Original Article

Impact of Sleeve Gastrectomy on Esophageal Physiology and Gastro-Esophageal Reflux Disease: A Bicentric Prospective Study

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ABSTRACT

Background: Obesity is associated with gastroesophageal reflux disease and esophageal dysmotility. Bariatric surgeries like laparoscopic sleeve gastrectomy (LSG) aid weight loss but can affect esophageal function. This study examines the impact of LSG on esophageal physiology, especially concerning reflux.

Patients and methods: This prospective study, conducted between 2022 and 2023 in Egypt and Italy, involved 15 patients with severe obesity who had undergone LSG. The study used conventional esophageal manometry, 24-hour impedance-pH monitoring, upper gastrointestinal series, gastroscopy, and a validated questionnaire pre and postoperatively to assess outcomes related to esophageal and lower esophageal sphincter (LES) functions and reflux.

Results: The study group after 1 year experienced significant reductions in weight and BMI, with P values less than 0.001 for both measures. Gastroesophageal reflux disease symptoms remained unchanged postoperatively (P=0.687) with 26.7% using proton pump inhibitors before and after surgery, and quality of life improved significantly, with a P value of 0.001. No significant changes were detected in the esophagogastroduodenoscopy, barium studies, and the metrics of the multichannel intraluminal impedance-pH monitoring. Regarding the manometric parameters, significant changes were observed as the total LES length decreased from 34.0 to 31.33 mm (P=0.027), LES residual pressure increased from 2.0 to 4.0 mmHg (P=0.012), and esophageal peristaltic wave amplitude decreased from 98.20 to 52.93 mmHg (P<0.001).

Conclusions: LSG is effective for weight loss and improving the quality of life. It controls reflux, with new cases being uncommon. Advanced diagnostics are key when standard tests are insufficient.

Key Words: 24-hour pH-impedance monitoring, esophageal manometry, sleeve gastrectomy.

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INTRODUCTION

Obesity has become a global health crisis, contributing to the rise of numerous severe conditions such as type 2 diabetes, cancer, heart disease, and gastroesophageal reflux disease (GERD) [1]. Bariatric surgery, including laparoscopic sleeve gastrectomy (LSG) which has gained popularity due to its simplicity, remains the most effective treatment for severe obesity offering significant and long-term weight loss [2]. Despite its popularity, LSG is not free from complications, and it can have a profound impact on esophageal physiology and quality of life (QOL) [3].

The relationship between LSG and GERD is complex, involving multiple anatomical and physiological factors. The impact of LSG on gastroesophageal function remains uncertain, as studies offer conflicting outcomes. Some research indicates an increased incidence of GERD following LSG [3,4], while others report improvements in reflux postoperatively [5,6]. The varying results highlight the need for a meticulous understanding of LSG's effects on GERD.

Several structural and functional factors may explain the heightened occurrence of GERD after LSG, particularly in predisposed patients. These include a weakened lower esophageal sphincter (LES) with decreased pressure due to removal of supportive sling fibers, disruption of the angle of His, diminished gastric compliance, increased intragastric pressure, delayed gastric emptying, late sleeve dilation, and the development of hiatal hernias. However, LSG may also reduce GERD through mechanisms such

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as weight loss, decreased gastric acid production, faster gastric emptying, and lower intra-abdominal pressure that may alleviate reflux.

By using tools like conventional esophageal manometry and multichannel intraluminal impedance-pH monitoring (MII-pH), along with endoscopy, gastrointestinal series, and specific questionnaire, this study aims to detect the effects of LSG and how this procedure influences esophageal physiology and GERD development thereby contributing to the optimization of surgical management for patients with severe obesity.

PATIENTS AND METHODS

This prospective observational study was conducted across two major bariatric surgery centers- Alexandria Main University Hospital in Alexandria, Egypt, and Molinette Hospital in Turin, Italy- between January 2022 and June 2023. The study included 15 patients with severe obesity who have undergone LSG. The inclusion criteria for the study required patients to be aged 18-65 years with a BMI greater than 40 kg/m² or greater than 35 kg/m² with associated comorbidities. Patients with severe GERD (Los Angeles C and D), large hiatal hernias (>5 cms), previous major abdominal surgeries, psychiatric disorders, or oncological conditions were excluded from the study. Ethical approval was obtained, and all participants provided informed written consent in line with the Good Clinical Practice guidelines and the Declaration of Helsinki [7].

Before surgery by one month, each patient underwent a thorough clinical evaluation that included a detailed medical history, assessment of GERD symptoms using the Gastroesophageal Reflux Disease-Health Related Quality of Life (GERD-HRQL) questionnaire [8], and physical examination including height, weight, and BMI measurements. In addition, all patients underwent esophagogastroduodenoscopy (EGD) to evaluate esophageal and gastric conditions, and a barium study to detect the presence of hiatal hernia and assess gastric anatomy.

