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Gastroesophageal Reflux Disease post Sleeve Gastrectomy

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ABSTRACT

Background: the most common bariatric procedure now is laparoscopic sleeve gastrectomy (LSG). Symptoms originating in the upper gastrointestinal tract (UGI) are common after LSG due to the altered stomach architecture.

Objective: Finding out how LSG affects GERD is the goal of this study. Also reviewing of the improvement or worsening of reflux disease in patients after LSG, and the development of new disease in healthy persons.

Methods: The 70 participants in this prospective study all had LSG. Evaluation specific to GERD was done prior to surgery. Patients had UGI endoscopies and stool samples tested for Helicobacter pylori before surgery to rule out any abnormalities. It was necessary to do postoperative UGI endoscopy in order to classify the findings and establish a connection between the evaluated symptoms and UGI issues.

Results: The number of patients displaying upper gastrointestinal symptoms increased significantly after a 6-month follow-up; however, there was no significant change in the percentage of patients who developed GERD ($p < 0.01$). Discomfort in the stomach has increased dramatically. Significant vomiting and dysphagia are among the new and ongoing symptoms. Six months after surgery, there was a link between vomiting and hiatus hernia, and there was a strong relationship between GERD and hiatus hernia overall. Preoperative GERD symptoms and H. pylori infection were significantly associated with each other and with abnormalities of the UGI.

Conclusion: Ultimately, most very obese patients with preoperative GERD have worsening symptoms after LSG, and "de novo" reflux is quite uncommon. After a median follow-up of 6 months after LSG, dyspepsia, not GERD, became the most common complaint. Because GERD was present in all patients who vomited, there was a strong correlation between hiatus hernia and GERD.

Keywords: *gastroesophageal reflux disease, laparoscopic sleeve gastrectomy, upper gastrointestinal symptoms, dyspepsia.*

1. INTRODUCTION

A major public health concern on a global scale, obesity has recently developed. As of now, 13% of the world's adult population (defined as those aged 18 and over) is obese, with a BMI of 30 kg/m² or more [1].

A BMI of 40 kg/m² or above, together with obesity-related complications, is indicative of morbid obesity and the need for surgical intervention to address weight-related health issues [2].

One effective surgical option for treating severe obesity is laparoscopic sleeve gastrectomy (LSG). The duodenal switch procedure was the first to use this technique in surgery [3]. In the last five years, LSG has unquestionably become the "rising star" of bariatric surgery because to its relatively low complication rate and comparable technical simplicity [4].

In the past, studies on the effects of bariatric surgery on weight reduction often used the excess weight loss percentage (%EWL) as a measure of success (EWL > 50%) or failure (EWL < 50%). in references [5, 6].

Obesity is known to have a major role in the development of GERD, a chronic gastrointestinal ailment that affects a large percentage of the population; about half of the obese population shows symptoms of GERD [7].

Significant anatomical and functional alterations impact stomach acid secretion and motility, especially accommodation, after gastric fundus (and antrum) excision, which may cause GIT symptoms [8].

Results for weight loss with gastric bypass (GB) and sleeve gastrectomy (SG) have been similar in many randomized trials with long follow-up. With a lower risk of major complications within 30 days after surgery, SG is a more direct and brief method than GB. According to international organizations that deal with bariatric surgery, SG is a distinct procedure in and of itself [9].

Finding out how LSG affects GERD is the goal of the current study. Also reviewing of the improvement or worsening of reflux disease in patients after LSG, and the development of new disease in healthy persons**.**

2. PATIENTS AND METHODS

This prospective cohort study includes 70 participants. All patients received a laparoscopic sleeve gastrectomy as a bariatric treatment throughout an 18-month period at Beni-Suef Teaching Hospital from March 2022 to December 2023.

The preoperative examination adhered to the established procedure, including a comprehensive personal, medical, and surgical history, an exhaustive endocrinological assessment, psychological evaluation, and dietary counseling, with a low-calorie diet implemented for one to three weeks based on BMI.

