) and renal failure [29, 30]. Given the theoretical risk of side effect from PPI therapy, the minimum therapeutic dose required for maintenance therapy should be used and periodic breaks in therapy should be attempted. There is some evidence that the addition of an overnight H<sub>2</sub> blocker may be beneficial in patients with GERD resistant to the twice daily PPI dosage [31]. In refractory cases, other disorders should be considered, in particular: eosinophilic esophagitis, drug esophagitis, delayed gastric emptying, duodenogastric (biliary) reflux, irritable bowel syndrome, psychological disorders, achalasia and Zollinger-Ellison syndrome [32].

Surgical treatment of GERD includes minimally invasive endoscopic techniques as well as traditional surgical techniques. However, given the structural features of the gastric "sleeve" formed in LSG, Nissen fundoplication is impossible in such patients. Thus, gastric bypass surgery is a radical method of surgical treatment for GERD.

It should be noted that endoscopic antireflux therapies for GERD are still under development and most of published research focuses on symptom relief in the short term. Endoscopic treatments have become possible treatment options for people with GERD refractory to drug therapy. These methods include the following groups of interventions: endoluminal suture or plastic surgery of the gastroesophageal junction; radio pulse therapy of the lower esophageal sphincter (Stretta<sup>®</sup>); injection or implantation of biopolymers into the gastroesophageal junction [33]. More recently, two meta-analyses have been described in the literature, one of which shows an overall increase in the effectiveness of transoral non-surgical fundoplication (TIF) performed with the EsophyX<sup>®</sup> device, compared to patients who did not undergo TIF [34]. The second study analyzes the Stretta procedure, showing no significant changes in physiological parameters (time at which the pH is less than 4, compression of the lower esophageal sphincter at rest, refusal of PPI drug therapy, and improvement in the quality of life according to GERD-HRQL) compared with sham therapy [35]. The main outcome of the study is to measure the overall efficacy of endoscopic treatment versus other treatments (PPIs or laparoscopic antireflux interventions) or sham treatments for chronic GERD. In 2018, a meta-analysis was published comparing the effectiveness of endoscopic treatment with pharmacological (PPI) treatment [36]. Analysis of the results of the treatment of 320 patients in 4 studies showed a greater efficacy of the endoscopic treatment (Stretta, exposure of the lower esophageal sphincter and cardiac stomach to radiofrequency energy; TIF2, transoral non-surgical fundoplication) compared with the control group. The endoscopic treatment was effective in treating chronic GERD in 69% of patients compared with 37% of patients treated with PPIs or sham + PPIs. In the analysis of individual subgroups, there was a statistically significant difference in favor of the endoscopic procedures at 6 months, but this difference was absent in the studies performed at 12 months [37]. These data suggest that these techniques have a temporary effect.

According to a study by Yves Borbély et al., electrical stimulation of the lower esophageal sphincter (LES-ES) in post-LSG patients with symptomatic PPI-resistant GERD results in a sustained reduction in symptoms and acid exposure to the esophagus in most patients. These data are preliminary. A larger sample size with longer follow-up is needed to confirm the results. The author states that longer follow-up may result in an even higher rate as the maximum effect is expected after 9 months, but the median of objective follow-up in this study was 6 months. While preserving anatomy after LSG, it offers a valid option

for patients who are unable or unwilling to undergo RYGB [38].

According to a study by Ryan C. Broderick et al. [39], placement of the LINX magnetic device is a safe and effective treatment for refractory GERD after bariatric surgery. This can relieve symptoms and eliminate the need for high-dose medical treatment or the transition to a more complex procedure. Magnetic dilation of the lower esophageal sphincter may be another surgeon's choice for managing reflux after bariatric surgery in some patients. According to the study, two patients developed complications requiring endoscopic dilation after LINX placement. 100% of patients reported overall satisfaction after the procedure.

Based on a comprehensive analysis of the literature data, the importance of early diagnosis and initiation of treatment should be emphasized in order to avoid the development of a wide range of complications. This requires close observation of patients in the postoperative period. The analysis of the literature on gastroesophageal reflux disease shows that the pathology is quite common in patients who have undergone laparoscopic sleeve gastrectomy. GERD as a complication of bariatric surgery requires the search for pathogenic symptoms and reliable examination methods, the study of possible causes of the development of the disease, as well as the selection of effective therapy.

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