MII-pH monitoring was performed using a portable data logger (Digitrapper pH-Z) and VersaFlex Z disposable pH/Impedance catheters (Sierra Scientific Instruments). This test was conducted off all anti-reflux medications for at least 15 days. The catheter was placed transnasally with its distal sensor 5 cm above the upper border of the LES. Patients were instructed to document meals, symptoms, and changes in posture during the 24-hour monitoring period. The collected data provided a detailed analysis of acid, weakly acidic, and alkaline reflux episodes, their frequency, duration, and clearance time. Reflux patterns were analyzed using the DeMeester score (DMS), with a score of less than 14.72 considered normal.

Esophageal conventional manometry (CM) was performed to assess esophageal motility and LES function. A ‘Dynograph R-611’ motility machine (Beckmann Inc., Germany) system with 8 channels perfusion catheters, four disposed radially and oriented at 90º to each other and four positioned longitudinally at intervals of 5 cm being perfused by distilled water (rate of 0.5 ml/min) by the Arndorfer water perfusion system (AMS, Greendale, WI, USA), was used for this purpose. The catheter was positioned through the patient’s nostril, and the patient was semi-seated during the test. Key measurements included LES pressure, total and abdominal LES length, and the duration of LES relaxation. Esophageal peristalsis was evaluated by measuring peak peristaltic pressures and the velocity of esophageal contractions. Data from the manometric studies were analyzed using specialized (SyneticsR, USA) software.

The surgical procedure was performed by the same experienced surgical team in each center. LSG, as described before [9], involved resecting a large portion of the stomach along its greater curvature (using a bougie of 36 Fr.) to induce significant weight loss while addressing comorbid conditions such as GERD.

Postoperatively, patients were followed-up at 12 months to assess changes in weight, GERD symptoms, and esophageal function. Evaluations included a repeat GERD-HRQL questionnaire, EGD, barium study, MII-pH monitoring, and CM. Also, the percentage of excess weight lost (PEWL) was calculated and data on postoperative weight and BMI were collected.

Statistical analysis was conducted using SPSS software [10], with results evaluated using both parametric and nonparametric tests depending on the data distribution. χ^2 tests were used for qualitative comparisons, and significance was set at *P* less than 0.05.

RESULTS

Clinical results

From January 1, 2022 to June 30, 2023, this study was conducted involving 15 patients who underwent LSG at Alexandria Main University Hospital and the Center for Minimally Invasive Surgery at Molinette Hospital. The cohort comprised 12 (80%) females and three (20%) males, with a mean age of 46.0±7.38 years.

The preoperative weight averaged 134.4±25.87 kg and the BMI was 49.45±6.94 kg/m². Postoperatively, the weight decreased significantly to 106.7±21.33 kg and BMI to 39.23±5.60 kg/m², with P values less than 0.001 for both measurements with PEWL of 36.21±10.64%.

Preoperatively, GERD symptoms were present in four (26.7%) patients. Postoperatively, two (13.3%) cases had resolution of symptoms, two (13.3%) cases had persistent symptoms, and two (13.3%) cases developed new GERD symptoms. Full doses of proton pump inhibitors (PPIs) were used by six (40%) cases preoperatively and decreased to four (26.7%) cases postoperatively, with no significant difference (*P*=0.687).

QOL assessed using the GERD HRQL questionnaire showed significant improvement after the operation as the median preoperative score was 58.0 (43.0–60.0) and the postoperative score was 25.0 (15.5–30.0) with a *P value* of 0.001.

Diagnostic results

Endoscopic evaluations preoperatively revealed esophagitis in 10 (66.7%) cases with no Barrett's metaplasia. Postoperatively, esophagitis was present in four (26.7%) cases, and Barrett's metaplasia was observed in one (6.7%) case. The differences between before and after the operation were not significant.

Barium studies showed no differences between pre- and postoperative values, with a single (6.7%) case that developed esophageal dilatation postoperatively. Reflux was evident in five (33.3%) cases before the operation and became evident only in two (13.3%) cases after the operation and small hiatal hernias were present preoperatively in six (40%) cases, while postoperatively three (20%) cases had small hiatal hernias. All cases had the normal configuration of the stomach/ sleeve and duodenal emptying.

Functional results

The data from MII-pHmetry showed no significant differences between before and after surgery in the total number of refluxes, as well as the number of acidic, weakly acidic, nonacidic, and mixed refluxes. Additionally, there were no significant changes in acid exposure time (AET), bolus exposure time, or DMS. Before surgery, one (6.7%) case had an increased total number of refluxes, acidic refluxes, AET%, and DMS above the normal range, while another case (6.7%) had elevated weakly acidic refluxes. Bolus exposure time remained normal in all cases. After surgery, three (20%) cases experienced a rise in total reflux events, bolus exposure time%, and DMS beyond normal limits. Among these, one case had increased acidic refluxes, another had weakly acidic refluxes, and one case showed both. Overall, two (13.3%) cases had elevated acidic refluxes, while three (20%) cases had increased weakly acidic refluxes, leading to a total of seven (46.7%) cases with an increased AET%.

