Laparoscopic sleeve gastrectomy compared with Roux-en-Y gastric bypass surgery: 2-year outcome of body weight, obesity-associated comorbidities, and quality of life

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Objective
The objective is to check the efficacy and safety of two operative techniques designed for treating morbidly obese patients: laparoscopic sleeve gastrectomy (LSG) and laparoscopic Roux-en-Y gastric bypass (LRYGB).

Patients and methods
The study includes 72 morbidly obese patients, who were divided into two groups: group A, 40 (55.5%) patients treated using LSG, whereas group B, 32 (44.5%) patients managed by LRYGB. Operations were completed according to the rules of laparoscopic surgery. Collected operative data included operative time, intraoperative complications, postoperative (PO) complications, ICU, and hospital stay. All patients were monitored throughout the first 2 PO years at 3rd, 6th, 12th, and 24th PO months.

Results
There is a significant difference between both groups regarding operative time. The rates of early PO complications were higher in LRYGB than LSG group. Both groups showed a significant weight loss at the first 12 months postoperatively. The mean BMI dropped from 39.5±3.03 to 33.10±3.56 kg/m^2 among LSG patients compared with 40.18±3.18 to 30.23±2.64 kg among LRYGB patients. However, at the end of the second PO year, no difference in patients' weight, BMI, The percentage of excess weight loss (%EWL), or EBMIL was noticed in both groups. At the end of the first PO year, a dramatic improvement in both groups was seen about frequency and severity of associated comorbidities except for gastroesophageal reflux disease. At the end of the second PO year, all comorbidities showed prominent remission among patients of LSG group. Patients of LRYGB showed complete resolution of type 2 diabetes mellitus, obstructive sleep apnea, and depression.

Conclusion
Both LSG and LRYGB are safe bariatric surgical procedures that deliver convenient outcomes in weight loss and resolution of most obesity-associated comorbidities.

Keywords:
body mass index, laparoscopic sleeve gastrectomy, morbid obesity, Roux-en-Y gastric bypass

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Introduction

Worldwide, the obesity epidemic is considered as one of the most frustrating medical, social, psychological, and economic burden [1]. Obesity is associated with many comorbidities, such as type 2 diabetes mellitus (T2DM), hypertension, heart disease, dyslipidemia, joint disease, back pain, gall bladder stones, gastroesophageal reflux disease (GERD), and obstructive sleep apnea (OSA) as well as an increase in rates of early death [2]. None of the accessible conservative measures (e.g. lifestyle changes, medications, and behavioral therapy) have succeeded to qualify persons for attaining weight loss and concurrently to treat the comorbidities associated with obesity [3].

Nowadays, bariatric surgery is the most effective way of achieving these goals [3]. Three mechanisms are considered for surgical weight loss: restriction, malabsorption, or combination of both. Restrictive procedures [laparoscopic adjustable gastric banding (LAGB) and laparoscopic sleeve gastrectomy (LSG)] lead to early satiety and reduced caloric ingestion because of a decrease in the gastric size [4]. Malabsorptive procedures (biliopancreatic diversion with or without duodenal switch) lead to a reduction in bowel absorption through by passing a long segment of the small bowel [4]. Roux-en-Y gastric bypass (RYGB) is the operation that includes the two mechanisms: malabsorption and restriction [5]. Although RYGB operations are useful

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for patients, they have variable ranks of success and drawbacks that are unique to each operation [4]. For a long time, RYGB has been considered the surgical management of choice for obesity, with a satisfactory decline of associated comorbidities [6].The rising prevalence of obesity has led to the appearance of alternative tactics such as the LSG, which was defined by Regan *et al.* [7]. LSG showed certain advantages over the laparoscopic Roux-en-Y gastric bypass (LRYGB), as the bowel passage remains intact, endoscopy of the residual stomach and duodenum is still possible, and no threat of postoperative (PO) internal hernias [8]. The American Society for Metabolic and Bariatric Surgery in 2012 suggested LSG as a legal substitute to LRYGB, but still, there is skepticism between surgeons about long-term outcomes of LSG in comparison with the reputable outcomes of LRYGB [9,10]. Several studies have been done recently evaluating the efficacy and safety of LSG. We decided to present our study for evaluation of the outcomes of LSG and LRYGB.

