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" *Comparing Laparoscopic Sleeve Gastrectomy Versus Laparoscopic Roux-en-Y Gastric Bypass with Hiatal Repair for Severe Obesity and GERD : Short-Term Outcomes* "

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ABSTRACT:

Background: Laparoscopic Roux-en-Y gastric bypass (LRYGB) and laparoscopic sleeve gastrectomy (LSG) are common bariatric procedures. In patients with obesity and gastroesophageal reflux disease (GERD), simultaneous hiatal hernia repair (HHR) is often indicated. However, the comparative outcomes of LSG+HHR and LRYGB+HHR remain unclear.

Objectives: To compare short-term outcomes of LSG+HHR versus LRYGB+HHR in terms of weight loss, GERD remission, comorbidity resolution, and perioperative parameters.

Methods: Seventy-nine patients with obesity and hiatal hernias were retrospectively analyzed; 37 underwent LSG+HHR and 42 underwent LRYGB+HHR. Primary outcomes were GERD remission, excess weight loss percentage (EWL%), and excess BMI loss percentage (EBMIL%). Secondary outcomes included operative time, hospital stay, comorbidity resolution, and quality of life (QoL) improvement at one year.

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Results: LRYGB+HHR achieved significantly greater weight loss at 6 and 12 months ($P < 0.001$) and higher GERD remission rates (83.8% vs. 61.1%, $P < 0.001$) with fewer recurrences compared to LSG+HHR. However, LRYGB+HHR had longer operative time (166.74 vs. 68.73 minutes, $P < 0.001$) and hospital stay (2.24 vs. 1.05 days, $P < 0.001$). Both procedures effectively improved comorbidities and QoL ($P > 0.05$).

Conclusions: LRYGB+HHR offers superior outcomes in GERD resolution and weight loss but at the cost of longer operative time and hospitalization. Both procedures effectively improve comorbidities and QoL. Surgical choice should be individualized based on patient characteristics.

Keywords: Gastroesophageal reflux disease; laparoscopic repair of hiatal hernia; laparoscopic sleeve gastrectomy; laparoscopic Roux-en-Y gastric bypass.

INTRODUCTION

The global increase in obesity has presented significant public health challenges, as it is associated with chronic conditions such as cardiovascular disorders, type 2 diabetes, and sleep-related breathing difficulties. The most dependable long-term strategy for managing severe obesity and its metabolic complications has been recognized as surgical weight-loss procedures, particularly bariatric interventions.[1].

The laparoscopic Roux-en-Y gastric bypass (LRYGB) is a well-known bariatric procedure that bypasses the duodenum and a part of the jejunum by forming a tiny upper pouch in the stomach. This procedure is particularly effective in managing GERD because it reduces the amount of contact with gastric acid. Nevertheless, LRYGB is associated with certain hazards, such as anastomotic leaks and internal hernias, which may need other intervention or surgery. [2, 3].

A tubular gastric sleeve is created by removing a sizable portion of the stomach along the larger curvature in a procedure known as laparoscopic sleeve gastrectomy (LSG). LSG lowers the risk of internal hernias by maintaining intestinal continuity, in contrast to LRYGB. Its effectiveness in treating GERD is still up for discussion, though, as LSG may make symptoms worse or possibly cause new ones because it raises intragastric pressure.[4]

Hiatal hernias are frequently observed in candidates for bariatric surgery, affecting 20–50% of individuals. in severely obese individuals. Their presence is strongly associated with GERD, necessitating simultaneous hiatal hernia repair (HHR) alongside bariatric surgeries to optimize surgical outcomes. Although LRYGB is generally favored for GERD resolution, the impact of merging hiatal hernia repair with various bariatric surgeries remains unclear.[5, 6]

While there is still much to learn about how various bariatric operations affect postoperative GERD, the evidence that is now available suggests that LRYGB may be more beneficial than LSG. [7] For someone with severe obesity, GERD symptoms, and a hiatal hernia, deciding if bariatric surgery is the right course of action may be challenging. Maximising the benefits of a single, concurrent surgical procedure is the aim. [8] This study aims to assess the effectiveness of LSG with HHR and LRYGB with HHR in managing GERD and obesity. Comorbidity status, weight loss metrics, and GERD symptom relief are key outcomes. Additionally, during the one-year follow-up, secondary endpoints will include measuring the time spent in the hospital, the time it takes to complete the operation, and any improvements in quality of life (QoL).