The measured reflux parameters are summarized in (Table 1).

CM revealed significant changes in LES total length, LES residual pressure, and esophageal peristaltic wave amplitude between before and after surgery. (Figure 1) shows a CM of a case with weak peristaltic waves' amplitude postoperatively.

The mean LES total length decreased from 34.0 (±6.04) to 31.33 (±3.52) mm, with one (6.7%) case below the normal range both pre- and postoperatively. The median LES residual pressure increased from 2.0 (1.0–2.50) to 4.0 (2.50–6.0) mmHg, with only one (6.7%) case above the normal range after surgery. Additionally, the mean peristaltic wave amplitude significantly decreased from 98.20 (±29.34) to 52.93 (±22.60) mmHg, with one (6.7%) case below the normal range postoperatively. The P values for these changes were 0.027, 0.012, and less than 0.001, respectively, as shown in (Figures 2–4).

Other LES metrics, such as basal pressure, abdominal length, complete relaxations%, and duration of relaxations showed no significant changes postoperatively. Similarly, no significant changes were observed in peristaltic wave characteristics like normal morphology% and velocity. Preoperatively, five (33.3%) cases had LES basal pressure below the normal range, increasing to six (40%) cases postoperatively. LES abdominal length was below normal in six (40%) cases presurgery, improving to three (20%) cases postoperatively. One (6.7%) case showed failure of complete relaxations postoperatively, while all cases had normal relaxation duration before and after surgery. Peristaltic waves were generally normal in morphology and velocity, except for one (6.7%) case after surgery. One (6.7%) patient developed type II achalasia postsurgery, with a basal LES pressure of 41 mmHg, residual pressure of 17 mmHg, failure of complete relaxations, and absent peristaltic waves, preventing further assessment.

The CM parameters measured are summarized in Table (2).

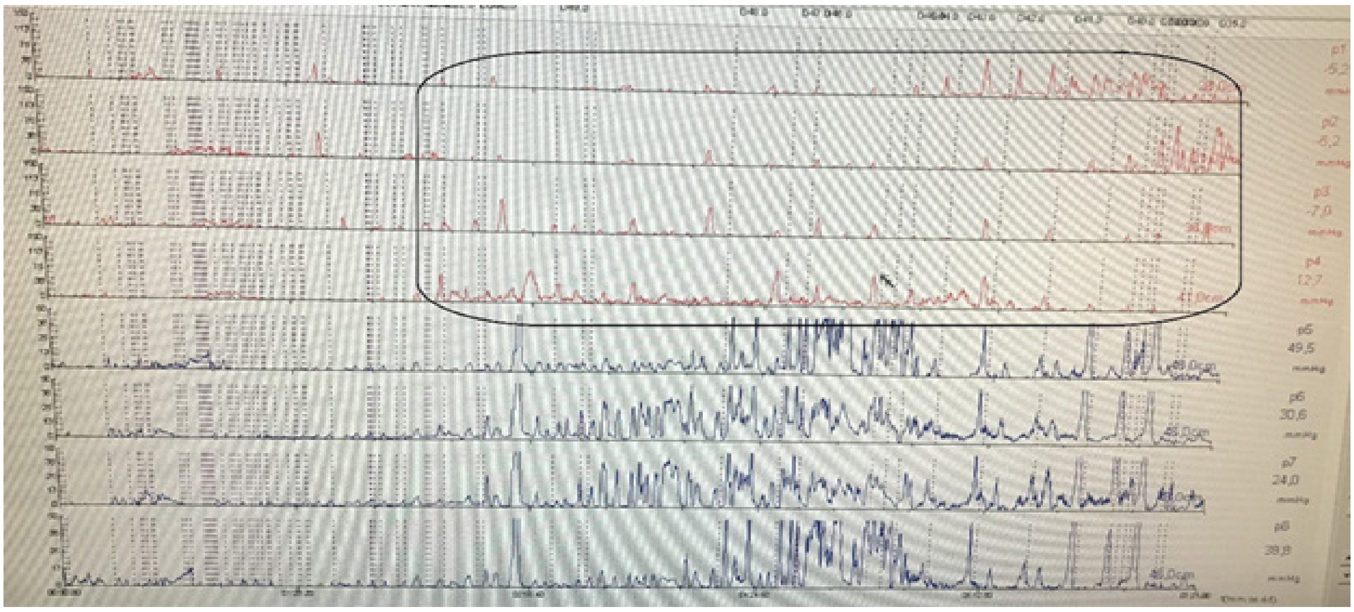

Fig. 1: Weak peristaltic waves' amplitude in a case after laparoscopic sleeve gastrectomy.