All patients underwent a standardized preoperative assessment for upper gastrointestinal symptoms utilizing the Rome III Diagnostic Criteria [10]. Each patient was also evaluated for H. pylori infection through a non-invasive H. pylori antigen rapid test (HpSA) conducted on stool samples. Using a mix of polyclonal and colloidal gold-conjugated monoclonal anti-H. pylori antibodies, this test was able to detect H. pylori antigens in fecal samples with a level of sensitivity and specificity that was on par with invasive procedures like culture-based biopsies and rapid urease tests. A proton pump inhibitor (PPI) like lansoprazole (30 mg twice daily), omeprazole (20 mg twice daily), pantoprazole (40 mg twice daily), rabeprazole (20 mg twice daily), or esomeprazole (40 mg once daily) was part of the triple therapy for patients who tested positive for H. pylori. Amoxicillin (1 g twice daily) and clarithromycin (500 mg twice daily) were required for a two-week period preceding surgery.
Third Rome All symptoms, not only those pertaining to the upper gastrointestinal tract, must have been present for at least three months previous to diagnosis, with the commencement of symptoms occurring at least six months before.

We asked for a full blood count, fasting blood sugar, lipid profile (cholesterol, LDL, HDL, triglycerides), clinical chemistry (serum albumin, ALT, AST, GGT, Urea, Creatinine), and prothrombin time and concentration when we requested blood tests. Prior to the operation, the patient had evaluation with abdominal ultrasound, chest X-ray, pulmonary function tests, and upper endoscopy.

Thromboembolic prophylaxis with subcutaneous low molecular weight heparin began the night before surgery and continued every day until the patient was able to walk alone after the procedure.

To the best of our ability, we managed the patient's comorbidities, which include hypertension and diabetes, which raise the perioperative risk.

After carefully outlining the potential risks that may arise during the peri-operative period, we were able to get signed informed permission.

We made sure that every patient knew what the study was about, and we got their consent before we started.

Inclusion Criteria :

The subjects were considered appropriate candidates for the present study if they were:

1- Morbidly obese patients between 20 - 60 years old willing and able to give consent.

2- Patients of both genders (male and female).

3- Patients of BMI = or > 40 kg/m2 or BMI = or > 35 with comorbidites like hypertension and diabetes.

4- Patients are generally fit for anesthesia and surgery.

5- All appropriate non-surgical measures have been tried but have failed to achieve or maintain adequate, clinically beneficial weight loss for at least six months.

Exclusion Criteria :

1- pregnancy or lactation at screening or surgery.

2- previous malabsorptive or restrictive procedures performed for the treatment of obesity.

3- upper GIT endoscopic finding that requires postponing, modification, change or even abortion of the procedure like cancer, varices or mass lesions.

4- Early post-operative complications that complicate the procedure like primary haemorrhage or leakage that mandates further interventions.

A different surgical procedure than LSG (usually LRYGBP), was chosen in the case of proven reflux disease, when a significant hiatal hernia was seen in the preoperative gastroscopy or if the patient is a sweet eater.

Surgical procedure [11]:

With the patient in a supine position and compression stockings on their lower legs, the surgeon would place himself between their legs (the French position) throughout all procedures performed under general anesthesia. Attached to the operating table were the patients' securing straps, which would allow for anti-Trendelenburg positioning if needed. We established pneumoperitoneum by carbon dioxide insufflation. In every case, we inserted the Veress needle in the left hypochondrium and maintained an intra-abdominal pressure of 15 mmHg and a flow rate of 2-2.5 liters per minute. Following the implementation of pneumoperitoneum, a five-trocar method was used. A liver retractor is a 5-mm subxiphoid trocar. Two 12-mm working ports are placed 3-4 cm beneath the left and right costal margins pararectally; the left port is for the linear stapler. An optical port is a single 12-mm trocar put between the subxiphoid 5-mm trocar and the umbilicus. Gastroplasty involves inserting a 5-millimeter trocar into the left subcostal anterior axillary line. Six centimeters from the pylorus and continuing to the angle of His is where the larger stomach curvature's circulatory supply begins to segment. A LigaSure device (Covidien, Cincinnati, OH, USA) and harmonic shears (Harmonic Scalpel, Ethicon Endo-Surgery Inc., Cincinnati, OH, USA) are used to transsect the gastroepiploic vessels that run along the greater curvature of the stomach as well as the shorter gastric vessels. It is necessary to dissect the adhesions that connect the pancreas to the posterior gastric wall. An anaesthesiologist placed a 36-Fr calibrating bougie into the stomach, advancing it down the lesser curvature into the pyloric channel and duodenal bulb. The stomach was sectioned with the Echelon Compact Linear Stapler (Ethicon Endo-Surgery Inc, Cincinnati, OH, USA). A mix of green reloads (4.1 mm) for the first discharge and golden reloads (3.8 mm) for the upper abdomen is used. A cuff of stomach of about 5–10 mm was retained at the angle of His to prevent the inclusion of the esophagus in the staple line. A leak test with methylene blue was conducted to assess the integrity of the stapler line. Upon completion of the process, the calibrating bougie was extracted. The resected stomach was extracted via the 12mm opening without necessitating any enlargement. In all instances, a suction drain was routinely placed at the surgical site. All patients had a contrast study 24 to 48 hours post-operatively to confirm the absence of leakage before drain removal and discharge.

