Short-term results of single-anastomosis gastric bypass after failed sleeve gastrectomy

Karim Sabry, Mohamed F. Mahfouz, Tamer M. Said Salama

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

Correspondence to Karim Sabry Abd El Samee Atia, Associate Professor of General Surgery, Ain Shams University Hospital, Egypt.
Tel: 00201033335498;
e-mail: dr.karimsabry12@gmail.com

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Background
It is recognized that sleeve gastrectomy (SG) is one of the most common bariatric procedures worldwide. It is considered a relatively safe and effective option in the treatment of morbid obesity. However, SG operations may fail in the treatment of obesity. In cases of unsuccessful SG surgery, revisional bariatric surgery may be used. One anastomosis gastric bypass (OAGB) was considered as an outstanding choice for revision surgery.
Objective
To assess the efficacy and safety of OAGB as a redo surgery after the failure of previous sleeve gastrectomy operation.
Patients and methods
This study is a retrospective cohort study, conducted in Bariatric Surgery Unit, Ain Shams University Hospital, Cairo, Egypt, from February 2018 to July 2019, with 6 months of postoperative follow-up till January 2020. We included 50 patients who underwent OAGB who were adults fit for surgery, aged between 18 and 60 years, with a history of failed SG.
Results
A total of 50 patients with history of failed SG underwent OAGB surgery with excess body weight loss of 14.10% at 1 month, 28.85% at 3 months, and 45.43% at 6 months. Weight loss was 7.14–32.43 kg (SD 6.14). The type 2 diabetes mellitus remission rate was 100% by 6 months, with glycated hemoglobin level of 5.88±0.77 (range, 5.4–7.2). Hypertension resolution was 40%. Overall, 100% of patients with sleep apnea improved symptomatically. No morbidity or mortality cases were reported.
Conclusion
OAGB operation is considered to be an effective and safe revisional surgical procedure after a failed primary SG operation.

Keywords:
conversion bariatric surgery, failed sleeve gastrectomy, one anastomosis gastric bypass

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Introduction

Bariatric surgeries are very common around the globe. Among all types of bariatric surgery, sleeve gastrectomy (SG) is considered to be one of the commonest. It is considered a fairly safe and effective option to treat morbid obesity. However, like every other surgical procedure, SG operations my fail in the treatment of obesity. Failure of SG may lead be presented in many ways, starting from unsatisfactory weight loss, up to weight regain [1].

Many possible factors may lead to failure of laparoscopic SG operations such as the dilatation of the residual stomach, failure of complete sectioning of the fundus, and creation of an excessively large gastric pouch owing to calibration with an inappropriately large boogie [2].

After the failure of SG, a revisional bariatric surgery may be considered such as resleeve, Roux-en-Y gastric bypass (RYGB), one anastomosis gastric bypass (OAGB), biliopancreatic diversion with duodenal switch (BPD/DS), and single-anastomosis duodenoileostomy with SG, which are some of the revisional bariatric surgeries [3].

Recently, OAGB was considered an excellent choice for revision surgery as it is considered to be a well-tolerated procedure associated with excellent weight loss outcomes and low complications. It was therefore considered to be the best conversion choice after the failure of the previous gastrectomy of the sleeve [4].

Patients and methods

In this retrospective cohort study, which was conducted in Bariatric Surgery Unit, Ain Shams University Hospital, Cairo, Egypt, from February 2018 to July

2019 with 6 months of postoperative follow-up till January 2020. The consent is taken and approved from the General Surgery Department Research Ethical Committee. We included 50 patients who underwent OAGB who were adults fit for surgery, aged between 18 and 60 years, with a history of a previous SG operation and failed to lose more than 50% of their initial weight during 2 years postoperatively, or failed to maintain the weight loss they achieved, with a BMI greater than 35 after 2 years postoperatively.

We excluded patients who were unfit for surgery; younger than 18 years or older than 60 years; patients who were considered a failure after experiencing intolerable adverse effects of SG like GERD, emesis, or maladaptive eating syndrome; patients with anatomical postsleeve complications like leakage or stricture, patients who did not have any history of dietary consultation; and psychiatric patients on antidepressant drugs.

We reviewed and collected all the preoperative, operative, and postoperative data from the patients' files, the medical records, and the patients' follow-up visits.

