

# Mini-gastric bypass versus single-anastomosis sleeve ileal bypass as revisional surgery after laparoscopic sleeve gastrectomy for gastroesophageal reflux disease management

Mohamed F. Mahfouz, Mohammed Matar, Tamer M. Saeid Salama

Department of General Surgery, Faculty of Medicine, Ain Shams University, Cairo, Egypt

Correspondence to Mohamed F. Mahfouz, MD, Zip Code 11566.  
e-mail: drmohamedelnhas@gmail.com

**Received:** 14 June 2021

**Accepted:** 10 July 2021

**Published:** xx Month 2021

**The Egyptian Journal of Surgery** 2021, 40:1229–1232

## Introduction

Bariatric surgeries are currently the only effective treatment for morbid obesity and its associated comorbidities, including type-2 diabetes mellitus, hypertension, and dyslipidemia. Laparoscopic sleeve gastrectomy (LSG) is nowadays the most performed bariatric procedure accounting for 46% of all bariatric procedures, according to 2018 IFSO global registry report. However, gastroesophageal reflux disease (GERD) remained a common complication of LSG. Studies had showed the effect of mini-gastric bypass (MGB) or single-anastomosis sleeve ileal bypass (SASI) on GERD either as primary procedures of revisional surgeries. Our study aims to compare MGB with SASI as revisional surgeries after LSG for GERD management.

## Patients and methods

A prospective cohort study for patients undergoing revision surgery, MGB, or SASI, after LSG at Bariatric Surgery Department at Ain Shams University Hospital, is done. We included all patients above 18 years old, and we excluded those who were below 18 years or over 60, had previous bariatric surgery other than LSG, had previous gastrointestinal surgery, psychiatric contraindications, pregnancy, and other medical conditions for denying laparoscopy. Patients were followed 1 year later at clinics.

## Results

A total of 50 patients, 25 MGB versus 25 SASI, were included in our study. No significant difference is detected between both groups regarding the resolution of GERD symptoms, 64% had complete resolution in MGB versus 56% had complete resolution in SASI. After 12 months of follow-up, no significant difference is detected between MGB and SASI in postoperative BMI with *P* value of 0.45. MGB and SASI procedures had significantly reduced BMI in each group during 12 months of follow-up, *P* value of 0.0001.

## Conclusion

Our study shows that both MGB and SASI are equally effective in BMI loss after 1 year of follow-up and that both procedures result in remission of GERD symptoms comparably with slight improvement in GERD symptoms after MGB than SASI. We recommend large multicenter RCTs to compare MGB with SASI with long-term follow-up period.

## Keywords:

gastroesophageal reflux diseases, mini-gastric bypass, single-anastomosis sleeve ileal bypass

Egyptian J Surgery 40:1229–1232  
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1110-1121

## Introduction

Bariatric surgeries are currently the only effective treatment for morbid obesity and its associated comorbidities, including type-2 diabetes mellitus (DM), hypertension (HTN), and dyslipidemia, although 20% of patients failed to lose weight or regained weight [1]. Laparoscopic sleeve gastrectomy (LSG) is nowadays the most performed bariatric procedure accounting for 46% of all bariatric procedures, according to 2018 IFSO global registry report [2]. WHO reported a triple increase in the prevalence of obesity globally between 1975 and 2016 [3].

Although LSG is continuing to increase globally, several complications arise forcing surgeons to find a solution or an alternative [4]. The commonest complications of LSG include postoperative bleeding, postoperative gastroesophageal reflux diseases (GERD), sleeve strictures, mesenteric vein thrombosis, surgical-site hernia, and staple-line leakage. LSG has been compared with other

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bariatric procedures, including laparoscopic mini-gastric bypass (MGB) and laparoscopic Roux-en-Y gastric bypass (RYGB) [5]. A recent meta-analysis comparing LSG to RYGB showed that both procedures are equally effective in weight loss and DM (type 2) resolution. RYGB is superior in patients with dyslipidemia, HTN, and GERD, but LSG had fewer rates of complications and reoperations [6,7].

Other studies had reported the effect of MGB or single-anastomosis sleeve ileal bypass (SASI) on GERD [7]. Emile *et al.* [8] showed that patients who had SASI bypass had significantly lower GERD compared with patients who had LSG. In another study, the authors concluded that MGB had a significantly lower rate of esophagitis compared with LSG [9]. Our study aims to compare MGB with SASI as revisional surgery for GERD management after LSG.