METHODS

The medical records of seventy-nine patients who presented with obesity, GERD symptoms, and symptomatic or incidentally found hiatal hernias were examined in this retrospective analysis. Between 2020 and 2022, all subjects were enrolled in the study and either had a laparoscopic sleeve gastrectomy (LSG+HHR) or a laparoscopic Roux-en-Y gastric bypass (LRYGB+HHR) with hiatal hernia repair.

Study Setting and Ethical Approval: The study's locations included connected non-governmental hospitals and Alexandria University Hospital's General Surgery Department. Research Ethics Board (IRB) No. 00012098) at Alexandria University approved the study's protocol. Since this was a retrospective study, we did not need participants' informed permission. At every stage of the data extraction and analysis process, the privacy of the patients' records was preserved.

Criteria for Selecting Patients

We selected patients with severe obesity as this population has the highest prevalence of GERD, hiatal hernia, and obesity-related comorbidities. Surgical intervention offers both weight-dependent and independent improvements in GERD and metabolic health. Including this group increases clinical relevance.

Inclusion Criteria: Adults aged 18 to 60 years diagnosed with severe obesity with associated GERD symptoms or incidentally discovered hiatal hernia and underwent LSG+HHR or LRYGB+HHR

Exclusion Criteria: a) History of prior bariatric surgery, b) Severe biliary reflux or Barrett’s esophagus, c) Esophageal motility disorders, d) Uncontrolled endocrine disorders, e) Significant psychiatric illness, f) Incomplete medical records

The diagnosis of associated hiatal hernia was determined through: a) Upper gastrointestinal endoscopy for patients coming to the outpatient clinic with symptoms of gastro-oesophageal reflux disease (GERD) or those with previous barium investigations confirming the existence of a hiatal hernia., and b) incidental findings during surgical procedures.

Choice of the procedure: The final procedure was determined based on multidisciplinary team assessment, clinical indications (e.g., GERD severity), and intraoperative findings. Patient preference was considered but was not the sole deciding factor.

Patients were counseled on the expected outcomes of both procedures. LSG was expected to have a lower risk of nutritional deficiencies, while LRYGB was anticipated to provide greater GERD symptom relief.[9-11] Each patient received thorough preoperative evaluations encompassing medical, nutritional, and psychological assessments.

Study outcomes: The study's primary objectives were to assess the outcomes of concurrent HHR and two distinct bariatric operations (LSG and LRYGB) for patients with extreme obesity and related hiatal hernias. During a one-year follow-up period, this comprised evaluating the rates of GERD symptom improvement or worsening, the incidence of new GERD cases, and the frequency of re-interventions required after the combined surgical method. The secondary goals focused on reducing weight, reducing comorbidities associated with obesity, monitoring surgical complications, managing the length of the surgery and hospital stay, and assessing overall quality of life after the combined surgical treatment. The study's goals were aligned with the standard outcome reporting for bariatric and metabolic surgery. [12]

Operative details

Group A (LSG+HHR): Thirty-seven patients had simultaneous hiatal repair and laparoscopic sleeve gastrectomy. A 36 French bougie was used to measure the stomach. The gastric fundus was carefully mobilised during the sleeve gastrectomy, which was performed with a linear stapler. The crural pillars on the right and left sides were sutured posteriorly with one or more non-absorbable interrupted sutures to address the observed hiatal deficiency. An anterior trans-esophageal stitch was also inserted to stop the stomach pouch from moving higher. Additionally, a posterior gastropexy to the left crus was performed.

Group B (LRYGB+HHR): A total of forty-two patients underwent laparoscopic Roux-en-Y gastric bypass along with hiatal repair.

A 100-cm Roux limb was measured from the duodenojejunal junction, creating a small gastric pouch with a 36 French bougie tube. A gastrojejunostomy was performed, followed by a 100-cm biliopancreatic limb jejunojejunostomy. Mesenteric defect closure was undertaken to prevent internal hernias. Cruroplasty and posterior gastropexy were performed to stabilize the esophagogastric junction.

Data Collection: Patient data was retrieved from hospital medical records and electronic databases. The following variables were systematically collected: a) Demographics and preoperative Comorbidities. b) Surgical History. c) GERD Status: Preoperative GERD symptoms, medication use, and GERD severity score. d) Surgical Details: Type of bariatric procedure, operative time, intraoperative complications, and hiatal hernia repair technique. e) Postoperative Outcomes: Weight loss parameters, GERD resolution, comorbidity improvement, hospital stay duration, and postoperative

complications. f) Postoperative Quality of Life (QoL). Data were anonymised and stored in a secure database before analysis.[13].