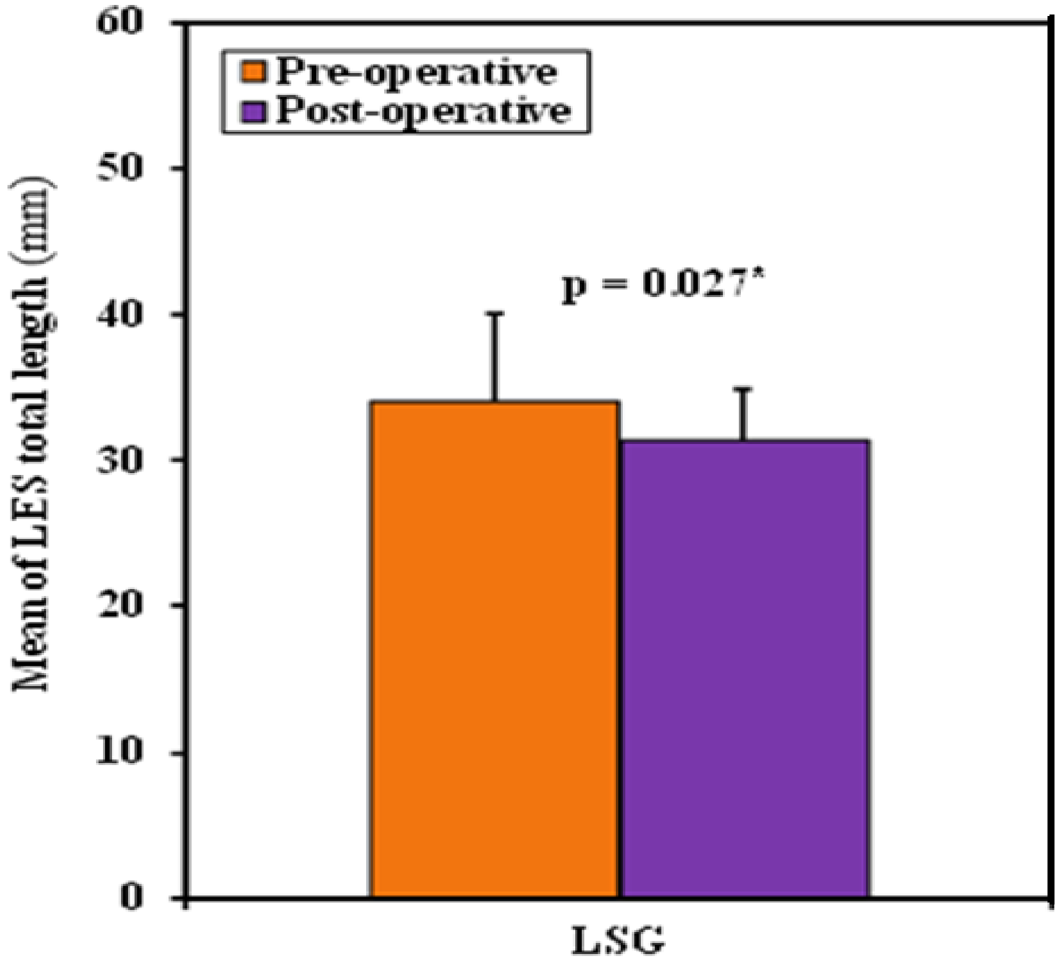

Fig. 2: Comparison between before and after laparoscopic sleeve gastrectomy (LSG) according to lower esophageal sphincter (LES) total length.