All the patients included in the study underwent a preoperative assessment, which included a preoperative detailed history of the previous SG operation, dietary habits, BMI, cardiovascular and respiratory problems, and a full medical history of associated comorbidities, other systems, and previous surgeries.

All the patients were subjected to laboratory investigations including complete blood count, liver and kidney and thyroid function tests, coagulation profile, lipid profile, arterial blood gases glycated hemoglobin, and serum electrolytes, such as calcium, vitamin D, and vitamin B12. Diabetic patients were tested for postprandial and random blood sugar. All the patients had ECG and cardiac echocardiography, whereas asthmatic patients underwent pulmonary function tests. All patients had chest radiograph, pelvi-abdominal ultrasound, upper gastrointestinal endoscopy, and three-dimensional computed tomography volumetry (Figs 1 and 2).

Postoperatively, all the patients received the standard prophylaxis against deep venous thrombosis and pulmonary embolism including intravenous fluids, stocking, and subcutaneous Clexan. All the patients received intravenous analgesia alongside intravenous broad-spectrum antibiotics according to drip method, which was found to provide better consistent pain relief. All patients received standard proton pump inhibitors as prophylaxis against postsurgical stress ulcers.

On the third postoperative day, all patients were subjected to an upper gastrointestinal contrast study in form of a three-dimensional computed tomography volumetry on the stomach to ensure the integrity of the staple line and the anastomosis (Fig. 3).

Patients were usually discharged on the first postoperative day after removing the tube drain.

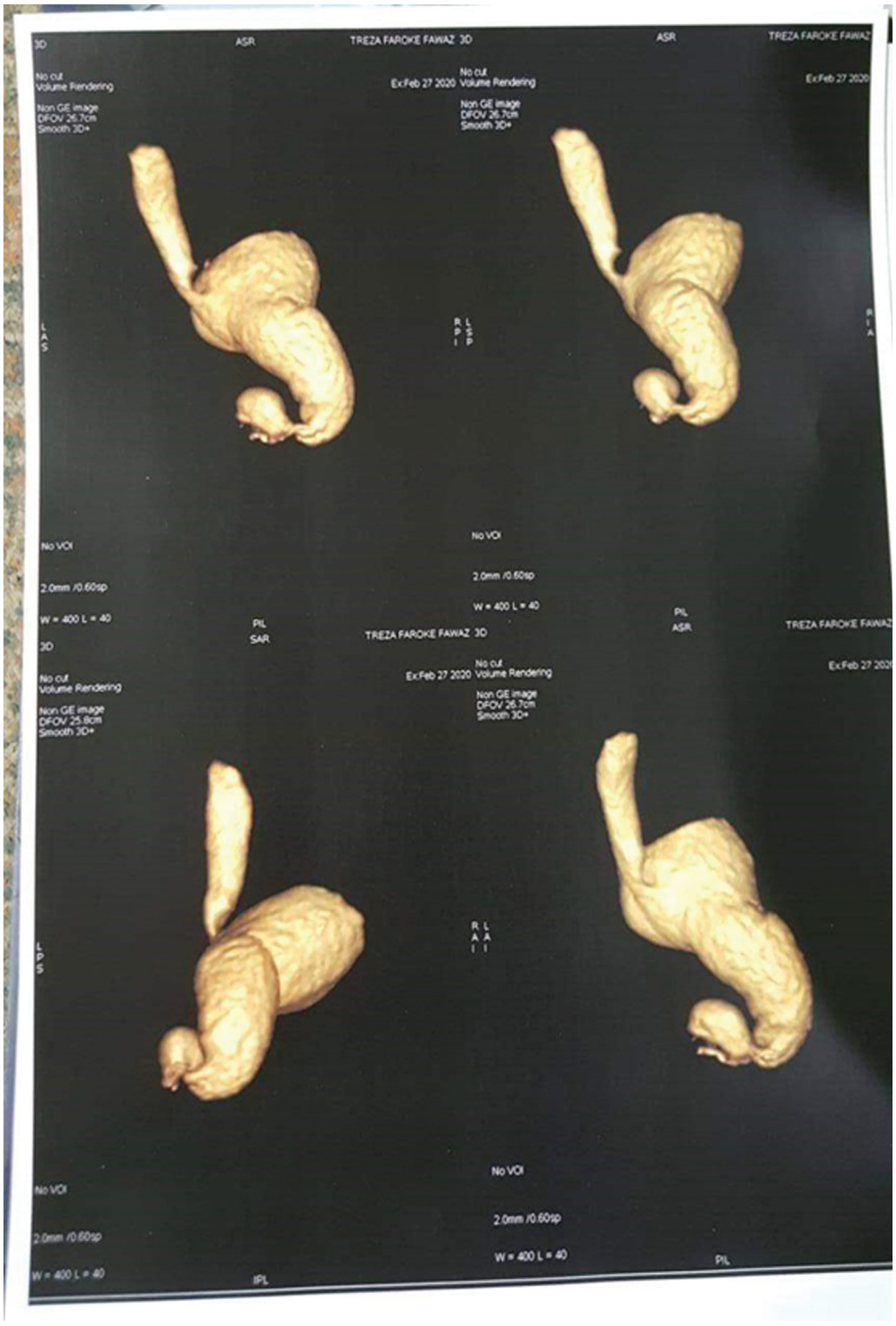
All patients were instructed to follow a four-stage diet: the first stage consists of 7 days of clear oral fluids, the second stage consists of a protein-rich fluid diet for 2 weeks, the third stage consists of soft diet for 2 weeks and starting from the sixth week, and stage 4 begins with solid diet. In addition, all patients were provided with a multivitamin regimen including vitamin B12, iron supplementation, and calcium.