Post-operative diet regimen :

A few hours after surgery, patients should walk about. Administer enoxaparin 40 U/day subcutaneously for one week after surgery as a prophylactic measure against deep vein thrombosis (DVT). The administration of intravenous PPIs begins on the day after surgery and continues for two weeks after patients begin eating orally. following a gastrografin test verifies that the suture line is unbroken, patients may start drinking fluids orally on the second day following surgery. After surgery, patients should gradually go from liquids to solids for 6 to 8 weeks. During this time, they should focus on meeting their protein and water needs, and they should take additional vitamin supplements every day. Following the first fifteen days of fluid restriction, patients were to gradually move to ground meals until one month had passed following surgery. Ever since then, moms and doctors have been telling youngsters to start with baby food and work their way up to more traditional entrées. Meals should be small, frequent, and varied, with the exception of items high in sugar and fat, as prescribed.

Follow-up and Data Collection:

All patients were monitored for early postoperative problems (within 30 days), including hemorrhage, leakage, and both superficial and deep infections.
The main purpose of the research was to evaluate weight reduction after 6 months of Laparoscopic Sleeve Gastrectomy. The weight loss evaluations included the absolute weight change, the alteration in BMI, and the percentage of excess body weight reduction (%EBWL). The other main primary goal is to evaluate post-operative problems associated with upper gastrointestinal symptoms during a 6-month follow-up using the Rome III Diagnostic Criteria [10]. Each symptom is examined individually to investigate the correlation between these symptoms and the results from upper gastrointestinal endoscopy during the post-operative follow-up phase.

Statistical analysis:

The collected data from the designated patients were analyzed and compared with other variables. Data were recorded prospectively on a dedicated database (Microsoft Excel) and were retrieved for the purpose of this study.

3. RESULTS

In table (1): The patients' ages varied from 25 to 58 years, with an average age of 40.36 years across the entire group. The male participants are aged between 25 and 54 years, with an average age of 36.64 years, while the female participants are aged between 28 and 58 years, with an average age of 41.29 years. The BMI of the morbidly obese patients included in this study ranged from 38.7 to 55 kg/m2. The median BMI for males was 49.15 kg/m², while for females it was 47 kg/m², resulting in an overall median of 48 kg/m² for all patients.

Table 1: Demographic distribution of patients (N=70)

Demographic	Distribution	No. of patients	Percentage %
Sex	• Male	14	20%
	• Female	56	80%
Age	• 20-30	19	27.1%
	• 30-40	24	34.3%
	• 40-50	18	25.7%
	• 50-60	9	12.9%
BMI	• 35-40	7	10%
	• 40-50	49	70%
	• >50	14	20%
Special habits	• Smoker	7	10%
	• Non Smoker	63	90%
H- pyori.in stool	• +ve	28	40%
	• -ve	42	60%

In Table (2): Forty percent exhibited symptoms of GERD, including heartburn, regurgitation, or cough, while seven out of twenty-eight individuals experienced dyspepsia characterized by postprandial distress or epigastric pain syndrome, which was also accompanied by GERD in ten percent of cases.

Table 2 Distribution of patients according to GERD symptoms prevalence pre-operative

Distribution	No. of patients	Percentage %
Non symptoms	42/70	60.0%
GERD without Dyspepsia	21/70	30.0%
GERD with dyspepsia	7/70	10.0%

In Table (3): In our study group of patients who underwent upper GI endoscopy pre-operatively, 28 out of 70 patients (40%) exhibited no specific findings, while 42 out of 70 patients (60%) were diagnosed with gastritis. Twenty percent exhibited associated oesophagitis (14 out of 70), 12.9% presented with duodenitis (9 out of 70), and 7.1% were accompanied by duodenal ulcers (5 out of 70).