Patients and methods

The current study was conducted in the general surgery and internal medicine departments of Banha University Hospital, Egypt, and King Saud Hospital, Saudi Arabia, from April 2013 to April 2017. Our study includes 72 morbidly obese patients. After approval of the study protocol by the Ethical Committee, patients were acquainted with the details of the possible hazards and benefits of both the procedures, fully informed written patients' consent forms were obtaining for participation in the study. For patients admitted for clinical evaluation, extra consent form was taken for the surgical operation. The patients were assessed by a multidisciplinary team (physician/endocrinologist, nutritionist, psychiatrist, and surgeon) and enrolled in the study if they fulfilled the inclusion criteria. BMI was calculated as weight (kg)/height (m^2) [11]. BMI was graded according to WHO classification as follows [11]: underweight: less than 18.5 kg/m^2, average weight: 18.5–25 kg/m^2, overweight: 25–30 kg/m^2, and obese: over 30 kg/m^2. Obesity was classified as obese class I (moderately obese) with BMI more than 30 to less than 35 kg/m^2, obese class II (severely obese) with BMI 35 to less than 40 kg/m^2, and obese class III (very severely obese) with BMI at least 40 kg/m^2. Only cases of BMI more than 35 kg/m^2 were included in the study. All cases were assessed preoperatively for the presence and severity of comorbidities, and routine laboratory investigations and evaluation of fasting blood glucose (FBG) and serum insulin levels for calculation of Homeostasis Model Assessment of Insulin Resistance were done [12]. All patients underwent abdominal ultrasonography and upper gastrointestinal endoscopy for detection of reflux esophagitis, hiatus hernia, and gastric or duodenal ulcers as well as esophageal manometer and upper gastrointestinal series.

Comorbidities were determined by using universal standards (T2DM: FBG≥126 mg/dl or 2-h plasma glucose ≥200 mg/dl through oral glucose tolerance test (GTT) or antidiabetic medication with or without insulin treatment; impaired glucose tolerance: 2-h plasma glucose ≥140 and ≤200 mg/dl during oral GTT; hypertension: systolic blood pressure 140 mmHg or more and/or diastolic blood pressure ≥90 mmHg or antihypertensive medications; OSA: repeated upper airway occlusion during sleep with or without sleepiness and high apnea/hypopnea index and the need for continuous positive airway pressure during sleep; GERD: necessity for PPI therapy and/or esophagitis detected by endoscopy and/or atypical manometry; arthralgia: through clinical examinations and radiological results; and dyslipidemia: fasting high-density lipoprotein <40 mg/dl for males, <50 mg/dl for females, and/or triglycerides >150 mg/dl and/or low-density lipoprotein >100 mg/dl or the use of statins).

Inclusion criteria for our study were as follows: (a) BMI more than 40 or BMI more than 35 with at least one major comorbidity related to morbid obesity (T2DM, dyslipidemia, OSA, hypertension, and arthralgia), (b) age between 18 and 60 years, and (c) failed conservative treatment)adequate diet and exercise program) over 2 years. Exclusion criteria were major abdominal surgery, noteworthy psychiatric disease, active peptic ulcer disease, patients with giant hiatal hernia, major eating disorder (binge eating), challenging GERD (not respond to medications), patients with inflammatory bowel disease (IBD), former bariatric surgery (apart from gastric banding), and active alcohol or substance abuse.

All included patients were examined clinically for demographic data including age, sex, anthropometric measurements, and accompanying comorbidities. Patients were classified according to the type of management provided as either LSG (group A) or LRYGB (group B). Operative and PO data were collected.

Preoperative assessment and preparation

Preoperative management was personalized based on patient history, physical examination, and investigations. Diabetic patients were kept on subcutaneous injection of regular insulin per 6 h, dose adjusted according to regular plasma and urine examination for

glucose to keep up FBG level less than 160 mg/dl, without ketonuria. Hypertensive patients were kept on β-adrenergic agonists and Ca-channel blockers to keep systolic arterial pressure (SAP) less than or equal to 130 and diastolic arterial pressure (DAP) less than or equal to 90 mmHg. Patients with COPD were kept on bronchodilators and β-adrenergic agonists.