All patients included in the study were scheduled on a 6-month outpatient follow-up program. The follow-up program consisted of weekly during the first month after discharge and a monthly visit for the remaining 5 months. In each visit, patients were subjected to a full clinical assessment, anthropometric measures taking, and any other required investigations were done according to follow-up plan.

Surgical technique

The revisional procedure was conducted laparoscopically. There have been no conversion to open surgery. Conversion of the SG to the OAGB entailed the acquisition of a pneumoperitoneum using a needle. For the optics, a supraumbilical port was used. Another 12-mm port was visually located in line with the optical port in the midclavicular line on the left, whereas another 12-mm port was located on the right of the midclavicular line with four fingers breath above the optical port. A 5-mm port was placed on the left anterior axillary line four fingers away from the 12-mm port. A Nathanson liver retractor was used to retract the liver (dilated sleeve is shown in Fig. 4). The adhesions were divided between the liver and the sleeve pouch. The opening was made 2 cm below the crow's foot to reach the lesser sac. The Ethicon 3.8 cm staple height, 6 cm long stapler, was fired horizontally through this opening to split the sleeve. In cases where there was a dilated sleeve, cautious dissecting was performed to isolate the omentum attached to the larger curvature of the remaining sleeve, and a tubular pouch shaped by a stapled resection next to the lesser curvature of the sleeve with a size of 36 Fr Bougie in the pouch

Figure 1



CT 3D volumetry of dilated sleeved stomach. 3D, three-dimensional; CT, computed tomography.

(trimming of the dilated sleeve to make a smaller gastric pouch Fig. 5). The length of the pouch produced ranged from 12 to 18 cm, and the approximate average volume of the tube pouch produced was between 75 and 90 ml. The length of the intestine was 200 cm from the Treitz ligament. At the mark of 200 cm, enterotomy was made at the antimesenteric border of the small intestine, and gastrotomy was also made on the posterior wall of the end of the tubular pouch. A 6-cm long Ethicon of 3.5 cm of staple height was inserted into enterotomy and gastrotomy, and an anastomosis of 3–4 cm of width was developed between the pouch and the small intestine (gastrojejunostomy Fig. 6). Gastroenterostomy was closed by handsewn

Figure 2

CT 3D volumetry of dilated sleeved stomach. 3D, three-dimensional; CT, computed tomography.

anastomosis using a sterile synthetic absorbable monofilament suture made from the polyester:p: dioxanone (PDS) TM sutures. The anastomosis was then tested using methylene blue injected through the Bougie. The staple line was then reinforced with full-thickness omentum sutures by PDS TM running sutures. A tube drain was left in the vicinity of the gastrojejunostomy under the left liver lobe. Peterson's defect was not closed. Patients began on a liquid diet the next day if vital parameters were normal.

Statistical analysis

Statistical analysis was done using IBM SPSS statistics for windows, Version 23.0. Armonk, NY: IBM Corp. Continuous variables were defined as mean±SD, and for demographic variables such as age, weight, and BMI, descriptive statistics were used. When the expected count in any cell was less than 5, a comparison of the variables was made using the χ^2 test and/or the Fisher exact test.