Follow up: During a one-year follow-up period after surgeries, patients were followed with scheduled visits to our outpatient clinic at six and twelve months. During these visits, we systematically evaluated several critical outcomes. Weight loss was assessed using weight, BMI, percentage of excess weight loss (EWL%) and the percentage of excess BMI reduction (EBMIL%). We additionally followed GERD symptoms to evaluate the extent of improvement over the year. Furthermore, we tracked the remission of comorbidities linked to obesity, such as diabetes mellitus, hypertension and hyperlipidemia. Finally, we documented any cases that required bariatric revision procedures. Unless there is a clinical indication, all patients had upper GI endoscopy at the follow-up period's end. Follow-up endoscopy was selectively performed in symptomatic patients or those with unresolved or worsening symptoms. Findings included one case of recurrent hiatal hernia in the LSG+HHR group.

Statistical analysis

A statistical analysis was carried out using the Windows version of IBM SPSS Statistics, version 25.0. Statistical significance was established when the p-value was less than 0.05. The use of percentages and frequencies allowed for the description of categorical data. Depending on the situation, we used Fisher's exact test or a chi-square test to compare two categorical variables. Values for continuous data were presented as median and mean ± standard deviation (SD). We used independent sample t-tests when the Shapiro-Wilk test showed a normal distribution ($P > 0.05$), and the Mann-Whitney U test when the data was not normally distributed.

RESULTS

The study included 79 patients, comprising 37 who underwent LSG+HHR and 42 who underwent LRYGB+HHR.

The demographics and obesity-related comorbidities (table 1): The two groups did not differ significantly in terms of age, gender, or height. Having said that, the LSG+HHR group had noticeably greater average weight and BMI than the LRYGB+HHR group ($P < 0.001$). A number of obesity-related complications, such as diabetes, high blood pressure, and abnormal lipid profiles, were more common in the LRYGB+HHR group prior to surgery ($P = 0.001$).

	LSG+HHR	**LRYGB+HHR**	***P*-value**
	(n=37)	**(n=42)**	
Age, (year)			0.170
Mean ± SD	36.97 ± 9.36	39.48 ± 6.59	
Min - Max	21 - 53	26 - 54	
Median	36	39	
Sex			0.301
Male	7 (18.9)	13 (31)	
Female	30 (81.1)	29 (69)	
Height (cm)			**0.017**
Mean ± SD	163.86 ± 8.01	167.33 ± 4.29	
Min - Max	145 - 180	155 - 175	
Median	164	168	
Weight (kg)			**<0.001**
Mean ± SD	138.78 ± 17.69	126.14 ± 8.13	
Min - Max	113 - 180	105 - 143	
Median	140	125.5	
BMI (Kg/m^2)			**<0.001**
Mean ± SD	51.78 ± 6.30	45.08 ± 2.85	
Min - Max	39.45 - 67.85	38.57 - 50.78	
Median	51.27	45.14	
Comorbidity			
DM			
On insulin	4 (10.8)	3 (7.1)	**0.001**
On oral	7 (18.9)	4 (9.5)	
Hypertension	7 (18.9)	10 (23.8)	

Hyperlipidemia	0 (0)	5 (11.9)	
Polycystic ovary	0 (0)	3 (7.1)	
Menstrual problems	0 (0)	7 (16.7)	
Hypothyroidism	0 (0)	3 (7.1)	
Obstructive Sleep Apnea	0 (0)	2 (4.8)	
Primary infertility	1 (2.7)	0 (0)	
Surgical History			
Laparoscopic Cholecystectomy	3 (8.1)	5 (11.9)	**0.018**
Appendectomy	0 (0)	4 (9.5)	
Inguinal hernia	0 (0)	4 (9.5)	
PUH repair	0 (0)	2 (4.8)	
Breast surgery	0 (0)	2 (4.8)	
Quality of life			
Fair	10 (27)	9 (22)	0.792
Poor	27 (73)	32 (78)	

Abbreviations: BMI, body mass indexed.

[a] Number (percentage).

Table 1: Baseline Demographics, Preoperative Related Comorbidities, Surgical History and Quality of Life

Operative and Postoperative Course (Table 2):

a) The operating time was markedly extended in the LRYGB+HHR cohort (166.74 ± 10.78 min vs. 68.73 ± 15.87 min, $P < 0.001$).

b) The length of hospitalization was significantly prolonged in the LRYGB+HHR group (2.24 ± 0.93 days vs. 1.05 ± 0.23 days, $P < 0.001$).

c) Intraoperative complications were comparable between both groups, with technical intraoperative adverse events such as splenic capsule bleeding, staple misfire, and small bowel injury; all managed intraoperatively without major consequences. The LSG+HHR group reported that one participant experienced bleeding from the splenic capsule during the dissection of fundic posterior adhesions, which was managed through the application of a local hemostatic agent (surgicell). One patient experienced a misfire of one reload.