Operative techniques

Laparoscopic sleeve gastrectomy

Under general anesthesia, with the patient in reverse Trendelenburg position, the surgeon while standing between the patient's legs performed the operation with a three-port technique. The greater omentum was dissected from the greater curvature of the stomach with division of the gastrocolic and gastrosplenic ligaments. Dissection was done close to the gastric wall using ultrasonic dissection or a bipolar sealing device. The left crus of the diaphragm was totally dissected and the angle of His defined. Hiatal hernias were explored and repaired with a posterior closure of the crura. The Posterior wall of the stomach was clearly visualized, and adhesions between it and pancreas were dissected. A 36-Fr (12 mm) stomach calibration tube (bougie) was inserted up to the pylorus. After leaving 7 cm of antrum from the pylorus, the sleeve of the stomach was created using a linear cutting (60 cm cartridge length, 4.1-mm staple-height) (Endo GIA stapler; Covidien, Mansfield, MA, USA). Reinforcement of the stable line was done by monofilament absorbable sutures to avoid the risk of PO leakage. The methylene blue test was done to detect any leak. The resected part of the stomach was extracted. Cholecystectomy was done for cholelithiasis. Nasogastric tube (NGT) was left in place, with no drains.

Laparoscopic Roux-en-Y gastric bypass

Under general anesthesia, with the patient in supine position, while standing on the right side of the patient, the surgeon performed the operation with a 6-port technique and exposed the ligament of Treitz. Overall, 50 cm of the jejunum was measured from the ligament of Treitz. Then, the biliopancreatic limb and Roux-limb were created. The 'white vascular' cartridge (2.5-mm staple height, 60-mm cartridge length) was used. Roux-limb was measured 75 cm distally in all cases. An end-to-side jejunojejunostomy was performed with Endo-GIA stapler with the 60-mm white load. The patient was transferred to a steep reverse Trendelenburg position. Endo-GIA stapler with 60-mm blue loads was applied two to three times across the gastric cardia (1 cm from the gastroesophageal junction) toward the angle of His to create a gastric pouch of about 15 ml. The Roux-limb is then advanced toward the gastric pouch for an end-to-side gastrojejunal anastomosis using absorbable surgical suture. An omental patch (shower cap) was used to cover the gastric pouch to protect against leakage. Mesenteric defects were sutured with a non-absorbable surgical suture to protect against internal herniation. Cholecystectomy was performed for cases with cholelithiasis. A closed suction drain was placed behind the anastomosis.

Postoperative care

Patients were managed with modern enhanced recovery after-surgery protocols. Patients were encouraged to get out of the bed on the same day of surgery. Close observation of pulmonary function and continuous SpO_2 monitoring were performed. Patients with medical diseases were maintained on the same ranks of treatment given preoperatively. Thrombosis prophylaxis measures (mechanical and chemical) were performed according to the policy. Early enteral feeding was started. After LSG, patients were discharged home by the second PO day. For LRYGB, the drains were usually withdrawn from the third PO day, and then the patients were discharged home.

Follow-up monitoring

(1) Anthropometric measures were evaluated at 3, 6, 12, 18, and 24 months after surgery. The %EWL and percentage of excess body mass index loss (%EBMIL) were calculated as follows:

$$\%\mathrm{EWL} = \frac{\mathrm{Preoperative follow-up\ weight}}{\mathrm{Preoperative\ weight}} \times 100,$$

and

$$\%\mathrm{EBMIL} = 100\left(\frac{\mathrm{Follow-up\ BMI25}}{\mathrm{Preoperative\ BMI25}} \times 100\right).$$

(2) Associated comorbidities were evaluated at 6, 12, 18, and 24 months after surgery. Remission and improvement of comorbidities were defined by the physician/endocrinologist responsible for the follow-up.

(3) The Quality of life (QOL) was evaluated at the end of second PO year with the Moorehead-Ardelt QOL Questionnaire II [12].