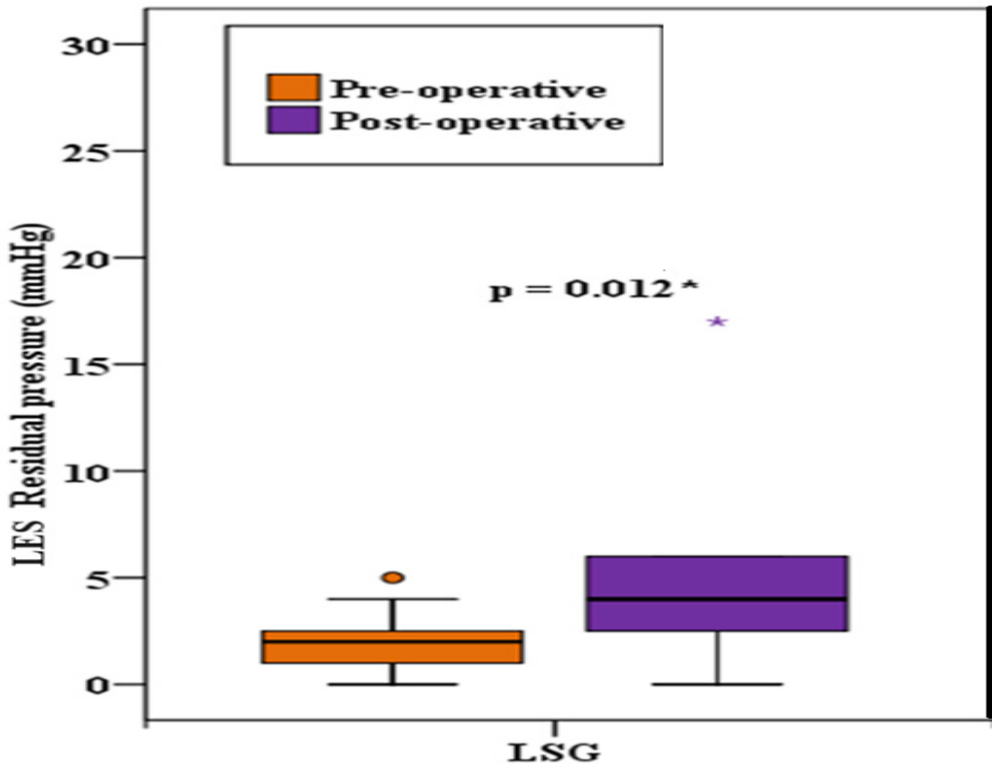

Fig. 3: Comparison between before and after laparoscopic sleeve gastrectomy (LSG) according to lower esophageal sphincter (LES) residual pressure.

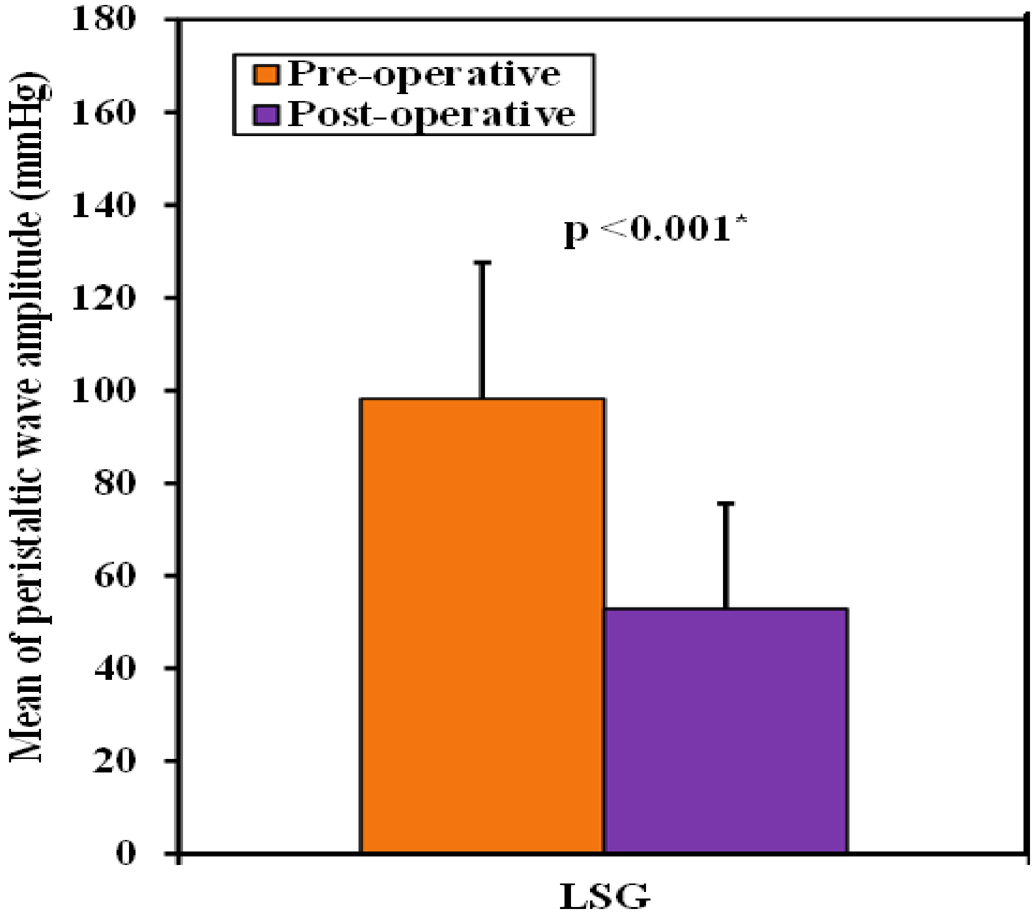

Fig. 4: Comparison between before and after laparoscopic sleeve gastrectomy (LSG) according to peristaltic waves' amplitude.

Table 1: Comparison between before and after laparoscopic sleeve gastrectomy according to MII pH.