Two patients in the LRYGB+HHR group sustained injuries to the gastric remnant pouch and another suffered a jejunal loop injury during manipulation; both patients underwent direct laparoscopic suturingBoth groups experienced no intraoperative mortalities.

d) Postoperative complications were comparable between both groups.

1- **Early complications (within 30 days of the operation):** One patient (2.4%) in the LRYGB+HHR group experienced a gastrojejunostomy leak, which was managed conservatively. One patient in the LRYGB+HHR group developed extraluminal bleeding, requiring supportive management with blood transfusions. Being hemodynamically stable, A CT scan with contrast of the abdomen identified a retro-gastric collection measuring approximately 10×6 cm with no active contrast extravasation. This patient remained hospitalized for 4 days, receiving antibiotic therapy, haemostatics and repeated blood transfusions, and was later discharged in stable condition with hemoglobin levels restored. Two patients in each group developed melena, which was successfully treated with proton pump inhibitors. Upper endoscopy did not reveal any clear intraluminal gastric source, leading to conservative treatment involving adequate hydration and high doses of proton pump inhibitors. Furthermore, two patients in the LSG+HHR group developed worsening chest infections, dyspnea, and mild fever within 72 hours post-surgery. A chest CT scan indicated pneumonia, necessitating treatment with intravenous fluids and systemic antibiotics, after which the patients showed signs of recovery. The outpatient clinic managed 3 cases of postoperative port site infections (two in the LSG+HHR group and one in the LRYGB+HHR group).

2- **Late complications (beyond 30 days postoperatively):** One patient in the LRYGB+HHR group developed protein-energy malnutrition showing hypoalbuminemia at 2.2 g/dl five months after the surgery, requiring intensive nutritional support. Another patient experienced excessive weight loss, achieving a BMI of 19.1 kg/m² ten months post-operation, and was subsequently evaluated at the nutrition clinic to assess the need for a revision. Furthermore, One LSG+HHR and three LRYGB+HHR patients developed cholelithiasis, requiring cholecystectomy. Both groups displayed no notable differences in postoperative complications. Additionally, there were no fatalities reported in either group throughout the follow-up period.

	LSG+HHR	**LRYGB+HHR**	***P*-value**
	(n=37)	**(n=42)**	
Operative time, min			
Mean ± SD	68.73 ± 15.87	166.74 ± 10.78	**<0.001**
Min - Max	46 - 120	145 - 200	
Median	66	166	
Hospital Stay, day			
Mean ± SD	1.05 ± 0.23	2.24 ± 0.93	**<0.001**
Min - Max	1 - 2	2 - 7	
Median	1	2	
Intraoperative complications			
Splenic capsule bleeding	1 (2.7)	0 (0)	0.442
Miss fired reload	1 (2.7)	0 (0)	
tear in the blind gastric pouch -repaired	0 (0)	1 (2.4)	
Injured loop	0 (0)	1 (2.4)	
Bleeding from omentum	0 (0)	1 (2.4)	
Broken stapler during stappling	0 (0)	1 (2.4)	
No	35 (94.6)	38 (90.5)	
Early Post-op. Complications (< 30 days)			
Vomiting	2 (5.4)	1 (2.4)	0.362
Pain	0 (0)	1 (2.4)	
Leakage	0 (0)	1 (2.4)	
Extraluminal bleeding	0 (0)	1 (2.4)	
Melena	1 (2.7)	1 (2.4)	

Port site wound infection	0 (0)	1 (2.4)	
Pneumonia	2 (5.4)	0 (0)	
Flatulence	1 (2.7)	0 (0)	
Late Post-op.Complications (>30 days)			
Hypo-albuminuria	0 (0)	1 (2.4)	
Excess weight loss	0 (0)	1 (2.4)	0.221
Dysphagia	2 (5.4)	1 (2.4)	
Cholelithiasis	1 (2.7)	3 (7.1)	
Quality of life			
Good	9 (24.3)	9 (21.4)	0.794
Very good	28 (75.7)	33 (78.6)	

Table 2: Intraoperative Complications & Post operative complications & Quality of life