Statistical analysis

Data were presented as mean±SD, ranges, numbers, and ratios. Results were analyzed using Wilcoxon's ranked test for unrelated data (Z-test) and χ^2-test for numerical data. Statistical analysis was conducted using the SPSS (version 21) for Windows statistical package (IBM Corp., Armonk, NY, USA). The P value less than 0.05 was considered as statistically significant.

Results

The study included 72 morbidly obese patients. They divided into two groups (A and B) according to bariatric operation offered to them. Group A contained 40 (55.5%) patients treated with LSG whereas group B contained 32 (44.5%) patients managed with LRYGB. There were no significant differences between both groups regarding age, sex, anthropometric measures, or associated diseases. Most enrolled patients experienced obesity-associated comorbidities. Patients' demographic data are clearly shown in Table 1.

Most patients in both groups passed the procedure smoothly without intraoperative complications or conversion to laparotomy. Details of the operations and PO periods are mentioned in Table 2. On discharge from the hospital, patients were instructed to stay on medications for control of their medical comorbidities according to the regimen stated by a multidisciplinary team. Three patients from LRYGB group were readmitted: one diabetic patient developed a wound infection and was admitted for control of blood sugar and wound infection, who responded to conservative therapy, whereas the second patient and the third patient had a severe asthmatic attack that

Table 1 Patients' demographic data

Data	Strata	LSG group	RYGB group	*P*-value
N (%)	72	40 (55.5)	32 (44.5)	
Age (years)	–	33.6±10.58 (20–55)	35.68±10.64 (23–59)	>0.05
Sex [*N* (%)]	Males	12 (30)	8 (25)	>0.05
	Females	28 (70)	24 (75)	>0.05
Anthropometric measures	Weight (kg)	122.5±7.58 (110–140)	123.2±8.83 (103–147)	>0.05
	Height (cm)	176±7.9 (157–188)	175.1±9.88 (151–192)	>0.05
	BMI (kg/m^2)	39.5±3.03 (35–46)	40.18±3.18 (35.3–47.8)	>0.05
Comorbidities	Hypertension	24 (60)	20 (62.2)	>0.05
	Diabetes	11 (27.5)	9 (28.2)	>0.05
	Dyslipidemia	26 (65)	18 (56.25)	>0.05
	GERD	15 (37.5)	14 (43.7)	>0.05
	OSA	18 (45)	15 (46.89)	>0.05
	Joint/back pain	27 (67.5)	20 (62.5)	>0.05
	Depression/anxiety	7 (17.5)	8 (25)	>0.05

Data are presented as mean±SD and numbers and ranges and percentages are in parentheses; GERD, gastroesophageal reflux disease; LSG, laparoscopic sleeve gastrectomy; OSA, obstructive sleep apnea; RYGB, Roux-en-Y gastric bypass.

Table 2 Operative and postoperative data

Data	Strata	LSG group	RYGB group	*P*-value
Operative time (min)	–	95±26.95 (55–140)	150±32.65 (135–190)	<0.05
Conversion to open	–	0	1 (3)	–
ICU admission (days)	1	2 (5)	1 (3)	
	2	1 (2.5)	1 (3)	
	3	0	2 (6)	
	Total (days)	1.3±0.58 (0–2)	2.4±0.89 (0–3)	>0.05
Hospital stay (days)	2–4	28 (70)	20 (63)	
	5–7	12 (30)	8 (25)	
	8–10	0	3 (9)	
	>10 days	0	1 (3)	
	Total (days)	3.87±1.52 (2–7)	7.06±1.95 (5–14)	<0.05
Reoperation	Owing to bleeding	0	1 (3)	NS
	Owing to leakage	0	1 (3)	
Readmission	–	0	3 (9)	NS
PO complication	Bleeding	2 (5)	1 (3)	
	Leakage	0	3 (9)	
	Infection	0	2 (6)	
	Dysphagia	1 (2.5)	3 (9)	
	Anastomotic stenosis	0	1 (3)	
	Total events	3	10	<0.05

Data are presented as mean±SD and numbers; ranges and percentages are in parentheses; GERD, gastroesophageal reflux disease; LSG, laparoscopic sleeve gastrectomy; PO, postoperative; RYGB, Roux-en-Y gastric bypass.

managed by the medical team. A total of four patients (one from LSG group and three from LRYGB group) developed dysphagia, and all responded well to medical therapy. At the sixth PO month, one patient from LRYGB group experienced repeated vomiting. Endoscopy revealed stenosis in the anastomotic line. Dilatation was done through endoscopy, and the patient's condition improved. More details are present in Table 2.

