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Short Term Outcomes of Roux en-Y Gastric Bypass vs. Re-Sleeve Gastrectomy for Failed Weight Loss or Weight Regain After Sleeve Gastrectomy

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ABSTRACT

Background: Sleeve gastrectomy (SG) is now the most used obesity surgery. There have been reports of different rates for conversion of LSG to other bariatric operations due to various factors such as recurrent weight gain (RWG) and/or failure of weight reduction. The purpose was to evaluate the security and effectiveness of redo after an unsuccessful primary LSG to either LRSG or rLRYGB. **Methods:** All patients who had SG at Tanta University Hospital in Egypt from July 2017 to July 2023 were included in this retrospective study. Patients with either LRSG or rLRYGB following their previous SG were listed, and their demographics and outcomes were examined. **Results:** Seven hundred sixty-two patients underwent SG from July 2017 to July 2023, of whom 112 (14.6%) had a conversion. There were 79 individuals with either suboptimal clinical response (SoCR) or recurrent weight gain (RWG). Seventy-three patients had a minimal follow-up ≥12 months after conversion. Four patients were removed from the cohort after undergoing conversions to BPD/duodenal switch following SG. The mean BMI after RSG was 33.6±5.3 kg/m^2, and 32.7±5.4 kg/m^2 in the RYGB group. Re-sleeve group had a significantly lower operative duration than RYGB, with a mean of 89±12.7 and 168±33.5 minutes, respectively. The length of hospital stay was significantly shorter in RSG 4±0.1 versus 7±1.2 in RYGB. **Conclusions:** Our results showed that revisional LRSG and rLRYGB after LSG are achievable and secure techniques with favorable weight reduction consequences, sustained weight loss over 1 year, and low complication rates.

Introduction

Sleeve gastrectomy (SG) is now the most used obesity surgery, with a rate of 55.4% **(1).** Sleeve gastrectomy is commonly used as a weight reduction surgery perse with a high-resolution rate of related medical issues and a good safety profile **(2,3)**. There have been reports of different rates for switching to other techniques of obesity operations due to different factors such as recurrent weight gain (RWG) and/or failure to lose weight **(4,5)**.

Inadequate weight reduction has been ascribed to different causes, such as technical issues with increased postoperative sleeve volume.

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Additionally, sleeve dilatation may happen after surgery **(6, 7).** These issues could need a second operation. Following SG, conversion rates vary from 6.1 to 22.6%, rising throughout the follow-up period **(4,8)**.

Revisional or conversional operations have been used in this situation. They have gained popularity recently due to their ability to help patients who have had unsuccessful primary surgeries. This has shown arousal in discovering their use and efficacy, making them a significant research topic in future time, with an increasing concern in studying redo operations after LSGs **(9-11)**.

Re-sleeve gastrectomy (RSG) is used for unsuccessful LSG, which has been shown to reduce weight **(4,10)**. Malabsorptive surgery has also been chosen **(12)**. There are several published studies; however, the evidence for selecting the optimum one is unclear.

The purpose was to evaluate the security and effectiveness of redo after unsuccessful primary LSG to either LRSG or rLRYGB and to analyze the results over a short term of follow-up regarding weight reduction, presence of complications, and the resolution of concomitant medical diseases.

Patient and methods

All patients who had SG at Tanta University Hospital in Egypt from July 2017 to July 2023 were included in this retrospective study. Patients with either LRSG or rLRYGB following their previous SG were listed, and their demographics and outcomes were examined.

This research aimed to assess the effects of re-sleeve and revisional RYGB on recurrent weight gain following LSG. The Ethics Committee of Tanta University accepted the protocol and took the registration number: (36264PR594/3/24). The inclusion criteria included patient between 18-65 years with failed previous SG due to recurrent weight gain (RWG) and/or failure to lose weight. Unsuccessful previous SG showed excess weight loss less than or equal to 50%, BMI more than 35 kg/ m^2, and more than 20% weight gain of the lost weight for a minimum period of 12 months. Patients with a planned second-stage surgery before the initial SG were excluded from our analysis. The study did not include patients who had revisions for causes other than controlling their weight such as GERD.

