GASTROESOPHAGEAL REFLUX DISEASE AFTER LAPAROSCOPIC SLEEVE GASTRECTOMY

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ABSTRACT

Background. GastroEsophageal Reflux Disease (GERD) is a common problem among obese and overweight people, including as a complication of bariatric surgery, Laparoscopic Sleeve Gastrectomy (LSG).

Aim. To conduct a retrospective analysis of the frequency of GERD in patients with morbid obesity after laparoscopic sleeve gastrectomy.

Materials and Methods. In this retrospective study, data from 152 patients who underwent LSG were analyzed. All patients were diagnosed with morbid obesity and were deemed suitable for surgery. The minimum follow-up period was twelve months. All patients were assessed preoperatively for the severity of GERD using 24-hour pH monitoring, and upper gastrointestinal tract examination via FibroGastroDuodenoScopy (FGDS) to identify signs of reflux disease, esophagitis and Barrett's esophagus and GERD-HRQL (Health-Related Quality of Life) questionnaire.

Results. During the study, out of 152 patients without GERD (DeMeester Index (DMI) was 6.87±3.38), 23 (15.1%) of them within 12 months after LSG developed de novo GERD (DMI 9.12±8.87, p=0.04). In four patients with de novo GERD, esophagitis grade A was detected. The pathomechanism of GERD following LSG was multifactorial, caused by a combination of anatomical, physiological, and physical factors. Contributing factors included the shape of the sleeve, damage to the lower esophageal sphincter, and esophageal motility disorders.

Conclusions. LSG is effective in promoting weight loss, but poses a significant risk of developing GERD. Our study found a 15.1% incidence of GERD after LRH, which is lower than other studies, probably due to the routine use of 24-hour pH monitoring to identify patients with asymptomatic GERD. Anatomical changes due to LSG, in particular resection of the gastric fundus and dissection in the area of the angle of His, increase the temporary relaxation of the lower esophageal sphincter, contributing to the development of GERD.

Keywords: *bariatric surgery, morbid obesity, GERD.*

INTRODUCTION

Obesity, as defined by the World Health Organization (WHO), is a chronic condition characterized by excessive fat accumulation that may impair health and is identified by a Body Mass Index (BMI) over 30 [1]. Approximately 20% of the global population is overweight (BMI>25), and 10% suffer from obesity. Unfortunately, in the next 20 years, about 2.16 billion people are expected to be overweight, and 1.12 billion will be obese [2]. Patients with obesity often develop comorbidities, including type 2 diabetes mellitus, arterial hypertension, dyslipidemia, ischemic heart disease, certain types of cancer, and GastroEsophageal Reflux Disease (GERD) [3–7]. GERD is a chronic gastrointestinal disorder characterized by symptoms occurring twice or more per week, worsening the individual's health condition [8–10]. GERD symptoms affect 8% to 33% of the population [11–13], but among those with morbid obesity, this figure can reach up to 63% [14]. GERD symptoms can

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include heartburn, regurgitation, or dysphagia, negatively impacting the individual's quality of life [15; 9]. Furthermore, long-term GERD significantly increases the risk of conditions such as Barrett's esophagus, stenosis, and esophageal cancer [16–18].

There is a strong correlation between GERD and obesity, with obesity being a risk factor for GERD [19–22]. Weight loss, especially through bariatric surgery, significantly improves GERD and overall health [23; 24; 13]. However, the choice of specific bariatric procedures can both improve and worsen GERD, sometimes even causing new cases [25]. This situation leaves GERD a significant issue for many patients following bariatric interventions, especially those who have undergone Laparoscopic Sleeve Gastrectomy (LSG). Similarly, GERD symptoms can appear after Roux-en-Y Gastric Bypass (RYGB) among patients who did not previously have these symptoms [26]. In this review, we will analyze the potential causes of GERD following LSG and examine the occurrence of de novo GERD after LSG.

The aim of study was to conduct a retrospective analysis of the frequency of gastroesophageal reflux disease in patients with morbid obesity after laparoscopic sleeve gastrectomy.

Materials and Methods

In this retrospective study, data from 152 patients who underwent LSG from December 2019 to January 2023 were analyzed. All patients were diagnosed with morbid obesity and deemed suitable for surgery. All procedures were performed in one hospital by a single surgeon experienced in laparoscopic bariatric surgery and GERD surgery. The minimum follow-up period was six months, with four cases lost during the follow-up period. All patients were assessed preoperatively for the severity of GERD using GERD-HRQL (Health-Related Quality of Life) questionnaire, 24-hour pH monitoring, and upper gastrointestinal tract examination via FibroGastroDuodenoScopy (FGDS) to identify signs of reflux disease, esophagitis (classified according to the Los Angeles classification [10] and Barrett's esophagus. Preoperative characteristics of the study population are summarized in *Table*. All patients underwent a preoperative multidisciplinary assessment by a psychologist, dietitian, and anesthesiologist; instrumental assessment included abdominal ultrasound and FGDS. Informed consent for surgery was obtained from each patient preoperatively. The primary outcome measures were weight loss parameters (weight and Body Mass Index (BMI)) and changes in GERD, the frequency of de novo GERD (defined as [GERD-HRQL score]≥8 or [DeMeester index]> >14.72) at 12 months postoperatively.