Patients in both groups showed a significant weight loss at the first 12 months of PO follow-up; however, the decreases in body weight and BMI were more prominent in LGRYB group compared with LSG group. The details of anthropometric measures of both groups throughout the follow-up period are mentioned in Table 3 and Figs. 1 and 2.

At the end of the second PO year, there was a dramatic improvement between patients of both groups in the frequency of obesity-associated comorbidities except for GERD. All details about PO changes in obesity-associated comorbidities are mentioned in Table 4 and Fig. 3.

Patients in both groups showed a marked PO improvement in QOL matched with the preoperative one. According to Moorehead-Ardelt QOL QuestionnaireII, 2 years postoperatively, the QOL was assessed as very good and good in 31 (77.5%) and 23 (72%) patients in LSG and LRYGB, respectively. Postoperatively, no patient was evaluated as very bad in both groups. Details of the QOL changes are shown in Fig. 4.

Discussion

Over the past decades, obesity represents an epidemic health problem all over the world. Surgical management of obesity till now is the gold standard for controlling excessive body weight [13]. Between all bariatric surgeries, LRYGB and LSG were the most popular operations [14]. In our study, we did not only report the results of each procedure

Table 3 Anthropometric measures of both groups throughout the follow-up period

	Time				
Data	Preoperative	3 months PO	6 months PO	12 months PO	24 months PO
Weight					
LSG group	122.5±7.58	118.2±4.36	113±4.67	104.5±3.41	102.58±3.45
RYGB group	123.2±8.83	115.6±5.23	109.4±2.65	100.32±6.51	98.95±3.26
BMI					
LSG group	39.5±3.03	37.15±4.81	35.65±5.24	33.10±3.56	32.30±3.15
RYGB group	40.18±3.18	37.98±5.02	34.5±4.23	30.23±2.64	29.75±6.40
%EWL					
LSG group	–	3.51±3.25	7.75±6.25	14.69±2.65	16.26±2.46
RYGB group	–	6.16±5.21	11.20±4.10	18.57±2.36	19.68±4.76
EBMIL					
LSG group	–	16.20±6.40	27.17±5.20	44.14±3.54	41.60±5.20
RYGB group	–	14.49±3.62	37.41±3.26	65.54±4.71	66.70±4.18

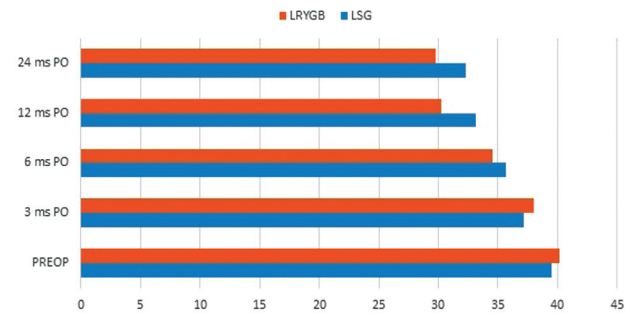
Data are presented as mean±SD; LSG, laparoscopic sleeve gastrectomy; PO, postoperative; RYGB, Roux-en-Y gastric bypass.