Table 3 Distribution of patients according to findings of upper GI endoscopy pre- operative:

Distribution	No. of patients	Percentage %
No FINDING	28/70	40.0%
• **GASTRITIS**	42/70	60.0%
• OESOPHAGITIS	14/70	20.0%
• DUODENITIS	9/70	12.9%
• D.U	5/70	7.1%

In table (4); Following a 6-month follow-up of upper gastrointestinal symptoms in the cohort of patients who underwent laparoscopic sleeve gastrectomy, a notable increase was observed in the incidence of upper GI symptoms, with 92.9% (65/70) of patients affected compared to 40% (28/70) during the pre-operative phase ($p < 0.001$). In the post-operative period, only 7.1% of patients exhibited no symptoms (5 out of 70), in contrast to 60% of patients who were symptom-free prior to the operation. The percentage of patients who developed GERD did not show a significant increase ($p < 0.01$), with a post-operative rate of 27.1% (19/70) compared to 40% (28/70) during the pre-operative period. The number of patients reporting dyspepsia rose significantly, with 65.71% (46/70) affected post-operatively compared to just 10% (7/70) pre-operatively ($p < 0.001$). New symptoms emerged and continued throughout the follow-up period, such as vomiting, which increased significantly, reaching 20% ($p < 0.01$) of all patients. This was associated with GERD in 14 out of 19 cases and dysphagia, which also showed a significant correlation ($p < 0.01$), with a prevalence of 12.9% linked to dyspepsia in 9 out of 47 patients.

Table (4): Distribution of symptoms according to post-operative upper gastrointestinal

Symptoms	Pre		Post		P value
	N	%	N	%	
Free	42	60.0	5	7.1	0.000 (<0.01)
GERD	28	40.0	19	27.1	0.003 (<0.01)
Dyspepsia	7	10	46	65.71	0.000 (<0.01)
Vomiting	0	0.0	14	20.0	0.000 (<0.01)
Dysphagia	0	0.0	9	12.9	0.003 (<0.01)

In table (5): The prevalence of GERD was not significantly with post-operative percentage of 27.14% (19/70) compared to 40% (28/70) in the pre-operative period ($p = 0.124$). Whereas only 17.86% (5/19) of patients who developed GERD post operatively already had GERD symptoms in the pre-operative period (17.86% (5/28) of patients with GERD before LSG). The symptoms of GERD newly developed in 33.3% (14/42) and pre-operative GERD symptoms disappears in 82.14% (23/28). The occurrence of dyspepsia rose markedly in the post-operative phase, with 65.71% (46/70) of patients affected, in contrast to 10% (7/70) pre-operatively ($p<0.05$). Additionally, 15.2% (7/46) of those who experienced dyspepsia after surgery had a history of dyspepsia prior to the operation. All patients (100.0%, 7/7) experienced dyspepsia prior to LSG, while 55.7% (39/63) subsequently developed De-novo dyspepsia. Vomiting emerged as a consistently observed new symptom during the post-operative period, with a notable incidence of 20.0% (14/70) ($p<0.01$), all of which were linked to GERD (14/19). A newly developed symptom observed was dysphagia, which presented a notable value of 12.86% (9/70) ($p<0.01$).

Table (5): Distribution of GERD, Dyspepsia, Vomiting, dysphagia pre and post operatively

Symptoms pre	Symptoms after 6 months						P value
	GERD		NO		Total		
	N	%	N	%	N	%	
GERD	5	26.32%	23	45.10%	28	40.00%	0.124 (>0.05)

NO	14	73.68%	28	54.90%	42	60.00%	
Total	19	27.14%	51	72.86%	70	100.00%	
Dyspepsia	7	10%	0	0.00%	7	10%	0.010 (<0.05)
NO	39	84.78%	24	100.00%	63	90%	
Total	46	65.71%	24	34.29%	70	100.00%	
Vomiting	0	0.00%	0	0.00%	0	0.00%	0.000 (<0.01)
NO	14	100.00%	56	100.00%	70	100.00%	
Total	14	20.00%	56	80.00%	70	100.00%	
dysphagia	0	0.00%	0	0.00%	0	0.00%	0.003 (<0.01)
NO	9	12.86%	61	87.14%	70	100.00%	
Total	9	12.86%	61	87.14%	70	100.00%	

In table (6): A significant relationship was identified within the study group of patients between positive symptoms observed after a six-month postoperative follow-up and the upper GI endoscopy conducted at the six-month mark to correlate with these symptoms, where 84.85% (56/66) of the patients having troublesome symptoms had positive findings and 100% (4/4) of patients who had no symptoms had no obvious finding (p =0.001).