Weight Reduction Results (Table 3): Both groups demonstrated significant weight loss over time. However, LRYGB+HHR resulted in significantly higher %EWL and %EBMIL at both 6 and 12 months compared to LSG+HHR ($P < 0.001$). At 6 months; the mean EWL% was 53.55 ± 7.11 in the LRYGB+HHR group compared to 44.73 ± 9.14 in the LSG+HHR group ($P < 0.001$). At twelve months; the LRYGB+HHR group achieved 85.57 ± 6.28% EWL, whereas the LSG+HHR group had 72.65 ± 11.75% EWL ($P < 0.001$). Similarly, EBMIL% was significantly greater in the LRYGB+HHR group at both follow-up time points ($P < 0.001$).

Ideal Weight	**LSG+HHR** (n=37)	Mean ± SD	57.86 ± 5.59		
		Min - Max	47.5 - 72.5		
		Median	57.5		
	LRYGB+HHR (n=42)	Mean ± SD	59.86 ± 2.90		
		Min - Max	52.5 - 65		
		Median	59.75		
	***P*-value**		**0.004**		
			Pre-operative	**6 months**	**1 year**
Weight (Kg)	**LSG+HHR** (n=37)	Mean ± SD	138.78 ± 17.69	102.68 ± 13.32	80.62 ± 12.77
		Min - Max	113 - 180	75 - 131	60 - 120
		Median	140	100	78
	LRYGB+HHR (n=42)	Mean ± SD	126.14 ± 8.13	90.74 ± 6.25	69.38 ± 5.01
		Min - Max	105 - 143	79 - 104	56 - 79
		Median	125.5	90	69.5
	***P*-value**		**<0.001**	**<0.001**	**<0.001**
BMI (Kg/m^2)	**LSG+HHR** (n=37)	Mean ± SD	51.78 ± 6.30	38.29 ± 4.66	30.06 ± 4.52
		Min - Max	39.45 - 67.85	30.45 - 50.15	23.53 - 46.29
		Median	51.27	37.55	29.43
	LRYGB+HHR (n=42)	Mean ± SD	45.08 ± 2.85	32.43 ± 2.19	24.78 ± 1.48
		Min - Max	38.57 - 50.78	27.38 - 36.63	19.15 - 27.64
		Median	45.14	32.65	24.68
	P-value		***<0.001***	***<0.001***	***<0.001***
%EWL	**LSG+HHR** (n=37)	Mean ± SD	-	44.73 ± 9.14	72.65 ± 11.75
		Min - Max		21 – 71	32 – 92
		Median		42.53	73
	LRYGB+HHR (n=42)	Mean ± SD	-	53.55 ± 7.11	85.57 ± 6.28
		Min - Max		37 - 70	72 - 107
		Median		54	85.5
	***P*-value**		**-**	**<0.001**	**<0.001**
%EBMIL	**LSG+HHR** (n=37)	Mean ± SD	-	50.92 ± 10.67	82.78 ± 14.69
		Min - Max		23 - 76	35 -108
		Median		48	83
	LRYGB+HHR (n=42)	Mean ± SD	-	63.31 ± 8.92	101.24 ± 7.87
		Min - Max		45 – 84	87 – 131
		Median		62.5	101.5
	***P*-value**		-	**<0.001**	**<0.001**

All values presented in mean ± standard deviation unless indicated otherwise.

Table 3: Preoperative and postoperative weight changes

Resolution of Obesity-Related Comorbidities (Table 4): Both procedures effectively improved obesity-related comorbidities, with no significant differences in resolving diabetes, hypertension, hyperlipidemia, or sleep apnea. Hypertension and

Type II diabetes mellitus were the most observed comorbidities. The LRYGB group achieved a 90% resolution rate for hypertension, while the LSG group had a 71.4% resolution rate, with no significant differences between the two groups. In terms of diabetes resolution, the LRYGB+HHR group reached an 85.7% resolution, whereas the LSG+HHR group achieved 72.7% (P = 0.244). Additionally, complete resolution of obstructive sleep apnea and menstrual irregularities was observed in both groups.