The LSG procedure was as follows: under general anesthesia and after preparing the surgical field, the patient was placed in the reverse Trendelenburg position with legs apart. Five trocars were inserted. The operating surgeon stood between the patient's legs. A 10-mm trocar was inserted 3 cm above the umbilicus (this trocar was used to introduce the optic with a 30° angle); a second 5 mm or 10 mm trocar was inserted 4 cm below the left costal margin along the left midclavicular line; a third 5-mm trocar was inserted 2 cm below the right costal margin along the right anterior axillary line; a fourth 12-mm trocar was inserted at the umbilicus along the right midclavicular line; and a fifth port was placed along the left anterior axillary line. The first step was to dissect the greater curvature, fundus, and posterior wall of the stomach using Ligasure Maryland (Covidien, USA), starting 5 cm from the pylorus and ending with the dissection of the fundus. The esophagus was intubated using a 38-F or 40-F bougie, which was advanced along the lesser curvature of the stomach. The next surgical step was the sleeve resection of the stomach, which began 5 cm from the pylorus and ended with the resection of most of the greater curvature and fundus of the stomach. The stomach was stapled in stages with triple-row stapler sutures using "Echelon" (Ethicon – Endo Surgery, Johnson & Johnson, USA). Typically, the first two cartridges were green, 60 mm long, with a staple height of 4.1 mm, and the next were blue, with a staple height of 3.5 mm. The gastric cavity was checked for defects by introducing a methylene blue solution.

In statistical analysis, continuous variables with normal distribution were described as [mean± ±standard deviation]. To compare preoperative and postoperative parameters for each surgery, we used the Chi-square test for categorical variables and the paired Student's t-test for continuous data. An independent sample test was used to compare parameters before and after LSG. A $p<0.05$ was considered statistically significant. Statistical analysis was performed using Review Manager 5.4 (The Cochrane Collaboration, United Kingdom).

Results

The study involved 152 patients, 74 women and 78 men, who underwent LSG. Patients underwent standard preoperative examination, as well as 24-hour pH monitoring, barium radiography, FGDS, and GERD-HRQL survey. Follow-up was

Table 1. Comparison of patients before and after LSG

	Before LSG (n=152)	After LSG (n=152)	p
Age (mean±SD)	41.12±11.71	-	-
Gender (Female/Male)	74/78	74/78	-
Weight±SD (kg)	125.17±20.11	87.00±16.2	<0.00001
BMI±SD (kg/m^2)	46.14±5.8	27.8±4.5	<0.00001
DeMeester score (mean±SD)	6.87±3.38	9.12±8.87	0.003
GERD-HRQL score	3.65±1.98	4.17±3.45	0.11
GERD, abs. (%)	0 (0.0)	23 (15.1)	0.005
Esophagitis A, abs. (%)	0 (0.0)	4 (2.6)	0.14

conducted twelve months after surgery. Comparative data are presented in *Table*. Exclusion criteria included patients with esophagitis A and above, the presence of a hiatal hernia, [DeMeester index]>14.72, i.e., patients without GERD were selected. Our study data demonstrate the effectiveness of the performed surgery in terms of weight and BMI reduction. De novo GERD developed in 23 (15.1%) patients, (OR=55.5 95% CI 3.33–920.16, p=0.005) with significant confirmation due to pH-metry (DeMeester index). While the GERD-HRQL questionnaire score did not strongly correlate with GERD, the latter is asymptomatic in certain cases. In four patients with de novo GERD, esophagitis grade A was detected.

Discussion

Laparoscopic sleeve gastrectomy has achieved success and widespread popularity worldwide, currently being the most common bariatric surgery in both the USA and Europe [27–29]. LSG, Roux-en-Y Gastric Bypass (RYGB), and One Anastomosis Gastric Bypass can improve or completely resolve GERD. However, improvements in GERD are not observed in all patients after LSG and are often short-term. It should be noted that RYGB impacts GERD symptoms significantly better than LSG, with symptom reduction rates up to 90% [30–32].