Using the analysis of variance repeated measures test accompanied by post-hoc study using the Bonferroni test, a distinction was made between more than two paired groups with respect to quantitative data and parametric distribution.

The confidence interval was set at 95% and the negotiated margin of error was set at 5%. Therefore, it was concluded that the *P* value was meaningful as follows: *P* value more than 0.05: nonsignificant; *P* value less than 0.05: significant value, and *P* value less than 0.01, highly significant value.

Results

Since introducing the inclusion/exclusion criterion, this analysis contained a total of 50 patients. All of whom had a previous SG procedure between 2010 and 2017 and underwent a revision of OAGB surgery in 2018 and 2019. Of the 50 patients, 40 (80%) were females, and the other 10 (20%) patients were males. The demographics of patients are given in Table 1.

The average weight, height, BMI, and obesity-associated comorbidities at the time of revision are shown in Tables 2–4.

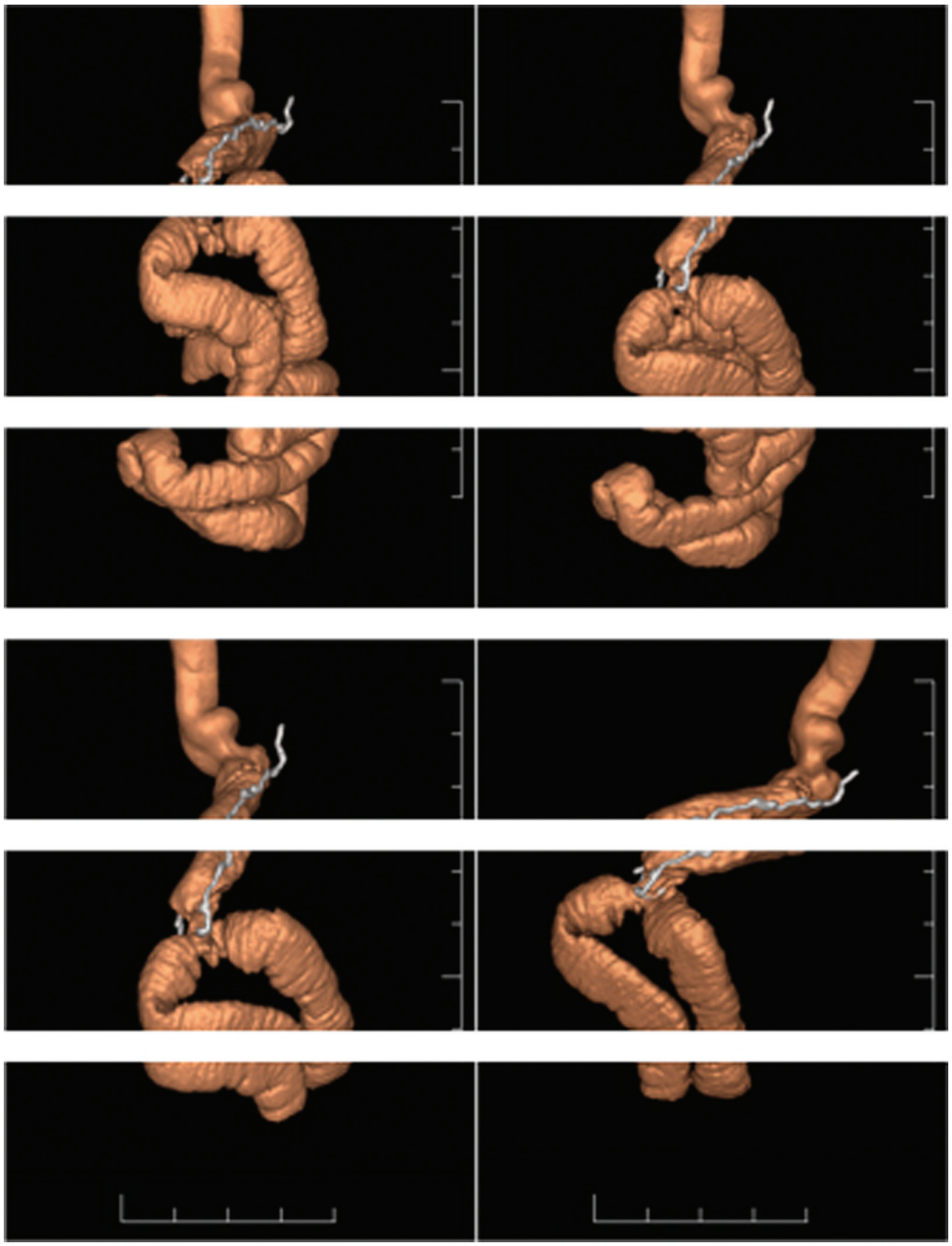
The average weight, BMI, the percentage excess body weight loss (%EBWL), and the comorbidities remission outcomes at 1, 3, and 6 months after revision to OAGB are in Tables 5–7.