MII pH	**LSG (*n*=15)**		
	Preoperative		**Postoperative**
Number of refluxes			
Min–max	12.0–82.0		10.0–146.0
Median (IQR)	28.0 (21.5–41.5)		25.0 (16.50–39.0)
P		0.691	
Acid exposure time%			
Min–max	0.20–6.80		0.20–29.30
Median (IQR)	2.10 (1.65–2.70)		2.40 (1.70–7.10)
P		0.124	
Acidic reflux			
Min–max	2.0–65.0		0.0–120.0
Median (IQR)	12.0 (6.50–20.5)		11.0 (3.0–19.50)
P		0.712	
Weak acidic reflux			
Min–max	2.0–41.0		2.0–65.0
Median (IQR)	16.0 (6.50–21.0)		8.0 (5.0–26.50)
P		0.865	
Non acidic reflux			
Min. – Max.	0.0–6.0		0.0–4.0
Median (IQR)	0		0
P		0.416	
Mixed reflux			
Min–max	– 28.0		0.0–46.0
Median (IQR)	9.0 (7.50–14.50)		8.0 (3.0–18.50)
P		0.733	
Bolus exposure time%			
Min–max	0.20–2.10		0.20–16.10
Median (IQR)	1.60 (1.20–1.70)		1.70 (1.20–2.35)
P		0.195	
DeMeester score			
Min–max	0.60–18.90		0.60–103.1
Median (IQR)	4.70 (2.15–7.60)		4.90 (1.75–9.80)
P		0.397	

IQR: Inter quartile range; Min: Minimum Max: Maximum; *P*: *P value* for comparing between the two studied groups for preoperative parameters; *: Statistically significant at *P* less than or equal to 0.05.

Table 2: Comparison between before and after laparoscopic sleeve gastrectomy according to conventional manometry.

CM	LSG (n=15)	
	Preoperative	Postoperative
LES basal pressure (mmHg)		
Min–max	6.0–25.0	6.0–41.0
Median (IQR)	14.0 (9.0–17.50)	14.0 (8.0–17.0)
P	0.574	
LES total length (mm)		
Min–max	25.0–45.0	25.0–40.0
Mean ± SD	34.0±6.04	31.33±3.52
P	0.027*	
Abdominal LES length (mm)		
Min–max	0.0–30.0	0.0–35.0
Median (IQR)	20.0 (2.50–25.0)	20.0 (15.0–25.0)
P	0.390	
LES complete relaxations %		
Min–max	70.0–100.0	0.0–100.0
Mean ± SD	95.33±9.15	84.67±25.32
P	0.052	
LES residual pressure (mmHg)		
Min–max	0.0–5.0	0.0–17.0
Median (IQR)	2.0 (1.0–2.50)	4.0 (2.50–6.0)
P	0.012*	
LES duration of relaxation (s)		
Min–max	6.0–10.0	5.0–11.0
Mean ± SD	8.47±1.51	8.60±1.72
P	0.634	
Peristaltic wave amplitude (mmHg)		
Min–max	66.0–155.0	0.0–91.0
Mean ± SD	98.20±29.34	52.93±22.60
P	<0.001*	
Normal peristaltic waves morphology%		
Min–max	90.0–100.0	0.0–100.0
Mean ± SD	99.33±2.58	86.67±25.26
P	0.075	
Peristaltic wave velocity (cm/s)		
Min–max	2.50–4.80	0.0–4.70
Mean ± SD.	3.63±0.90	3.29±1.20
P	0.306	

IQR: Inter quartile range; SD: Standard deviation; Min: Minimum; Max: Maximum; *P*: *P value* for comparing between the two studied groups for preoperative parameters; *: Statistically significant at *P* less than or equal to 0.05.

DISCUSSION

Bariatric surgery is effective for weight loss and managing obesity-related conditions like GERD, however, it can negatively affect esophageal function, especially in relation to GERD. While weight loss after surgery should theoretically reduce GERD symptoms, outcomes vary based on the procedure. Preoperative evaluation is essential, as no single bariatric surgery suits all patients.

Despite being more complex and associated with a higher incidence of postoperative complications than LSG, laparoscopic Roux en-Y gastric bypass is often recommended for patients with both obesity and GERD, particularly when GERD is severe. While LSG may still be considered in some cases, many bariatric surgeons view GERD as a contraindication to this procedure due to its potential to exacerbate reflux symptoms [11].

Studies investigating the relationship between GERD and esophageal function after LSG vary significantly in their methodologies and outcomes. Many focus primarily on symptom evaluation through questionnaires, while only a few objectively assess GERD and esophageal function using advanced diagnostic technologies like ambulatory 24-hour pH monitoring and manometry.

Our study aimed to fill the knowledge gap regarding the effects of LSG on GERD by using advanced diagnostic tools like esophageal manometry and MII-pH monitoring. While common assessments rely on symptom questionnaires and standard tests like endoscopy and barium studies, these technologies provide a deeper understanding of changes in esophageal motility, pressure, and acid exposure postsurgery. Given GERD's physiological nature, this comprehensive approach helps clarify how LSG impacts esophageal function in patients with severe obesity, focusing on GERD outcomes.