Surgical Techniques

Re-sleeve gastrectomy technique

Re-sleeve gastrectomy (RSG) was taken into consideration only after sleeve dilatation was diagnosed either by endoscope or 3D Ct volumetry. Every LRSG was performed using a 5-port laparoscopic approach (Three were 5 mm, and two were 12 mm). An energy gun is used to dissect the adhesions to guarantee complete neo-fundus visualization and mobilization. The stomach is cut 1 cm from the angle of His using a 36-fr Bougie tube by the staples. Methylene blue is injected through the nasogastric tube as part of the leak test to check the staple line.

Revisional Roux-en-Y gastric bypass technique

Every rLRYGB was carried out using a 5-port laparoscopic approach. Using the energy device, begin by dissecting the adhesions surrounding the gastric sleeve. The gastric pouch was formed beginning at 4-5 cm below the cardia, with calibration over a 40-fr bougie. The biliopancreatic limb was measured 150 cm distal to the duodeno-jejunal junction to create the gastro-jejunostomy and the jejuno-jejunostomy. After dividing the small bowel, a second Roux limb of 75–100 cm was taken. To avoid pressure on the anastomosis, the larger omentum was separated. A nonabsorbable 2/0 Prolene suture was used to close the stapling defects. The mesenteric openings are finally closed. The staple line is evaluated using a standard leak test. Methylene blue is injected through the nasogastric tube as part of the leak test to check the staple line**.**

Choice of revision

Furthermore, the surgical method used at our institution depended on the operator's recommendation, medical indications, and the patient's preference. The team of endocrinologists, dietitians, and bariatric surgeons examined each patient before conversion and performed a standard physical examination. Following a series of stages aimed at identifying the precise cause of the initial SG's failure, the proper revisional approach was decided. If a barium swallow showed that the stomach fundus was dilated or the endoscopy showed that the stomach sleeve was dilated and could retroflex the endoscope, an LRSG was the recommended course of action. An LRYGB was the preferred treatment option If there was incisural constriction, a hiatal hernia, no signs of dilatation or oesophagitis, and putting in mind the patient's

ability to take supplementary vitamins for life. All patients in the study for prophylaxis against venous thrombosis received a prophylactic dose of LMWH 12 hours before the surgery and continued for two weeks postoperatively.

The primary outcome was weight loss following revision, expressed as a change in BMI and weight. All revisional or conversional procedures had different follow-up rates, so only short-term results (≥12 months and≤18 months) were evaluated. Various weight loss measures following revision were calculated using the most recent weight reported prior to revisional bariatric surgery as a reference. A BMI of 25 kg/m2 was considered the ideal body weight.

The secondary outcomes were complications and were divided into early (< 30 days), including anastomotic leak, hemorrhage, infection, and perforation, and late complications, including gastric ulceration, stricture, and internal herniation regarding guiding for obesity surgery **(13)**. Hypertension and type 2 diabetes were among the comorbidities that were searched for.

Results

Seven hundred sixty-two patients underwent SG from July 2017 to July 2023, of whom 112 patients (14.6%) had a conversion. There were 79 individuals with either suboptimal clinical response (SoCR) or recurrent weight gain. Seventy-three cases had the least time for follow-up,≥12 months and ≤18 months after redo and joined the study. Four patients were removed from the cohort after undergoing conversions to BPD/duodenal switch following SG. During the study period, fifty-five cases underwent conversion for RYGB and fourteen for a revisional SG. The cause for revision or conversion surgery was recurrent weight gain 53 (76.8%) and inadequate weight loss 16 (23.2%). DM and HTN were present in 7 (10.2%) & 17 patients (24.6%). The patients' average age was 38.5±6.3 years, and approximately 88% were female. The mean duration until surgery was significantly lower in the RSG group, as shown in Table (1).

Prior to SG, patients' average weight was 136.8 ±15.2 kg, and their average BMI was 51 ± 7.7 kg/m2. Following initial SG, the mean weight reduction showed a decrease in the mean BMI at revisional or conversional surgery, which came to 40.2 ± 6 kg/ m^2, or 115.8 ± 14 kg.

Table (2) shows that the mean BMI after RSG was 33.6±5.3 kg/m^2 and 32.7±5.4 kg/m^2 in the RYGB group at the year follow-up. There was no statistical difference between the two groups regarding EWL percentage.