In this study, all procedures were conducted by a specialized bariatric team with an estimated surgery period of 78.5±15.05 min and an estimated hospital stay of 1.45±0.69 days. There were no early problems with the OAGB revision of the SG. In this study, there was no mortality either.

Discussion

Many studies reported that when it was first performed, SG operation was first meant to be the first stage of the two-staged operation BPD/DS [5]. However, postoperative patient observation after the first stage of the operation revealed satisfying weight loss results compared with RYGB, which contributed to the

Figure 3



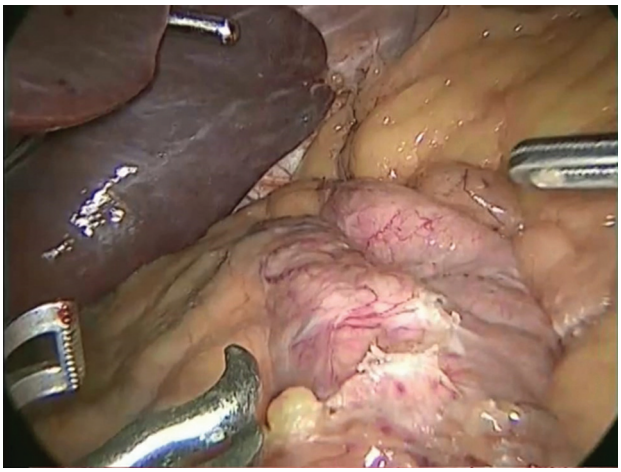
CT 3D volumetry of OAGB after failed sleeve gastrectomy. 3D, three-dimensional; CT, computed tomography; OAGB, one anastomosis gastric bypass.

promotion of a SG operation to be considered a standalone procedure [6]. Although SG is one of the world's most frequently done bariatric procedures, follow-up studies have shown that SG has a failure rate of 27.8% at 7 years postoperatively and 33.6% at 11 years postoperatively [7]. A further redo-operation or what was previously intended to be 'the second-stage operation' has to be performed in those situations. The potential options and effects of revising failed SG after weight regain were evaluated by several published papers.

In this study, we reviewed and analyzed the effects of OAGB surgery following failure of previous SG, either owing to weight regain or insufficient initial weight loss, on 50 patients from February 2018 to July 2019, with 6 months of postoperative follow up till January 2020, using EWL%, remission/improvement of diabetes, hypertension (HTN) remission, obstructive sleep apnea remission, and safety of operation.

From all our results, we found the most interesting to be the safety and efficacy of OAGB operations,

Figure 4

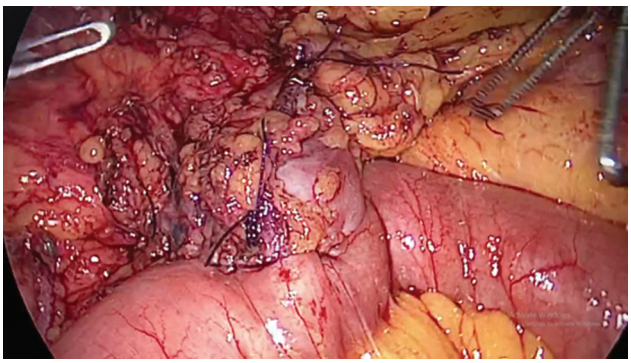


Intraoperative image of dilated sleeved stomach.

Figure 5

Intraoperative image of trimming of dilated sleeved stomach to create a long narrow gastric pouch.

Figure 6



Intraoperative image of gastrojejunostomy.