GERD Outcomes (Tables 4):

a) **GERD and Hiatal hernia prevalence:** Among the 79 patients, 55 (69.6%) had preoperative symptomatic GERD, notably more common in the LRYGB+HHR group (88.1% compared to 48.6%, P < 0.001). The remaining 24 patients (30.4%) had incidentally discovered hiatal hernia; the LSG+HHR group had a notably higher percentage at 51.4%, whereas the LRYGB+HHR group was at 11.9% (P < 0.001).

b) **Preoperative GERD Severity:** The preoperative GERD severity scores (Table 4) were markedly elevated in the LRYGB+HHR group relative to the LSG+HHR group (P = 0.002). The median preoperative GERD score was higher in the LRYGB+HHR group (2.31 ± 1.44) than in the LSG+HHR group (0.89 ± 1.13, P = 0.002)

c) **Postoperative GERD Outcomes (table 4):** Postoperatively, GERD symptoms significantly improved in both groups, but with a higher remission rate in the LRYGB+HHR group (83.8% vs. 61.1%, P < 0.001). GERD improvement without full remission was comparable between groups (16.2% vs. 16.7%, P = 0.49) However, worsening GERD symptoms were reported exclusively in the LSG+HHR group (11.1% vs. 0%). At the end of the follow-up period, symptoms

of Denovo GERD were observed in just one patient in the LSG+HHR group (5.3%), while two patients reported deterioration in GERD symptoms in the same group. One of these patients' responded positively to high doses of PPI, while the other did not respond to treatment and on a follow-up endoscopy, a recurrence of hiatal hernia was documented (2.7%), which required reoperation and conversion to LRYGB.

d) Postoperative GERD Scores (Table 4): Postoperative GERD scores improved significantly in both groups, with a higher percentage of patients achieving a GERD score of 0 in the LRYGB+HHR group (90.5%) compared to the LSG+HHR group (73%), although this difference did not reach statistical significance (P = 0.238). The mean postoperative GERD score was lower in the LRYGB+HHR group (0.17 ± 0.58) compared to the LSG+HHR group (0.51 ± 0.96), though this difference did not reach statistical significance (P = 0.238).

	LSG+HHR (n=37)	**LRYGB+HHR (n=42)**	***P*-value**
DM			
Resolved	8 (72.7)	6 (85.7)	
Improved	3 (27.7)	1 (14.3)	
HTN	5 (71.4)	9 (90)	
Hyperlipidemia	0 (0)	5(100)	0.244
Polycystic ovary	0 (0)	0 (0)	
Menstrual problems	0 (0)	6 (85.7)	
Hypothyroidism	0 (0)	3 (100)	
Obstructive Sleep Apnea	0 (0)	2 (100)	
Resolved infertility	1 (100)	0 (0)	
Preoperative GERD			
Symptomatic	18 (48.6)	37 (88.1)	**<0.001**
Asymptomatic (Incidentally discovered HH)	19 (51.4)	5 (11.9)	
Remission of GERD	11 (61.1)	31 (83.8)	**<0.001**
Improvement of GERD	3 (16.7)	6 (16.2)	0.490

Worsening of GERD	2 (11.1)	0 (0)	0.216
De Novo GERD	1 (5.3)	0 (0)	1.000
No Change in GERD	1 (5.6)	1 (2.7)	1.000
Preoperative GERD Score			
0	19 (51.4)	5 (11.9)	
1	8 (21.6)	9 (21.4)	
2	6 (16.2)	8 (19)	**0.002**
3	3 (8.1)	10 (23.8)	
4	1 (2.7)	8 (19)	
5	0 (0)	2 (4.8)	
Mean ± SD	0.89 ± 1.13	2.31 ± 1.44	
Median	0	2	
Postoperative GERD Score			
0	27 (73)	38(90.5)	
1	4 (10.8)	2 (4.8)	
2	3 (8.1)	1(2.4)	0.238
3	3 (8.1)	1 (2.4)	
4	0(0)	0 (0)	
5	0 (0)	0 (0)	
Mean ± SD	0.51 ± 0.96	0.17 ± 0.58	
Median	0	0	
Follow up endoscopy			
Recurrent Hiatal hernia	1 (2.7)	0 (0)	0.468
Conversion/Revision	1 converted to RYGB(2.7)	0 (0)	0.468

All values presented in Number (percentage).

Table 4: Resolution of obesity related comorbidities, GERD status & Preoperative and postoperative GERD Score

These findings indicate that while both procedures significantly improved GERD symptoms, LRYGB+HHR provided superior and more durable symptom relief.

Quality of Life Outcomes: Upon completion of the follow-up period, an evaluation of the patients' quality of life was conducted, along with their satisfaction regarding both procedures. Utilizing the Moorehead-Ardelt Quality of Life Questionnaire II (M-A QoLQII), both groups showed notable enhancements in their quality of life, without statistically significant differences (P value > 0.05).