### Patients and methods

We conducted a prospective cohort for patients undergoing revision surgery, MGB, or SASI, after LSG for GERD symptoms. We reviewed all medical records of the Bariatric Surgery Department at Ain Shams University Hospital from January 2020 to December 2020. This research was performed at the Department of General Surgery, Ain Shams University Hospitals. Ethical Committee approval and written, informed consent were obtained from all participants. A matched-pair analysis by patients' demographics was performed with 25 patients for the MGB group and another 25 patients for the SASI group. We included all patients above 18 years old, and we excluded those who were below 18 years or over 60, had previous bariatric surgery other than LSG, had previous gastrointestinal surgery, psychiatric contraindications, pregnancy, and other medical conditions for denying laparoscopy. Patients were followed 1 year later at clinics. Missing patients were phone called and asked to attend the next day for follow-up.

Preoperatively, a multidisciplinary team evaluated the participants regarding medical, endocrinological, nutritional, and psychiatric workup. Preoperative assessment included blood examinations, cardiology evaluation, and chest radiography. Psychiatric counseling was conducted to evaluate mental health contraindications to surgery. Patients were also assessed for BMI and GERD using upper gastrointestinal endoscopy and 24-h esophageal manometry.

### Surgical procedures

Trocars were placed at the same sites of previous LSG operation. Careful dissection was done in both groups due to adhesions from previous LSG operation. All

cases were operated laparoscopically with no conversion to open surgery.

### Laparoscopic mini-gastric bypass

A long and narrow gastric tube calibrated with a 36-Fr bougie was performed using a linear stapler and began at the lesser curvature of the stomach until the angle of His. A unique anastomosis was made between the bottom of the gastric tube and a long jejunal omega loop of 200 cm. It was an end-to-side gastrojejunal anastomosis done with a linear stapler and closed on its anterior part with a running suture (Fig. 1).

### Laparoscopic single-anastomosis sleeve ileal bypass

After dissection of the greater curvature till well visualization of the left crus of the diaphragm, resection begins 4–5 cm from the pylorus along a 36-Fr calibration tube, Resleeve was done using violet-linear tristaplers (GIA-Rotulators, Covidien, Dublin, Ireland). Then an antecolic side-to-side anastomosis, using 45-mm linear stapler, between the antrum of the stomach and the ileum, 250 cm from the ileocecal junction, was created (Fig. 2).

### Statistical analysis

Statistical analysis was done using IBM SPSS statistics for windows, Version 23.0. Armonk, NY: IBM Corp. To ensure our data had normal distribution, we performed Kolmogorov–Smirnov test and Shapiro–Wilk test. We used Student's *t* test for comparison of means between two groups MGB versus SASI. Paired-sample *t* test was used to compare BMI before surgery and 1 year postoperatively in each group. *P* value less than 0.05 was considered statistically significant.

### Results

Between January 2020 and December 2020, a total of 50 patients were included in our study, 25 patients in

Figure 1



Laparoscopic MGB after sleeve. MGB, mini-gastric bypass.

each group. Patients' baseline characteristics are shown in Table 1. No significant difference is detected between both groups regarding the resolution of GERD symptoms, 64% had complete resolution in MGB versus 56% had complete resolution in SASI. Both groups had comparable postoperative morbidities.

After 12 months of follow-up, no significant difference is detected between MGB and SASI in postoperative BMI with *P* value of 0.45, as shown in Table 2.

In Table 3, we compared preoperative and postoperative BMI in each study group. MGB and

**Figure 2**



Laparoscopic SASI after sleeve. SASI, single-anastomosis sleeve ileal bypass.

**Table 1 Patient characteristics regarding type of operation mini-gastric bypass versus single-anastomosis sleeve ileal bypass**

	MGB	SASI	<i>P</i> value
Number of patients	25 (50)	25 (50)	
Age (mean±SD)	32.4±3.4	34.8±5.1	0.63
Sex			
Male	11	10	0.77
Female	14	15	
Preoperative BMI (mean±SD)	34.1±3.7	34.08±4.2	0.97
Resolution of GERD symptoms			
No resolution	2	4	0.74
Complete resolution	16	14	
Partial resolution	6	5	
Worsening	1	2	
Postoperative morbidities			
No morbidities	22	21	0.17
Suture-line bleeding	2	0	
Wound infection	1	1	
Unsatisfactory weight loss	0	3	
Mortality			
No	25	25	NA
Yes	0	0	

GERD, gastroesophageal reflux disease; MGB, mini-gastric bypass; SASI, single-anastomosis sleeve ileal bypass.