Morbidity and comorbidity

The shortest procedure was re-sleeve and was significantly lower than RYGB with median operative times of 89±12.7 and 168±33.5 minutes, respectively. The length of hospital stay was significantly shorter in RSG 4±0.1 versus 7±1.2 in RYGB.

Two patients (2.8%) experienced bleeding in the form of melena in the RYGB group, which was resolved with non-operative management using coagulants and blood transfusions; two patients (2.8%) experienced leaks, one in each group, and were treated conservatively (one in RSG, which was found at the gastroesophageal junction and was managed by an endoscopic stent, and the other with an anastomotic leak that needed lavage and sonar guided drainage. Superficial surgical site infection was found in 5 (7.2%) cases. One patient in each group underwent concurrent port site hernia repair at a 12 mm trocar site. One patient in RYGB had an internal hernia and was represented with bowel obstruction requiring laparoscopic exploration 5 days postoperatively with undoing of the small bowel and closure of the defect with prolene sutures. One patient in RYGB had gastro jejunal stricture and presented with poor oral intake requiring readmission, TPN, and revision of the stoma 7 months after revisional surgery.

Diabetes was resolved in 28.6% of cases and hypertension in 23.5% throughout follow-up (Table 3). Patients who received LRSG showed more excellent resolution of their hypertension (33.3% against 21.4%), whereas those who received rLRYGB showed a resolution of DM (33.3% versus 0%).

During the study's follow-up period, two patients (one in each group) passed away (2.9%); however, the patient's death in RYGB was unrelated to the operation, whereas the patient in RSG died on the eighth day after surgery from a pulmonary embolism.

Table 1. Bio-demographic characteristics of the studied cohort (n=69)

Variable	RYGB n=55	RSG n=14	*Total* *n=69*	*p*-value
Gender • Male • Female	 6(10.9%) 49(89.1%)	 2(14.3%) 12(85.7%)	 8(11.6%) 61(88.4%)	 X^2=0.12 0.7
Age (years)- Range mean (SD)	 34-51 38±9.3	 38-55 40±10.5	 34-55 38.5±6.3	t=0.6 0.5
Reason for conversion • Inadequate weight loss (less than 50% EWL) • Recurrent weight gain (more than or equal to 20% of weight lost)	 12(21.8%) 43(78.2%)	 4(28.6%) 10(71.4%)	 16(23.2%) 53(76.8%)	 X^2=0.28 0.6
Comorbidities • Yes • No DM Hypertension	 20(36.3%) 35(63.7%) 6(10.9%) 14(25.5%)	 4(28.5%) 10(71.5%) 1(7.1%) 3(21.4%)	 24(34.7%) 45(65.3%) 7(10.2%) 17(24.6%)	 X^2=0.3 0.5
Duration until revisional surgery(months) Range Mean	 18-45 (33 ±7.2)	 22-39 (28 ±4.1)	 18-45 30.5±5.7	 t=2.4 0.01*

t independent t-test , X^2 Chi square test

Table 2. Bodyweight and BMI Criteria of the studied cohort (n=69)

Body weight criteria	**RYGB** **n=55**	**RSG** **n=14**	**Study cohort** **Mean**	**Test of significance** ***p*-value**
• Prior to SG initial weight(kg) -mean (SD)	142 ±24.5	133±7	136.8±15.2	t=2.3 0.02*
• Initial BMI (kg/m^2) - mean (SD)	53.4±8.7	48.6±10.4	51±7.7	t=1.3 0.2
• Prior to revision Lowest weight(kg) -mean (SD)	117±17.1	116.4±20.2	115.8±14	t=0.9 0.1
• Lowest BMI (kg/m^2) - mean (SD)	41.3±5.38	39.7±5.3	40.2±6	t=0.3 0.9
• Post-revisional weight(kg) at 1 year - mean (SD)	86.7±11.4	89±0.8	87.8±6.2	t=1.4 0.14

• Post-revisional BMI (kg/m^2) at 1 year -mean (SD)	32.7±5.4	33.6±5.3	32.5±5.2	t=0.5 0.5
• EWL% at 1 year Mean	44.5±3.6	41.6±2.3	42.25	t=1.8 0.06

t independent t-test , X^2 Chi square test

Table 3. Postoperative characteristics of the studied cohort (n=69)