Table 1 Demographic data

Demographic data	*N*=50
Age (years)	
Mean±SD	45.00±11.68
Range	24–64
Sex [*n* (%)]	
Female	40 (80.0)
Male	10 (20.0)
Weight before SG	
Mean±SD	146.05±34.11
Range	107–220
BMI before SG	
Mean±SD	53.73±93.28
Range	40.77–80.81
NADIR	
Mean±SD	105.20±20.54
Range	79–155
BMI NADIR	
Mean±SD	38.81±5.52
Range	31.64–50.04

SG, sleeve gastrectomy.

which were clearly translated into zero intraoperative and postoperative mortalities, as well as high EWL and remission/improvement of diabetes and other comorbidities.

In our study, the EBWL% was reported to be 14.10% after the first month, 28.85% after 3 months postoperative, and 45.43% after 6 months postoperative, which are considered to be excellent when compared with the results reported usually after a primary OAGB operation.

Chiappetta reported an excellent weight loss result, with 2 years of follow-up after revision OAGB operation after a failed SG. Similarly, Poghosyan *et al.* studied a series of 72 patients after six years follow-up and reported results similar to the results reported after a primary OAGB [3].

In a recent study, Hussain and EL-Hasani reported in a retrospective study on 527 patients who underwent OAGB either a primary or redo bariatric operation an EBWL of 89% after 1 year [8].

Bhandari *et al.* on the contrary reported in a study on 32 patients who underwent OAGB after failed SG that EBWL at 1 year was 54.90%, at 2 years was 52.13%, and at three years was 35.95%, which was less than what is reported after primary OAGB weight [3]. Back to our study, weight loss was highly significant; the average weight at revision was 131.80 ±25.71, with a range of 100–180, and average BMI was 48.55±6.65. After 1 month postoperative, the EBWL was 8.85±4.00 Kg and increased to be 18.15±6.32 Kg and 28.55±9.62 Kg at 3 and 6 months, respectively.

Table 2 Weight, height, and BMI at revision

	N=50
Weight	
Mean±SD	131.80±25.71
Range	100–180
Height	
Mean±SD	164.25±9.68
Range	150–188
BMI	
Mean±SD	48.55±6.65
Range	40.01–66.12

Table 3 Patient comorbidity profile at the revision

Comorbidities	*N*=50
DM treatment [*n* (%)]	
Nondiabetic	37 (74.0)
Diabetic on OHGS	10 (20.0)
Diabetic on insulin	3 (6.0)
HbA1c of T2DM patients	
Mean±SD	9.15±1.75
Range	7.7–12
HTN [*n* (%)]	
No	35 (70.0)
Yes	15 (30.0)
OSA [*n* (%)]	
No	28 (56.0)
Yes	22 (44.0)

HbA1c, glycated hemoglobin; HTN, hypertension; OSA, overall survival; T2DM, type 2 diabetes mellitus.

Table 4 Type of surgery, operative time, intraoperative complications, early complications, and hospital stay (days) of revisional one anastomosis gastric bypass

Type of surgery	*N*=50
Lap. OAGB	50 (100.0)
Operative time (min)	
Mean±SD	78.50±15.05
Range	60–110
Intraoperative complications [*n* (%)]	
No	50 (100.0)
Yes	0
Early complications [*n* (%)]	
No	50 (100.0)
Yes	0
Hospital stay (days)	
Mean±SD	1.45±0.69
Range	1–3

OAGB, one anastomosis gastric bypass.

Regarding DM, 13 of the patients included in this study were diabetics. Of them, 10 were diabetics on OHG drugs and three were on insulin. All of them were medication free after 6 months of revision to the OAGB, with average glycated hemoglobin of 5.88 ±0.77 range 5.4–7.2.

In a previously published study, Wang *et al.* [10] have reported a remission rate of 86% for type 2 diabetes mellitus (T2DM), and in another meta-analysis comparing between OAGB and RYGB, Wang *et al.* [10] reported that the remission rate of T2DM in the OAGB was higher than RYGB group [9].

Similar to that, Guenzi *et al.* [11] reported similar results of OAGB operations as an effective procedure in the management for T2D. They reported that 12% of patients reported a decrease in the use of medication, and 88% of the patients reported total remission.

In a study published earlier, Al-Khalifa *et al.* [12] reported that OAGB operations were more successful than laparoscopic SG in the treatment of T2DM after 1 year of follow-up.

The variations in the outcomes between different studies may be owing to the usage of different surgical techniques and the variation in the length of the biliopancreatic limb (BPL) and the common channel between different patients. Longer BPL was associated with superior outcomes owing to the more aggressive metabolic effect.