Table (6): Relation between post-operative symptoms and upper GIT Symptoms after 6 months

Post-UGI findings		upper GI Symptoms after 6 months				P value
		negative		positive		
		N	%	N	%	
Findings	positive	0	0.00%	56	84.85%	0.001(<0.01)
	Negative	4	100.00%	10	15.15%	
Gastritis	positive	0	0.00%	33	50.00%	0.072(>0.05)
	Negative	4	100.00%	33	50.00%	
Incompetent cardia	positive	0	0.00%	19	28.79%	0.273(>0.05)
	Negative	4	100.00%	47	71.21%	
Hiatus hernia	positive	0	0.00%	24	36.36%	0.178(>0.05)
	Negative	4	100.00%	42	63.64%	

In table (7): A notable correlation was observed between patients reporting GERD symptoms six months after surgery and the identification of Hiatus Hernia during upper GI endoscopy, with a p-value of less than 0.05.

Table (7): Relation between GERD and upper GI endoscopy finding after 6 months

Post-UGI findings		GERD after 6 month				P value
		Negative		GERD		
		N	%	N	%	
Findings	positive	19	100.00%	37	72.55%	0.008 (<0.01)
	Negative	0	0.00%	14	27.45%	

Gastritis	positive	5	26.32%	28	54.90%	0.030(<0.05)
	Negative	14	73.68%	23	45.10%	
Incompetent cardia	positive	10	52.63%	9	17.65%	0.005(<0.01)
	Negative	9	47.37%	42	82.35%	
Hiatus hernia	positive	19	100.00%	5	9.80%	0.000(<0.01)
	Negative	0	0.00%	46	90.20%	

In table (8): A notable correlation was identified between patients reporting vomiting six months after surgery and the observation of Hiatus Hemai during upper GI endoscopy, with a p-value of less than 0.05. No significant relationship was identified between patients reporting vomiting six months after surgery and the observation of gastritis during upper GI endoscopy, with a p-value exceeding 0.05.

Table (8): Relation between vomiting and upper GI endoscopy finding after 6 months

Post findings		Vomiting after 6 month				P value
		Negative		GERD		
		N	%	N	%	
Findings	Negative	0	0.00%	14	25.00%	0.030 (<0.05)
	positive	14	100.00%	42	75.00%	
Gastritis	positive	5	35.71%	28	50.00%	0.256(>0.05)
	Negative	9	64.29%	28	50.00%	
Incompetent cardia	positive	9	64.29%	9	16.07%	0.001(<0.01)
	Negative	5	35.71%	47	83.93%	
Hiatus hernia	positive	14	100.00%	14	25.00%	0.000(<0.01)
	Negative	0	0.00%	42	75.00%	

In table (9): A significant relationship was identified between H-pylori infection and pre-operative GERD symptoms (p<0.01), with GERD observed pre-operatively in 50.0% (14/28) of cases, and Dyspepsia alongside GERD in 17.87% (5/28). Patients who exhibited no symptoms were also found to be negative for H-pylori infection, with a percentage of 78.57% (33/42).

Table (9): Relation between H-pylori infection and symptoms pre -operative

Symptoms	H-Pylori				P value
	Negative (n=42)		Positive (n=28)		
	N	%	N	%	
Negative	33	78.57%	9	32.14%	0.000(<0.01)
GERD	9	21.43%	14	50.00%	
Dyspepsia & GERD	0	0.00%	5	17.87%	

Table (10) reveals a significant relationship between H-pylori infection and pre-operative GERD symptoms, with a p-value of less than 0.01. Specifically, the incidence of GERD pre-operatively was observed in 50.0% (14 out of 28) of cases, while Dyspepsia and GERD were noted in 17.87% (5 out of 28). Patients who exhibited no symptoms were also found to be

negative for H-pylori infection, with a percentage of 78.57% (33/42).

Table (10): Relation between H-pylori infection and upper GI findings pre -operative

Pre UGI finding	H-Pylori				P value
	Negative (n=42)		Positive (n=28)		
	N	%	N	%	
No FINDING	28	66.70%	0	0.00%	0.000(<0.01)
GASTRITIS	14	33.33%	28	66.67%	0.000(<0.01
OESOPHAGITIS	5	35.71%	9	64.29%	0.039(<0.05)
DUODENITIS	0	0.00%	9	100.00%	0.000(<0.01)
D.U	0	0.00%	5	100.00%	0.008(<0.01

In table (11): No significant correlation was found between special habits of medical importance which is exclusively smoking in our study and upper GI symptoms before LSG.

Table (11): Relation between smoking, and upper GIT symptoms prior to surgery.