Operative characteristics	RYGB n=55	RSG n=14	Study cohort n=69	Test of significance *p*-value
Operative time (min) Mean Range	 168 ±33.5 110-209	 89± 12.7 58-160	 137±20.5 58-209	 t=8.6 <0.0001*
Length of hospital stay (LOS)(days)	7±1.2 (4-20)	4±0.1 (3-14)	5.8±0.7 (3-20)	t=9.2 <0.0001*
Early (≤30 days) complications • Leak • Bleeding • Wound infection	 1(1.8%) 2(3.6%) 3(5.4%)	 1(7.1%) 0(0%) 2(14.2%)	 2(2.8%) 2(2.8%) 5(7.2%)	 *MCET =0.13* *0.9*
Late complications • Internal hernia • Port-site hernia • Marginal ulcer • Gastro jejunal stricture	 1(1.8%) 1(1.8%) 1(1.8%) 1(1.8%)	 0(0.0%) 1(7.14%) 0(0.0%) 0(0.0%)	 1(1.4%) 2(2.8%) 1(1.4%) 1(1.4%)	 *MCET=0.27* *0.9*
Follow-up after conversion (months) Range Mean	 13-38 17.5 ±9.8	 14-31 15.6± 8.3	 13-38 14.7±8	 t=0.6 0.5
Resolution of Comorbidities Yes No DM Hypertension	 5(9%) 50(91%) 2(33.3%) 3(21.4%)	 1(7.1%) 13(92.9%) 0 1(33.3%)	 6(8.6%) 63(91.4%) 2(28.6%) 4(23.5%)	 X^2*=0.05* *0.3*
Mortality rate	1(1.8%)	1(7.1%)	2(2.8%)	X^2*=1.2* *0.2*

t independent t-test , X^2 Chi square test , *MCET Monte Carlo Exact test*

Discussion

Recurrent weight gain (RWG) after sleeve gastrectomy (SG) is caused by a number of reasons. It could be partially explained by the hyperactivity of ghrelin-producing cells previously silenced following fundic resection in previous sleeve gastrectomy, which is frequently observed during long-term follow-up **(14).** Another explanation was that patients eventually lose their dietary restrictions and/or adjust to a diet rich in calories over time. Additionally, neo-fundus and stenosis brought on by procedural problems may contribute to weight gain. Over time, these problems worsen, and their effects are more noticeable with long-term follow-up **(11).**

For patients undergoing restrictive surgeries, weight loss failure and/or recurrent weight gain are serious concerns **(15)**. A study representing about 10-year outcomes after LSG showed that about one-third of sleeve gastrectomy patients needed revision **(16)**. As a result, developing successful revisional or conversional procedures has become more crucial in recent years. Surgeons use their judgment and experience when deciding which conversional surgery is appropriate because no official guidelines or consensus recommend a single procedure to treat weight regain after LSG. Because conversional treatments are attached to a high level of general morbidity, when we decide on a surgical maneuver, we should consider its complexity, the patients' traits, and the possible outcome. Given the difficulties, the ideal bariatric operation's goal for any case is to find a surgical option that offers the best risk-benefit ratio **(17)**.

The conversion rate in the literature varies according to the duration of follow-up, which was about 50% with fifteen years of follow-up **(18)**. In contrast, other studies showed a conversion rate between10-22% within 10 years **(4,19)**.

While deciding to do a redo surgery, it is essential to reshape the previous sleeve if needed, and /or length of the roux limb (20), because weight loss depends mainly on how it is performed and the length of the biliopancreatic limb. The longer the biliopancreatic limb, the more weight loss will increase, as shown in a study with different limb lengths in RYGB **(21)**.

In our cohort, there were significant reductions in BMI from 41.3±5.38 kg/m^2 and 39.7±5.3 kg/m^2 to 32.7±5.4 kg/m2 and 33.6±5.3 kg/m^2 one year after redo surgery in the RYGB and re-sleeve groups, respectively. In patients where the indication was inadequate weight loss, the analysis indicated a virtually identical BMI loss after SG (7.4 kg/m2) and after revision to RYGB (7 kg/m2) **(22)**. In comparison, in our study, it was (12.1 kg/m^2) & (8.6 kg/m^2) respectively.