SASI procedures had significantly reduced BMI during 12 months of follow-up, *P* value of 0.0001.

## Discussion

The role of bariatric surgery in treatment of morbid obesity is to reduce obesity-related morbidity and mortality, including cardiovascular, endocrinal, musculoskeletal, and psychological problems. To our knowledge, our study is the first to compare MGB with SASI as revision surgeries for treatment of GERD in patients with LSG. Our study shows that both MGB and SASI were effective in reducing BMI during 1 year of follow-up, but there was no significant difference between both operations in reducing BMI. Most of the patients had complete resolution of GERD symptoms in both operations effectively.

Several complications, including postoperative bleeding, postoperative GERD, sleeve strictures, mesenteric vein thrombosis, weight regain, and staple-line leakage, arise after LSG forcing surgeons to find solutions [4]. Sydney patch has been recently proposed for staple-line leakage [10]. Revisional surgeries are offered to the patients in case of weight regain. Another recent solution for weight regain is banding of the stomach remnant after LSG [11,12]. GERD symptoms usually require the use of medical treatment or revisional surgery [11]. RYGB, as a revisional surgery, is the mostly used procedure for postoperative GERD [12].

Several studies had compared RYGB with either MGB or SASI. Mahdy and Emile [13] reported that RYGB and SASI had comparable improvement in

**Table 2 Comparison between mini-gastric bypass and single-anastomosis sleeve ileal bypass regarding BMI loss during 12 months of follow-up**

	MGB	SASI	<i>P</i> value
Postoperative BMI (1 year) (mean ±SD)	24.9 ±1.7	24.4 ±2.9	0.45

MGB, mini-gastric bypass; SASI, single-anastomosis sleeve ileal bypass.

**Table 3 Comparison between preoperative and postoperative BMI loss during 1-year follow-up period in mini-gastric bypass and single-anastomosis sleeve ileal bypass groups**

	Preoperative BMI (mean±SD)	Postoperative BMI (1 year) (mean±SD)	<i>P</i> value
MGB	34.1±3.7	24.9±1.7	0.0001
SASI	34.08±4.2	24.4±2.9	0.0001

MGB, mini-gastric bypass; SASI, single-anastomosis sleeve ileal bypass.

comorbidities and had a satisfactory weight loss. Rheinwalt *et al.* [14] concluded that both MGB and RYGB achieved comparable total weight loss and comorbidity remission after 3 years of follow-up. In meta-analysis of five studies comparing RYGB with MGB after failed restrictive procedures, the authors concluded that MGB and RYGB had comparable results regarding estimated weight loss, BMI reduction at 1 year of follow-up, and leakage rates, but MGB had less postoperative bleeding [1]. Wang *et al.* [5], comparing RYGB with MGB, stated that MGB had better remission rate of DM than RYGB. In YOMEGA trial, a multicenter-randomized noninferiority trial of 253 patients, showed that MGB is not inferior to RYGB regarding weight reduction and remission of DM (glycated hemoglobin) [15]. In a study done by Mahdy *et al.* [16], 551 had undergone SASI for morbid obesity. SASI had effectively improved comorbidities, including HTN, DM, GERD, and sleep apnea. Kermansaravi *et al.* [17], in meta-analysis of 26 studies, studied MGB after failed primary-restrictive procedures. They showed that MGB achieved satisfactory weight loss and remission of the associated comorbidities. However, no current study compares MGB with SASI for GERD management after failed LSG.

Our study had a small sample size due to a decrease in elective surgeries performed during the COVID-19 pandemic. Future large-sample multicenter RCTs with a long follow-up period are required to evaluate the benefits and complications of MGB versus SASI in patients with GERD after LSG.