Symptoms pre	No special habitis (n=63)		smoking(n=7)		P value
	N	%	N	%	
• Negative	37	58.73%	3	42.86%	0.636(>0.05)
• GERD	23	36.51%	4	57.14%	
• Dyspepsia	3	4.76%	0	0.00%	

4. DISCUSSION:

Finding out how LSG affects GERD was the driving force for this study also evaluation of the improvement or worsening of reflux disease in patients with reflux disease after LSG, and the development of new sickness in patients who did not have this before the procedure.

Seventy people who had LSG were the subjects of this prospective study. There was evaluation specific to GERD prior to surgery. Patients had upper gastrointestinal endoscopies and stool samples tested for Helicobacter pylori before surgery to rule out any abnormalities. It was necessary to do postoperative UGI endoscopy in order to classify the findings and establish a connection between the evaluated symptoms and UGI issues.

The current study found that, across the board, the patients' average age was 40.36 years. All patients had a median BMI of 48, with a range of 38.7 to 55 kg/m² among the severely obese people studied. Borbély et al. [12] found that the average age of patients getting primary LSG was 43.1 ± 12.8 years in a related study. Of them, 46% were men. Preoperatively, the average BMI was 49.6 ± 7.2 kg/m².

Sixty percent of patients had no symptoms at all, whereas forty percent showed signs of GERD, such as heartburn, regurgitation, or cough. Concomitant with GERD, 7 out of 28 patients (or 10.0% of the total) had dyspepsia defined by postprandial discomfort (PPD) or epigastric pain syndrome (EPS).

Mokhtar et al. [13] found that 60% of participants had no symptoms, while 40% experienced GERD symptoms such heartburn, regurgitation, or cough. Out of the 12 patients, 2 had dyspepsia with GERD, which is defined by PPD or EPS, and 6.7% of those patients had GERD overall.

According to Althuwaini et al. [14], 44.13% of patients had heartburn before LSG. This finding is in line with an earlier research that reported 45.4% of patients had GERD overall, and an even greater incidence among those with a high body mass index [15].

We still don't know what causes silent GERD in those who are really obese. Ortiz et al. [16] conducted a second study comparing 30 severely obese patients to 28 controls. The results showed that the obese individuals responded much better to acid instillation in the esophagus (14% vs. 96%) and had significantly less esophageal sensitivity (57% vs. 14%) during pH-

metry. Obese people may have a different autonomic nervous system, which might explain it further [12].

Our study group of 30 patients who had preoperative UGI endoscopy found gastritis in 60% of cases and no abnormalities in 40% of cases. Thirteen percent had duodenitis (4/18), 6.7% had duodenal ulcers (2/18), and 20% had concurrent esophagitis (6/18).

Mihmanli et al. [17] found similar results when they examined bariatric surgery patients before the procedure. Among these patients, 54% had gastritis, 10% had esophagitis, 17% had a hiatal hernia, 5% had a stomach ulcer, and 3% had other abnormalities.
Additionally, Tawfik et al. [18] noted that endoscopic abnormalities such as gastritis and incompetent cardia were most often seen in patients who had endoscopic esophagogastroduodenoscopy (EGD) before LSG.

Although being overweight increases the likelihood of GERD, there is evidence linking obesity to anomalies in esophageal motility and GERD, which helps to explain why obese people are more likely to have gastritis and esophagitis [19].

There was a significant increase in the frequency of upper gastrointestinal symptoms in the current group of patients who had LSG. After six months, the rate rose to 92.9% (65/70), up from 40% (28/70) before the operation ($p < 0.001$). In contrast to the 60% of patients who were asymptomatic before surgery, only 7.1% of patients had no symptoms in the post-operative period (5/70).

The average scores for heartburn when standing (0.71 vs. 1.09, $p < 0.01$) and heartburn symptoms requiring dietary changes (0.67 vs. 1.16, $p < 0.01$) on the GERD-HRQL questionnaire significantly increased when compared to scores before and after LSG, according to Althuwaini et al. [14].

In a study that matched our results, Mokhtar et al. [13] found that the incidence of UGI symptoms significantly increased after LSG (93.3%, 28/30) compared to 40%, 12/30, before surgery ($P<0.001$). In contrast to the 60% of patients who were asymptomatic before surgery, only 6.7% had no symptoms in the postoperative period (2/30).

In 116 patients who underwent LSG, Borbély et al. [12] found that GERD symptoms worsened after the procedure. Of these, 108 (93% of the total) showed the typical symptoms, 7 (6%) had respiratory symptoms, 12 (10%) had obstructive symptoms, and 13 (11% of the total) reported pain-related symptoms.