Persistent GERD after RYGB is associated with diaphragmatic hernias, lower esophageal sphincter hypotension, and severe esophageal motility disorders. These data encourage the search for new solutions to the problem of morbid obesity and associated GERD, as well as more thorough preoperative patient examinations [33]. LSG is undoubtedly a safe procedure with excellent short- and long-term results, but the information regarding its impact on pre-existing reflux and the development of de novo reflux is controversial. It is noted that GERD after LSG occurs four times more frequently than after RYGB [34–38].

A meta-analysis of randomized clinical trials studying GERD after LSG showed that GERD occurs in 19% of patients post-LSG while de novo reflux develops in 23% of patients. Additionally, 4% of patients require revisional RYGB due to severe reflux following LSG [39]. GERD remains the primary reason for revision surgeries after LSG [40]. Revisional RYGB after LSG provides remission of GERD symptoms in 94% of cases [41; 42]. GERD significantly reduces the quality of life following bariatric surgeries, associated with decreased physical activity and increased psychological and emotional problems [43; 44]. It should be noted that LSG increases not only the incidence of symptomatic GERD but also the occurrence of hiatal hernias and esophagitis, both in comparison to preoperative conditions and when compared to RYGB, despite the use of proton pump inhibitors [45; 46]. Most patients with endoscopically verified diseases do not exhibit gastrointestinal symptoms, and conversely, digestive system symptoms are not always correlated with endoscopic findings that explain the symptoms [47–49].

The anti-reflux barrier is represented by several anatomical structures at the gastroesophageal junction, with the Lower Esophageal Sphincter (LES) and diaphragmatic crura being the most significant. These structures play a key role in the mechanism of GERD development post-LSG, with anatomical changes in these structures asso-

ciated with the onset of reflux symptoms [50–52]. There are three main types of LES impairment: reduced LES length, motor (hypotonic) disturbances, and Transient LES Relaxations (TLESRs). TLESRs are periods lasting 10–60 seconds, characterized by LES and diaphragmatic crura relaxation, occurring independently of swallowing, which itself relaxes the LES [53–55]. TLESRs are associated with reflux episodes and occur due to a temporary reduction in LES length and subsequent LES pressure decrease, caused by food entering the stomach and gastric distension [56–59]. Compared to normal-weight patients, those with morbid obesity and GERD exhibit a significant increase in TLESRs during the postprandial phase, including episodes with acid reflux [60]. LSG increases the number of TLESR episodes, reduces LES length and pressure, increases the DeMeester index, and prolongs reflux episodes [61–66].

Since the gastric fundus is resected, this leads to a reduction in the vagal reflex during physiological postprandial relaxation, increasing intragastric pressure and potentially causing retrograde stomach propulsion. Additionally, ghrelin reduction, associated with decreased esophageal motility, plays an important role [67–69]. The presence or absence of esophageal motility disorders is also crucial [62]. Furthermore, careful dissection of the angle of His during surgery is important, avoiding excessive blunting and trauma to the LES, and ensuring the sleeve is not too narrow [70].

Sleeve stenosis post-LSG is rare ([0.5–1.0]%), but up to 80% of patients with sleeve stenosis exhibit GERD symptoms, such as nausea and vomiting [71; 72; 68]. Strict patient selection and mandatory preoperative endoscopy are primary steps to prevent and reduce the incidence of postoperative GERD [73]. In general, it is recommended to avoid performing LSG on patients with existing reflux symptoms [74–76].

In our study, we included patients without GERD, including those without asymptomatic GERD, and yet de novo GERD developed in 23 out of 152 (15.1%) patients. Authors report postoperative GERD rates of 4-73%, but the routine use of 24-hour pH monitoring is not mentioned in these studies [77–83; 40]. Routine use of this test allows for the detection of asymptomatic GERD, enabling other bariatric surgeries to be performed on these patients [84; 85]. The study also highlights the refluxogenic nature of the LSG due to the shape of the sleeve, dissection in the area of the angle of His, and resection of the gastric fundus, where ghrelin is produced, which influences esophageal motility, consistent with global data [86–88].

Conclusion

LSG is effective in promoting weight loss, but poses a significant risk of developing GERD. Our study found a 15.1% incidence of GERD after LRH, which is lower than other studies, probably due to the routine use of 24-hour pH monitoring to identify patients with asymptomatic GERD. Anatomical changes due to LSG, in particular resection of the gastric fundus and dissection in the area of the angle of His, increase the temporary relaxation of the lower esophageal sphincter, contributing to the development of GERD. Routine preoperative pH monitoring should be standard for identifying patients with asymptomatic GERD and prescribing them alternative surgeries.

DECLARATIONS:

Disclosure Statement

The authors have no potential conflicts of interest to disclosure, including specific financial interests, relationships, and/or affiliations relevant to the subject matter or materials included.

Data Transparency

The data can be requested from the authors.

Statement of Ethics

The authors have no ethical conflicts to disclosure.

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Consent for publication

All authors give their consent to publication.

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