In our study, GERD symptoms remained stable pre- and postoperation, aligning with Del Genio *et al.* [12], who found no change in reflux-related symptoms in 25 patients over a median of 13 months, and Raj *et al.* [13], who studied 30 patients who had undergone LSG and found improvements in weight-related parameters 6 months, with no significant differences in GERD symptoms. Gadiot *et al.* [14] reported that 7% of asymptomatic patients developed de novo GERD after LSG, while 96% of those with preoperative GERD had symptom resolution after 5–8 years. In our study, four (26.7%) patients had postsurgery GERD, in whom symptoms resolved in two (50% of the affected). We also had two (13.3%) patients who continued to have GERD, and two (13.3%) who developed de novo GERD.

Clinically, the patients in our study reported a significant decrease in reflux symptoms postoperatively, as measured by the GERD HRQL questionnaire. This aligns with a study of 128 patients assessing QOL after 1 year post-LSG using seven questionnaires, which showed similar significant improvements in scores between baseline and 12 months [15]. Another prospective study confirmed this improvement in score after the procedure [6].

Our study found that PPIs usage decreased modestly from 40 to 26.7% postoperatively. PPIs were prescribed regardless of esophagitis detection, as GERD can occur without visible mucosal changes, which affect about 50% of GERD patients [16].

Comparing with other studies, Himpens *et al.* [17] reported 75% resolution of GERD in LSG patients, but 21.8% developed new GERD cases within the first year. A French retrospective study showed over 50% of patients required PPIs during the first year after LSG [18], and Braghetto *et al.* [19] reported 57.2% of patients using PPIs due to reflux symptoms. Parmar *et al.* [20] observed that 80% of patients who converted from LSG to laparoscopic Roux en-Y gastric bypass stopped GERD medications.

In our cases, EGD showed a decrease in esophagitis from 66.7 to 26.7%, with 20% having LA-A and 6.7% having LA-B esophagitis, comparable to another study reporting 26.3% with LA-A and 15.8% with LA-B, however, that study also noted a 42.1% increase in esophagitis postsleeve gastrectomy [21]. De novo GERD signs were seen in 13.3% of cases, consistent with other studies showing new esophagitis ranging from 6.5 to 66.7% [4,19,22,23]. Sharma *et al.* [6] found post-LSG esophagitis in 25% of patients. One (6.7%) case of Barrett's metaplasia occurred after LSG, falling between Braghetto's 1.2% and Genco's 17.2% [24,25]. These differences might be due to the strict endoscopic follow-up of cases, low severity of GERD, and the use of PPIs.

In our study, barium swallow studies showed a decrease in reflux signs from 33.3 to 13.3% after LSG. A review by Howard *et al.* [26] found 18% of patients had GERD signs post-LSG, with a 40% PEWL and a mean follow-up of 8 months.

Gastric morphology is another factor contributing to the progression of esophagitis after bariatric surgery. Dias da Silva *et al.* [27] found that 28.3% of patients with esophagitis post-LSG had abnormalities in the gastric tube, including gastric dilation, twist, neo fundus formation, and hiatal hernia. In our study, 20% of patients had hiatal hernias after the surgery. Despite a significant reduction in the number of cases with hernia due to weight loss, the size of the gastric tube was not measured, as computed tomography, which is more accurate, was not done. The correlation between hiatal hernias and GERD symptoms was noted, and some studies suggest that concurrent hernia repair during bariatric surgery, especially for small hernias, might not always be beneficial and could introduce complications as Snyder *et al.* [28] who reported that there was no impact on GERD symptoms from repairing small hiatal hernias (<4 cm) with LSG and we held the same opinion.

Accelerated gastric emptying after LSG was reported by Melissas [28], but Bernstine *et al.* [29] did not find the same results. Our study observed no abnormal gastro-duodenal emptying. Variations in results may be due to differences in surgical techniques and the lack of scintigraphy.

MII-pH monitoring has significantly improved GERD assessment by identifying more reflux episodes than traditional 24-hour pH monitoring, using both physical and chemical parameters of the refluxate. The prevalence of de novo GERD after bariatric surgery varies due to differences in follow-up duration and diagnostic criteria. MII-pH is now considered the new gold standard for GERD diagnosis and management, as it detects acidic, weakly acidic, and alkaline refluxes, and distinguishes between liquid, gas, and mixed refluxes, providing a comprehensive characterization of GERD.

Studies on LSG's impact on acid exposure show mixed results: some indicate a significant increase in total acid exposure after 12 months [30], while others report a decrease within the same timeframe [31].