It is more often than not changed motility patterns, not acid-related disorders, that cause esophageal or gastric-related symptoms after LSG. Some evidence supports this theory: dysphagia is associated with LSG, it is not associated with GERD, and proton pump inhibitors are less effective in treating gastrointestinal symptoms after surgery [20].

This study found that GERD was not significantly more common after surgery ($p < 0.01$), with a rate of 27.1% (19/70) compared to 40% (28/70) before the procedure. Compared to the 17.86% (5/28) of patients with GERD before to LSG, only 17.86% (5/19) of patients who developed post-operative GERD also had symptoms before the operation. While 82.14% of patients had relief from GERD symptoms prior to surgery, 33.3% of patients had new GERD symptoms (14/42).

In a similar vein, Mokhtar et al. [13] found no statistically significant increase in the incidence of GERD from 40% (12/30) before surgery to 26.7% (8/30) after surgery.

Rebecchi et al. [21] demonstrated that LSG improved GERD in a study that used 24-hour pH manometry with 65 patients divided into two groups: group A (pathologic, $n = 28$) and group B (normal, $n = 37$). The Gastroesophageal Reflux Disease Symptom Assessment Scale score decreased from 53.1 ± 10.5 to 13.1 ± 3.5 ($P < 0.001$), indicating that Group A saw an improvement in symptoms. Additionally, only 5.4% of the participants in this group developed new GERD.

Our results are in line with those of Pilone et al. [22], who found that sleeve gastrectomy had no negative effect on preoperative GERD in 0% of patients, no change in 10 cases, and no worsening in 65.5% of cases.

Similarly, manometric studies and reflux analyses conducted by Georgia et al. [23] failed to demonstrate an increase in GERD after SG.

Borbély et al. [12] found that the prevalence of GERD increased overall after LSG, which contradicts our results. 23% (52 patients) of the pre-operative group and 52% (116 patients) of the post-operative group had GERD, with 85 patients (73%) showing signs of new GERD.

The effects of LSG on gastroesophageal function are unclear, and the relationship between LSG and GERD is complicated. There are several proposed anatomical and physiological factors that could explain why GERD is more common after LSG: hypotensive LES, changed His angle, sling fiber resection, reduced gastric compliance due to increased intragastric pressure, impaired gastric emptying, sleeve dilation, hiatal hernia, and so on. In contrast, factors associated with less GERD after LSG include losing weight, re-establishing the angle of His, decreasing acid secretion, and speeding up stomach emptying [24].

Compared to 10% (7/70) before surgery, the prevalence of dyspepsia significantly increased in the post-operative period (65.71%, or 46 out of 70) patients ($p<0.05$). In addition, 55.7% (39/63) of patients who acquired dyspepsia after LSG had no

previous history of dyspepsia, while 15.2% (7/46) of those patients had dyspepsia in the past.

The proportion of patients experiencing dyspepsia following sleeve gastrectomy significantly increased (66.7%, 20/30) postoperatively compared to 6.7%, 2/30 preoperatively (P<0.001), according to Mokhtar et al. [13].

There are many pathophysiological mechanisms that might be involved in functional dyspepsia after LSG. The rebuilt stomach has less capacity, one-tenth of the distensibility, and increased luminal pressure, therefore it may have trouble

ccommodating food after fundus excision. A worsening of dyspeptic symptoms may result from an increase in gastric emptying that is already associated with decreased duodenal sensitivity to feeding [25].

During the follow-up period, the present investigation found additional symptoms including vomiting, which rose to 20% ($p < 0.01$) across all patients and were all associated with GERD (14/19). Furthermore, a prevalence of 12.9% was shown to be substantially connected ($p < 0.01$) with dysphagia, which was also correlated with dyspepsia (9 out of 47 cases). We found a statistically significant association ($p < 0.05$) between patients' reports of vomiting six months after surgery and the identification of a Hiatus hernia during upper gastrointestinal endoscopy. Another notable effect after LSG was vomiting, according to Mokhtar et al. [13]. Twenty percent of patients had vomiting, and it persisted during the six-month follow-up; hyperphagia worsened, although not substantially (P=0.125), and vomiting was almost invariably associated with gastroesophageal reflux disease. After a median follow-up of 6 months post-sleeve gastrectomy, 66.7% of patients showed a significant link between vomiting and incompetent cardia on UGI endoscopy (P=0.029). Additionally, 13.3% of patients experienced dyspepsia (4/20). A possible cause of surgical nausea and vomiting is the failure to fixate the stomach along its normal axis on the greater curvature [26]. When the neostomach is less flexible, the patient may have dysphagia because their gastric pouch empties more slowly and they feel fuller for longer. Additionally, technical obstacles, such as the bougie used for sleeve calibration and the distance from the pylorus (i.e., the section of the antrum excised), may influence upper gastrointestinal tract discomfort during LSG [20].