Table 4 The rates of resolved obesity-associated comorbidities throughout the postoperative follow-up period

Diseases	Groups							
	LSG group				RYGB group			
	Preoperative	6 months PO	12 months PO	24 months PO	Preoperative	6 months PO	12 months PO	24 months PO
Hypertension	24	7 (29.2)	16 (66.6)	21 (87.5)	20	7 (35)	15 (75)	18 (90)
Diabetes	11	4 (36.4)	8 (72.7)	10 (90.9)	9	4 (44.5)	8 (89.9)	9 (100)
Dyslipidemia	26	7 (27)	16 (61.5)	23 (88.5)	18	7 (39)	14 (77.8)	17 (94.5)
GERD	15	5 (33.3)	7 (46.7)	11 (73.3)	14	7 (50)	12 (85.7)	12 (85.7)
OSA	18	8 (44.5)	13 (72.3)	16 (88.9)	15	6 (40)	12 (80)	15 (100)
Joint /back pain	25	6 (24)	16 (64)	21 (84)	20	10 (50)	17 (85)	19 (95)
Depression/ anxiety	7	2 (28.6)	5 (71.4)	6 (85.7)	8	3 (37.5)	7 (87.5)	8 (100)

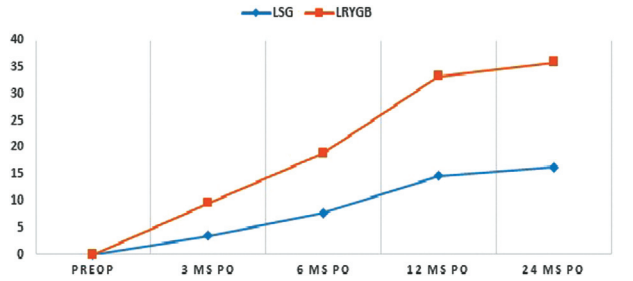
Data are presented as numbers and percentages; GERD, gastroesophageal reflux disease; LSG, laparoscopic sleeve gastrectomy; PO, postoperative; RYGB, Roux-en-Y gastric bypass; OSA, obstructive sleep apnea.

Figure 1



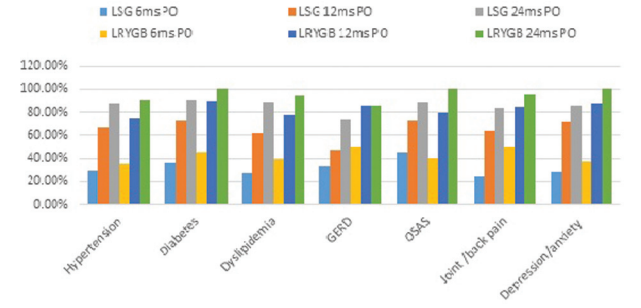
Frequency of changes in BMI throughout the follow-up period.

Figure 2



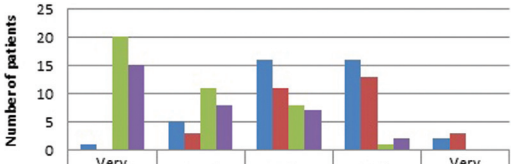
Frequency of changes in %EWL throughout the follow-up period.

Figure 3



The rates of cured obesity-associated comorbidities throughout the follow-up period.

Figure 4



QOL	Very good	Good	Medum	Bad	Very bad
Preoperative LSG	1	5	16	16	2
Preoperative LRYGB	0	3	11	13	3
Two years PO LSG	20	11	8	1	0
Two years PO LRYGB	15	8	7	2	0

The QOL changes as specified with the Moorehead-Ardelt QOL Questionnaire II.

separately as before, but we made a comparison between perioperative results and 2-year outcomes on body weight and obesity-associated comorbidities to share with our colleagues the best and safest way for reduction of excessive body weight.

In our study, the mean operative time for LRYGB was significantly (P<0.05) higher than LSG (50±32.65 vs. 95±26.95 min, respectively). Intraoperative complications were more prominent among patients treated with LRYGB, which obligated conversion of one (3%) case to an open procedure. During LSG, there was no intraoperative hazards or conversion. There is no doubt that the durability and complexity of LRYGB reflected on PO patients' condition and total hospital stay. This goes with the findings of Mingrone *et al.* [15] and Helmio *et al.* [16], who mentioned that LSG is considered a technically less challenging operation than the LRYGB, mirrored by smaller operation time and minor complication rate in the LSG group. The mean PO ICU admission in LSG group was much less than the LRYGB group. The mean total hospital stay for LSG patients was 3.87±1.52 days, and it is significantly lower than the LRYGB group, which was 7.06±1.95 days (P<0.05). This goes to some extent with the findings of Albeladi *et al.* [17], who stated that LSG is technically simpler than the LYRGB, which is reflected by shorter operative time. However, they found that these features are not interpreted into the shorter PO hospital stay. Early outcomes in our study reflect a significant difference (P<0.05) in PO morbidities between patients of both groups; compared with the LSG, LRYGB has a higher rate of bleeding, anastomotic leaks, dysphagia, infection, and fevers. This goes with Matthew *et al.* [18], who mentioned that, compared with LSG, LRYGB has a high rate of approximately all PO bariatric specific events requiring reoperation, readmission, or an intervention. Zhang *et al.* [19] reported that the complication rate was slightly higher among patients treated with LRYGB, with 13.2% for LSG and 26.5% for LRYGB. This also goes with Jurowich *et al.* [20] and Topart *et al.* [21], who mentioned that morbidity is lower in patients undergoing LSG; however, early and late complications in both groups showed no statistically significant difference (P>0.05).