Unlike previous studies reporting significant increases in AET% and DMS after LSG [32,33], our study found only a mild, non-significant rise in these parameters, with AET% increasing from 6.7 to 46.7% and DMS from 6.7 to 20%. These results are consistent with a prior trial involving 37 patients, where no significant changes in DMS or AET% were noted, and DMS increased in 18.9% of cases [31]. Similarly, a recent study of 30 patients with a 1-year follow-up reported a nonsignificant rise in AET% and DMS, with QOL remaining unaffected [34]. Additionally, while there was a nonsignificant decrease in the total number of reflux episodes and acidic refluxes, which aligns with another study showing a stable DMS and a nonsignificant reduction in reflux episodes and acid exposure after one year [21]. These findings may be influenced by continued PPI use despite recommendations to discontinue them 15 days before assessment.

The study of nonacidic reflux in bariatric surgery is limited. Our research found no significant changes in the number of nonacidic reflux episodes after LSG, aligning with another group's findings [13].

For weakly acidic reflux, our study showed no significant changes overall, though there was a minor decrease. This contrasts with Chern *et al.* [35], who reported a significant increase in weakly acidic reflux after LSG due to reduced gastric acidity after resection, however, our study did not observe the significant decrease in LES pressure noted by theirs.

Esophageal manometry provides both quantitative and qualitative measurements of esophageal pressure and peristaltic coordination, along with pressure changes of the LES [36], but data regarding manometric changes after bariatric surgery are still controversial.

Our study found no significant changes in LES basal pressure following LSG. Preoperatively, 33.3% of patients had LES pressures below the normal range, which increased slightly to 40% postoperatively. This result is consistent with Del Genio *et al.'s* study of 25 patients[12], which showed no significant changes in LES pressure and an increase in ineffective motility one year after LSG. Similarly, Rebecchi *et al.* [31] reported no changes in LES pressure. In contrast, Braghetto *et al.* [19] observed a significant decrease in LES pressure in 85% of patients six months post-LSG, attributed to partial sectioning of the sling fibers. Burgerhart *et al.* [37] also noted reduced LES pressure three months after LSG, despite stable peristalsis. Petersen *et al.* [38] suggested that higher LES pressure post-LSG might protect against GERD, potentially due to variations in surgical technique. These findings suggest that isolated LSG may not significantly impact the LES, highlighting the importance of surgical technique, especially in dissection near the gastroesophageal junction.

In our study, the total LES length decreased significantly after LSG while the abdominal LES length remained unchanged. The observed shortening of the LES following LSG might be due to the effacement from gastric distention due to the increased intragastric pressure. Despite significant weight loss, the abdominal LES length did not reduce. Another study has reported conflicting results, showing an increase in LES length after LSG [39].

Interestingly, the median LES residual pressure nearly doubled postoperatively after the operation, with only one (6.7%) case exceeding the normal range. This is contrary to other studies where LES residual pressure slightly decreased [35,40]. The increased intragastric pressure and reduced distensibility of the sleeve might heighten tension at the gastroesophageal junction.

The study found a significant difference in esophageal peristaltic wave amplitude postoperatively, where a more pronounced decline in esophageal contractility was shown, with one (6.7%) patient falling below the normal range postoperatively. This decline may lead to ineffective clearance of regurgitated gastric contents and stasis, possibly as a compensatory mechanism for the weakened LES. While some studies reported no significant changes in esophageal wave amplitude postsleeve gastrectomy [31,32,41], findings from two Italian studies with 25 and 21 patients, respectively, indicated a significant increase in ineffective esophageal motility following LSG [12,21].

It is important to highlight that one case was diagnosed as achalasia type II (LES basal pressure of 41 mmHg, residual pressure of 17 mmHg, failure of complete relaxations, and absent peristaltic waves preventing assessment of amplitude, velocity, and morphology) which was confirmed by high-resolution manometry. It is a rare finding after LSG as mentioned in the systematic review of ***Crafts et al.,*** and was planned for a heller cardiomyotomy with the conversion surgery [42].

Our study is prospective and integrates both subjective and objective parameters for assessment. The primary limitations of this study include the relatively short follow-up period and the limited sample size. The study faced challenges in recruitment, as many patients declined to undergo the minimally invasive investigations. Additionally, CM was utilized instead of the more advanced high-resolution manometry technology.

CONCLUSIONS

LSG has shown effective weight loss and improvements in QOL at 1 year postsurgery. In obese patients with pre-existing GERD, LSG often alleviates symptoms and controls reflux. De novo GERD following LSG is uncommon and typically linked to ineffective esophageal motility rather than changes in LES pressure. LSG remains a viable option for managing obesity in GERD patients.

Advanced diagnostics, such as manometry and MII-pH monitoring, offer important metrics for assessing gastroesophageal function, particularly when standard methods like endoscopy or barium studies do not explain symptoms. Larger randomized studies with longer follow-up periods and incorporating technologies like high-resolution impedance manometry are needed to further evaluate postoperative gastroesophageal function and symptom resolution in bariatric patients.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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