The present investigation shown a strong association between good symptoms at the six-month postoperative follow-up and the results of the upper gastrointestinal endoscopy. In particular, there were no detectable results in 100% of asymptomatic individuals ($p = 0.001$) and 84.85% (56/66) of patients with problematic symptoms. The presence of a Hiatus hernia during upper gastrointestinal endoscopy was also significantly associated with patients describing GERD symptoms six months after surgery ($p < 0.05$).

In line with our results, Mokhtar et al. [13] found a strong association between UGI endoscopy performed at the same interval as six months of follow-up following sleeve gastrectomy with good symptoms. To be more precise, there were no detectable findings in the asymptomatic patients (P=0.034), but 85.7% (24/28) of patients with problematic symptoms obtained positive results.

We found a strong correlation between the Positive GERD-HRQL and the endoscopic outcomes in postoperative (sleeve gastrectomy) assessments, and Pilone et al. [22] found a similar pattern: 13.5% of patients had esophagitis at the 12-month EGDS, with or without a hiatal hernia.

A decade after LSG, Felsenreich et al. [27] evaluated 20 patients with GERD paraclinically, using upper endoscopy and pH-metry. The results showed that 15% of patients acquired Barrett's esophagus without dysplasia and 45% of patients had a de novo hiatus hernia (n=9/20).

Up to 40% of asymptomatic individuals after LSG develop severe erosive esophagitis, according to Genco et al. [28]. The present study found a robust association between H. pylori infection and symptoms of GERD before to surgery ($p<0.01$), leading to GERD in 50.0% (14/28 patients) and dyspepsia with GERD in 17.87% (5/28 cases). H was also shown to be negative in patients who did not show any symptoms. pylori infection, which accounts for 78.57% of cases (33 out of 42).

Emile et al. [24] compared patients who had sleeve gastrectomy with and without H. indications, which is in line with our results. People whose H. ulcerative colitis. Patients with pylori had worse dyspepsia symptoms (50.7% vs. 27.1%, $p = 0.002$; RR = 1.87, 95% CI = 1.27-2.76) and a considerably greater incidence of preoperative GERD (39.1% vs. 23.4%, $p = 0.03$; RR = 1.67, 95% CI = 1.06-2.63).

H.pylori has the potential to cause antrum predominant gastritis, which in turn increases the production of stomach acid and may be associated with an increased frequency and severity of GERD [29].

The present study found a robust association between H. pylori infection and symptoms in the upper gastrointestinal tract in those who have H. pylori had a significantly higher risk of developing gastritis (66.67%), esophagitis (64.29%), duodenitis (100.00%), and duodenal ulcer (100.00%) prior to surgery. hemolytic ureteral infection ($p<0.01$). All patients who had no symptoms in the esophagus or stomach were also considered to be negative for H. infection caused by H. pylori, with a frequency of 66.70 percent (62/42).

Similarly, Tawfik et al. [18] found that patients with nodular gastritis (68.8% of cases) and gastric ulceration (80.0%) had a significantly higher prevalence of positive Helicobacter pylori cases when they underwent endoscopic EGD before LSG.

Similar to what Ayana et al. [30] found, gastritis was the most common symptom, and there was a statistical connection between H and gastritis as well as duodenal ulcer. H. pylori was responsible for 72 percent of gastritis cases and 89.5 percent of duodenal ulcers H. pylori is positive. Helicobacter pylori cause an inflammatory reaction in the stomach mucosa, which has negative effects on gastric function, the esophagus, and the duodenum [31].

The present study disproved the hypothesis that a correlation between smoking—a particular medically relevant habit—and esophageal or gastric-related symptoms prior to LSG. In line with our results, Mokhtar et al. [13] found no statistically significant correlation between smoking—a specific risk factor in our study—and esophageal or gastric-related pain before LSG.

5. CONCLUSION

Although "de novo" reflux is uncommon, LSG worsens GERD symptoms in most very obese patients who already had the condition before surgery. After a median follow-up of 6 months after LSG, dyspepsia, not GERD, became the most common complaint. Because GERD was present in all patients who vomited, there was a strong correlation between hiatus hernia and GERD. We recommend larger-scale, cross-institutional studies to confirm our results. To confirm these results, future prospective studies should have longer follow-up periods.

6. CONFLICT OF INTEREST:

Nil

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