## Conclusion

Our study shows that both MGB and SASI are equally effective in BMI loss after 1 year of follow-up and that both procedures result in remission of GERD symptoms comparably with slight improvement in GERD symptoms after MGB than SASI. We recommend large multicenter RCTs to compare MGB with SASI with long-term follow-up period.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## References

- 1 Velotti N, Vitiello A, Berardi G, Di Lauro K, Musella M. Roux-en-Y gastric bypass versus one anastomosis-mini gastric bypass as a rescue procedure following failed restrictive bariatric surgery. A systematic review of literature with metanalysis. *Updates Surg* 2021; 73:639–647.
- 2 Welbourn R, Hollyman M, Kinsman R, Dixon J, Liem R, Ottosson J, *et al.* Welbourn2019\_Article\_BariatricSurgeryWorldwideBasel.pdf. *Obes Surg* 2019; 29:782–795.
- 3 OMS. Obesity-and-Overweight @ Www.Who.Int [Internet]. Organización Mundial de la Salud 2018; 1.
- 4 Guan B, Chong TH, Peng J, Chen Y, Wang C, Yang J. Mid-long-term revisional surgery after sleeve gastrectomy: a systematic review and meta-analysis. *Obes Surg* 2019; 29:1965–1975.
- 5 Wang FG, Yan WM, Yan M, Song MM. Outcomes of mini vs Roux-en-Y gastric bypass: a meta-analysis and systematic review. *Int J Surg* 2018; 56:7–14.
- 6 Han Y, Jia Y, Wang H, Cao L, Zhao Y. Comparative analysis of weight loss and resolution of comorbidities between laparoscopic sleeve gastrectomy and Roux-en-Y gastric bypass: a systematic review and meta-analysis based on 18 studies. *Int J Surg* 2020; 76:101–110.
- 7 Madyan A, Emile SH, Abdel-Razik MA, Ellithy R, Elbanna HG, Elshobaky A. Laparoscopic single anastomosis sleeve ileal (SASI) bypass for patients with morbid obesity: technical description and short-term outcomes. *Surg Laparosc Endosc Percutan Tech* 2020; 30:E13–E17.
- 8 Emile SH, Madyan A, Mahdy T, Elshobaky A, Elbanna HG, Abdel-Razik MA. Single anastomosis sleeve ileal (SASI) bypass versus sleeve gastrectomy: a case-matched multicenter study. *Surg Endosc* 2021; 35:652–660.
- 9 Musella M, Vitiello A, Berardi G, Velotti N, Pesce M, Sarnelli G. Evaluation of reflux following sleeve gastrectomy and one anastomosis gastric bypass: 1-year results from a randomized open-label controlled trial. *Surg Endosc* 2020; 35:6777–6785.
- 10 Rahman AA, Riaz AA, Kuzinkovas V. Laparoscopic sleeve gastrectomy and the 'sydney Patch': triple reinforcement of staple line: a study with 546 patients. *Bariatric Surg Pract Patient Care* 2018; 13:145–150.
- 11 Yeung KTD, Penney N, Ashrafian L, Darzi A, Ashrafian H. Does sleeve gastrectomy expose the distal esophagus to severe reflux?: a systematic review and meta-analysis. *Ann Surg* 2020; 271:257–265.
- 12 Gu L, Chen B, Du N, Fu R, Huang X, Mao F, *et al.* Relationship between bariatric surgery and gastroesophageal reflux disease: a systematic review and meta-analysis. *Obes Surg* 2019; 29:4105–4113.
- 13 Mahdy T, Emile SH. Roux-en-Y gastric bypass with long biliopancreatic limb compared to single anastomosis sleeve ileal (SASI) bypass in treatment of morbid obesity. 2021; 31:3615–3622.
- 14 Rheinwalt KP, Plamper A, Rückbeil MV, Kroh A, Neumann UP, Ulmer TF. One anastomosis gastric bypass-mini-gastric bypass (OAGB-MGB) versus Roux-en-Y gastric bypass (RYGB)—a mid-term cohort study with 612 patients. *Obes Surg* 2020; 30:1230–1240.
- 15 Robert M, Espalieu P, Pelascini E, Caiazzo R, Sterkers A, Khamphommala L, *et al.* Efficacy and safety of one anastomosis gastric bypass versus Roux-en-Y gastric bypass for obesity (YOMEGA): a multicentre, randomised, open-label, non-inferiority trial. *Lancet* 2019; 393:1299–1309.
- 16 Mahdy T, Emile SH, Madyan A, Schou C, Alwahidi A, Ribeiro R, *et al.* Evaluation of the efficacy of single anastomosis sleeve ileal (SASI) bypass for patients with morbid obesity: a multicenter study. *Obes Surg* 2020; 30:837–845.
- 17 Kermansaravi M, Shahmiri SS, DavarpanahJazi AH, Valizadeh R, Berardi G, Vitiello A, *et al.* One anastomosis/mini-gastric bypass (OAGB/MGB) as revisional surgery following primary restrictive bariatric procedures: a systematic review and meta-analysis. *Obes Surg* 2021; 31:370–383.