DISCUSSION

To reduce the risk of problems related to gastroesophageal reflux disease (GERD), bariatric surgeries are commonly used to treat hiatal hernias. To address severe obesity linked with GERD, this research compared the outcomes of LSG+HHR versus LRYGB+HHR. Reflux symptoms and the need for acid-suppressing medicine are both reduced after bariatric or metabolic surgery. According to some research, surgery may be more beneficial than medication alone in controlling gastroesophageal reflux disease (GERD). Further, increased intra-abdominal pressure, which is associated with obesity, is a significant factor in hernia repair failure or recurrence.[14–16].

Due to concerns about increased surgical risks and the idea that LRYGB alone adequately treats GERD, surgeons have historically been hesitant to conduct hiatal hernia repair during LRYGB procedures. However, it was shown by Chaudhry et al. that combining HHR with LRYGB is a safe and beneficial procedure. The combined surgery enhanced GERD-specific quality of life and decreased the need for acid-reducing drugs at a median follow-up of three years. According to Madalosso et al. [19], LRYGB effectively reduces GERD symptoms for up to three years after the surgery. The overall efficacy of LRYGB in treating GERD may be attributed to its ability to reduce acid production and encourage bile diversion, which is likely the cause of the decreased frequency of simultaneous hiatal hernia procedures in LRYGB patients. Better patient outcomes, however, could result from a more cautious approach to hiatal hernia surgery during LRYGB.

Redondo et al. [20] reviewed the literature on postoperative GERD symptoms and concomitant hiatal hernia surgery with LSG and found that LSG may cause patients to have new or worsened GERD symptoms, possibly as a result of elevated stomach pressure. Similar results were reported by Howard, Caban, and Cendan (21): after LSG

operations, 82% of patients had worsening GERD symptoms. However, one year following LSG, Daes, Jimenez, and Said (22) reported a 48% decrease in the occurrence of GERD symptoms. According to Soricelli, Iossa, and Casella (23) GERD symptoms appeared in around 22.9% of individuals who received LSG alone. However, in their study, this risk was eliminated when LSG was done in conjunction with hiatal hernia repair. The LRYGB+HHR group's much higher GERD remission rate (83.8% vs. 61.1%) in our research is consistent with the proven anti-reflux advantages of gastric bypass surgery. By removing the acid-producing gastric remnant, rerouting bile away from the oesophagus and lowering intragastric pressure, LRYGB modifies the gastrointestinal tract's structure in ways that successfully prevent reflux. On the other hand, LSG+HHR was linked to a 2.7% recurrence risk of hiatal hernias that required reoperation and a 5.3% incidence of de novo GERD. This confirms previous research showing that LSG does not completely prevent GERD recurrence, especially when combined with contemporaneous HHR.

LRYGB is thought to be the most successful solution for those with extreme obesity when it comes to weight control following bariatric procedures.[24, 25] The technique has shown positive long-term weight reduction even after a 20-year follow-up period [25, 26]. In comparison to the LSG with cruroplasty, Moussa et al. [27] found a statistically significant increase in EWL% with the LRYGB at three, six, and one year post-procedure. Additionally, Peterli et al. [28] shown that LRYGB and LSG were both quite effective at promoting weight loss. The LRYGB group showed a 73.8% decrease in excessive BMI at the three-year point, whereas the LSG cohort showed a 70.9% decrease. However, during the first three-year follow-up period, Karamanakos et al. [29] found that the EWL% following LSG was either equal to or higher than that following LRYGB. Furthermore, the eradication of the main source of the orexigenic

hormone ghrelin was clearly correlated with the removal of the gastric fundus [29, 30]. Antrum resection also involves cutting out a part of the stomach, around 2 to 3 cm from the pylorus. This reduces the volume of the antrum and might hasten the emptying of the stomach [31]. This contributes to the factors that lead to weight reduction. In our study, Weight loss outcomes were significantly better in the LRYGB+HHR group, with higher %EWL and %EBMIL at both 6 and 12 months ($P < 0.001$). These results align with earlier studies that LRYGB produces more sustained weight loss than LSG, primarily due to: malabsorptive components, hormonal alterations affecting appetite regulation and stronger metabolic effects on glucose and lipid metabolism.