Our results also reported an improvement in other comorbidities such as HTN and overall survival (OSA). Overall, 40% of patients who had HTN after the previous SG reported to be totally medication free after 6 months of conversion to OAGB. Moreover, 100% of patients with OSA reported clinical improvement [13].

In our study, 15 patients were hypertensive before revisional OAGB, and after conversion to OAGB, six patients were medication free at 6 months of follow-up.

On the contrary, all of the 24 patients who had OSA showed marked improvement 1 month after the revision to OAGB.

Wang and colleagues had shown the overall remission rate of HTN and OSA was 75 and 93%, respectively, for minigastric bypass (MGB). Many other studies showed a remission rate of 52.1–94% and 50–90%, for HTN and OSA, respectively.

One-year follow-up after MGB in a study done by Rutledge *et al.* [18] showed HTN resolution in 80% of cases, whereas a study done by Wang *et al.* [10] showed HTN resolution in 94%, and another study done by reported HTN resolution in 85%.

Table 5 Postoperative weight loss outcomes

	Preoperative	1 month	3 months	6 months	Test value[a]	*P* value	Significance
Weight (kg)							
Mean±SD	131.80±25.71	122.95±23.65	113.65±21.48	104.25±21.96	123.469	0.000	HS
Range	100–180	95–167	89–160	80–155			
BMI							
Mean±SD	48.55±6.65	45.30±6.15	41.91±5.76	38.37±5.91	147.059	0.000	HS
Range	40.01–66.12	38.1–61.34	35.06–58.77	31.59–56.93			

[a]Repeated measures analysis of variance test. *P* value more than 0.05: nonsignificant; *P* value less than 0.05: significant; *P* value less than 0.01: highly significant

Table 6 Excess body weight loss

EBWL (%)	Range	Mean±SD
Pre vs. 1 month	6.13–24.29	14.10±5.09
Pre vs. 3 month	15.07–40.49	28.85±6.40
Pre vs. 6 month	20.55–64	45.43±10.55

EBWL, excess body weight loss.

Table 7 Postoperative comorbidities remission outcomes

	Preoperative [*n* (%)]	1 month [*n* (%)]	3 months [*n* (%)]	6 months [*n* (%)]	Test value[a]	*P* value	Significance
DM							
No	37 (74.0)	44 (88.0)	47 (94.0)	50 (100.0)	7.778	0.051	NS
Diabetic on OHGS	10 (20.0)	3 (6.0)	0	0	9.173	0.027	S
Diabetic on insulin	3 (6.0)	3 (6.0)	3 (6.0)	0	2.051	0.562	NS
HbA1c of T2DM patients							
Mean±SD	9.15±1.75	–	6.48±1.02	6.38±0.83	20.804	0.037	S
Range	7.7–12	–	5.8–8	5.4–7.2			
HTN							
No	35 (70.0)	35 (70.0)	48 (76.0)	42 (84.0)	1.600	0.659	NS
Yes	15 (30.0)	15 (30.0)	12 (24.0)	8 (16.0)			
OSA							
No	26 (52.0)	50 (100.0)	50 (100.0)	50 (100.0)	30.423	0.000	HS
Yes	24 (48.0)	0	0	0			

HbA1c, glycated hemoglobin; HTN, hypertension; OSA, overall survival. [a]χ^2 test. *P* value more than 0.05: nonsignificant; *P* value less than 0.05: significant; *P* value less than 0.01: highly significant.

Revisional bariatric surgeries are usually associated with a high rate of complications in the review of the literature. Postoperative leakage and bleeding can be owing to adhesions formed during the initial surgery, resulting in difficult dissection [12,14,15].Comparisons of other options for revision, such as resleeve, RYGB, or BPD/DS revision operations were done. Nedelcu *et al.* [16] suggested that resleeve surgery was associated with successful short-term follow-up outcomes, but only 58.3% of patients maintained the outcomes after 5 years of follow-up. Casillas *et al.* [17], on short-term and medium-term follow-up, have confirmed that conversion of SG to RYGB was consistent with positive weight loss results. Currently, RYGB is considered to be the most common option after SG for revisional surgery. After up to 36 months of follow-up, multiple studies recorded that conversion of failed SG to BPD/DS was associated with excellent weight loss outcomes but was associated with an increased occurrence of nutritional deficiency [17].

Conclusion

OAGB operation is considered to be an effective and safe revisional surgical procedure after a failed primary SG operation.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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