In our present study, there was a significant drop in the mean body weight and mean BMI with a progressive elevation of %EWL and EBMIL among patients of both groups in the first PO year than after 24 months;

however, the decrease was prominent among patients treated with LRYGB than LSG. This goes to some extent with Ralph *et al.* [10], who mentioned that body weight markedly decreased in the first PO year nearly to the same extent in both groups, but there was no difference concerning weight loss or EBMIL between the two groups after 12 months. According to Boza *et al.* [22], the bariatric surgery was considered as successful only when the patients achieved a percentage of EWL of more than 50%. The results of our study showed that LRYGB and LSG were effective bariatric operations resulting in significant weight loss, with %EWL of 62.5% in LSG and 75% in LRYGB [22].

In this study, PO resolution of comorbidities was very favorable. Cure rates for patients undergoing LSG exceeded 70% among patients with T2DM in the first year and 90% after 24 months. Resolution rates of hypertension, dyslipidemia, OSA, joint/back pain, and depression/anxiety were between 60 and 70% in the first year and exceeded 80% after 24 months. On the contrary, the cure rates of obesity associated-comorbidities such as diabetes, hypertension, OSA, joint/back pain, and depression/anxiety among patients undergoing LRYGB were higher than the figures of LGS group, where the cure rates of LRYGB range from 75–90% in the first PO year. At the end of second PO year, all patients with diabetes, OSA, and depression/anxiety stopped medications completely. This goes in hand with Rao *et al.* [23], who mentioned that clinical studies with a 1–2-years follow-up showed that LSG produced greater remission in T2DM rates than those achieved after other bariatric techniques. Also, Benaiges *et al.* [24] noticed a high cure rate of T2DM among patients who were undergoing RYGB; this improvement happened soon after surgery even before significant weight loss had not yet been reached; this could be related to changes in the gut hormonal mechanisms. In patients undergoing LRYGB, GERD significantly improved in the first and second PO years by 87.5%; this may be attributed to the acceleration of gastric emptying, and weight loss may improve GER. On the contrary, GERD improvement was lower among patients treated with LSG, with 40 to 70% at the end of first and second years, respectively. This goes with de Groot *et al.* [25] who concluded that LSG may deteriorate gastroesophageal reflux owing to raised intragastric pressure, decreased gastric emptying, and reduced lower esophageal sphincter pressure. They also suggested that the use of LSG as a final technique for the surgical management of morbid obesity is a respectable option for the obese people who do not have GERD or a hiatus hernia [25]. In our study, patients from both groups showed a marked PO improvement in the QOL matched with the preoperative one. These findings are similar to the study by Zellmer *et al.* [26], in which the PO improvements in QOL even exceeded that of healthy people.

Conclusion

Our prospective study demonstrates that LSG and LRYGB are respectable options for the management of morbidly obese people. LRYGB is more effective than LSG for the rapid decrease of excessive body weight, surgical treatment of T2DM, improvement ofthe symptomized GERD, curing OSA, and control of metabolic syndrome. LSG is easier and safer and has a lesser rate of PO morbidity and mortality. However, further studies with longer follow-up periods and with a larger patient pool are mandated to give more reliable evidence before we can judge which operation should be considered as the gold standard bariatric procedure.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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