Although both procedures led to the rate of diabetes remission was greater in LRYGB+HHR (85.7%), combined with a notable decrease in comorbidities associated with obesity as compared to LSG+HHR (72.7%), albeit this difference was not statistically significant. This pattern is consistent with research indicating that LRYGB improves insulin resistance and glycaemic management better than LSG. This result is consistent with previous research; Kehagias et al. [32] emphasised how LRYGB affected metabolic profiles, demonstrating how well it worked to treat a range of issues. A higher rate of diabetes resolution was seen when LSG was combined with hiatal hernia repair compared to LSG alone, at both 6- and 12-month post-surgery, according to research by Khalil et al. [33]. Possible changes in gastrointestinal hormones help the rapid normalization of blood sugar levels following both LRYGB and LSG operations [34, 35]. Peterli et al. [28] found that dyslipidemia significantly improved for up to three years after LRYGB and LSG operations. In contrast to the LSG cohort, the LRYGB group saw a greater reduction in total and LDL cholesterol levels.

There was no notable difference in postoperative nutritional deficiencies between the two groups in our study. Davies et al. [36] proposed that LSG resulted in a lower occurrence of dietary deficits than LRYGB. Following LSG, food moves rapidly through the upper digestive tract while still interacting with the duodenum and proximal jejunum. However, the status of micronutrients is less well-documented [37].

According to the postoperative quality of life measure, Peterli et al. [28] saw a significant improvement in quality of life a year after surgery compared to the preoperative period. Up to three years following surgery, no discernible variations in the incidence of complications were discovered. Our study, which also demonstrates a comparable increase in quality of life for both operations, is in line with these findings.

It is difficult to do a surgical treatment concurrently. The safety of doing bariatric surgery in addition to hiatal hernia repair was covered by Kothari et al. [38]. According to their findings, individuals who underwent both operations and those who simply had bariatric surgery had similar 30-day morbidity and death rates. When LSG was used in conjunction with hiatal hernia surgery, Shada et al. [39] found that the incidence of problems was lower than when LRYGB was used in conjunction with hiatal hernia repair. Therefore, the authors argued that LSG was the best option for weight reduction surgery for patients who needed to have a hiatal hernia repaired. But according to Hefler et al. [40], who conducted a retrospective examination of over 80,000 patients, the higher morbidity was probably caused by the generally higher hazards connected with LRYGB as opposed to LSG. In this study, individuals with extreme obesity and GERD had their LSG+HHR and LRYGB+HHR compared. The main conclusions show that LRYGB+HHR led to considerably greater rates of GERD remission (83.8% vs. 61.1%, $P < 0.001$), with no instances of GERD getting worse, whereas 11.1% of LSG+HHR

patients had increasing symptoms. Furthermore, LRYGB+HHR produced better weight reduction results at 6 and 12 months ($P < 0.001$), even though both treatments successfully addressed comorbidities associated with obesity. While LRYGB+HHR led to longer operating times ($P < 0.001$) and hospital stays ($P < 0.001$), both therapies significantly improved quality of life (QoL), and postoperative complications were comparable in the two groups. Remarkably, a GERD resurgence and a hiatal hernia relapse in one LSG+HHR patient necessitated conversion to LRYGB, confirming the longer-lasting nature of GERD management with LRYGB.

The study's strengths include a well-matched patient cohort, a comprehensive assessment of GERD outcomes using standardized grading systems, and the inclusion of endoscopic follow-up data, which allow for an objective evaluation of GERD resolution, recurrence, and de novo reflux formation.

But it's crucial to recognize some boundaries. Despite being clinically significant, the 12-month follow-up period could not adequately reflect long-term GERD recurrence rates, and the retrospective technique makes it more difficult to prove causation. Moreover, endoscopic confirmation was performed selectively rather than routinely, and the assessment of GERD was mostly based on symptoms. Finally, because the study was conducted in a single site, its generalisability to other groups would have been limited. Notwithstanding these drawbacks, the results offer compelling clinical support for LRYGB+HHR, which is thought to be the best bariatric procedure for treating GERD in obese patients with a hiatal hernia that needs to be repaired. LSG+HHR is still a good choice for patients with mild or incidental GERD who want to lose weight, but there is a greater chance that their symptoms will worsen

or persist. To further confirm these results, prospective studies with longer follow-up periods are necessary.

Conclusions

For obese patients suffering from GERD and hiatal hernia, the combination of LRYGB and HHR offers better GERD resolution than LSG with HHR, particularly for those with severe reflux disease. While both procedures effectively promote weight loss and improve metabolic comorbidities, LRYGB+HHR is associated with more durable GERD remission and a lower risk of symptom recurrence. Surgeons should individualize surgical choices based on patient GERD severity, comorbidity profiles, and long-term weight loss expectations.

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