In a retrospective analysis by Huynh et al., after conversion to RYGB with the final follow-up (33.3 months), a preoperative BMI of 33.8 ± 5.61 dropped to a BMI of 31 **(8)**. According to another study by Boru et al. **(23)**, 24 months after conversion to RYGB, the end BMI was 28.4 ± 4.3, while the preoperative BMI was 36 ± 9. However, in our study, at the last follow-up (12 months) after conversion to RYGB, the preoperative BMI was 41.3±5.38, and the end BMI was 32.7±5.4.

The indication for conversion determines the possibilities available for converting the SG. A study including patients receiving RSG showed a mean EWL of 61.5% after 1 year **(24)**, whereas our investigation found 41.6%. But according to Cheung et al. [25]. EWL decreased from 68.0% in one year to 44.0% in two years following RSG, in keeping with our findings of a total EWL of 41.6% at one year's follow-up. Consequently, in the instance of IWL, RSG does not appear to be the best choice for conversion **(25)**.

Abdemur et al. **(26)** discovered 76.5% overall EWL following a conversion to RYGB. Another cohort reported a total EWL of 50.8% at one year, which aligns with our study's 44.5%. At three and five years, the percentage drops to 45.3% and 33.8%, respectively **(27)**.

Revisional or conversional surgery in the form of both LRSG and rLRYGB was found to be feasible, and the two methods' efficacy (as indicated by EWL results) did not appear to have differed much during different follow-up periods in other studies that matched ours **(28,29)**

Revisional or conversional surgery has shown a lot of morbidities, specifically leaks and bleeding. This is because adhesions may occur following primary procedures, making the tissues imperfect for anastomosis **(30)**. Our study cohort observed a 20.2% complication rate after revisional surgery. The complications followed either RYGB (N=10/55) or RSG (N=4/14), and two patients were deceased. Our study complication rate matches what is reported in the literature (6.7–31.5%) **(29, 31,32)**.

This study showed 2 (2.8%) leak cases, one in each group. The leakage was successfully

controlled conservatively in both situations and matched with the leakage rate of the literature **(33,34)**. Two patients (2.8%) in REGYB suffered from bleeding, which was controlled by non-operative treatment with coagulants and blood transfusions. Despite routine closure of the mesenteric defects, we saw one patient (1.8%) with an internal hernia complication following RYGB, with no occurrence on RSG, which was less than a study with a rate of 7.3% **(29).**

Two patients (2.8%) showed port-site hernias, one in each group, and both needed re-intervention, which matches the results of a study (1.4%) **(35).** The incidence of internal hernia is lower in the RSG group, but still, the patient may suffer from intestinal obstruction due to a complicated port site **(36)**.

With no significant differences, one patient (1.4%) in the RYGB group and no patients in the RSG group had endoscopy-diagnosed marginal ulcers (MU) in this study. The patient was treated medically. In contrast, the incidence of MU in RYGB was found to be 4.6%, with a range of 1 to 9% **(33,37)**. Diagnoses of MU were less common than these reported rates. However, during the study's follow-up period, endoscopies were not frequently carried out; instead, they were reserved for patients who had symptoms. As a result, we may have missed certain MU or GERD cases.

The follow-up showed improvements in persistent obesity-related comorbidities, with a resolution rate of 23.5% for hypertension and 28.6% for diabetes. This is lower than what was shown in research by **(38),** which shows resolution up to 80%, and another research by Andalib et al. because it included both resolution and improvement (for DM2 60–83%, for HTN 40–60) **(29)**.

The study had certain drawbacks—first, selection bias results from the retrospective data analysis. A bigger sample size is required to show changes between these two groups. The effect of redo surgery on GERD is uncertain in our study because patients with GERD were omitted. Lastly, a more extended follow-up period is required to compare the two procedures adequately.

Conclusions

Our results showed that revisional LRSG and rLRYGB after LSG are achievable and secure techniques with favorable weight reduction, sustained weight loss over 1 year, and low complication rates. Until then, we suggest that both methods be valid for weight reduction revisional or conversional surgery, and the choice between both techniques can be tailored according to patient needs, comorbidities, and available surgical expertise.

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