Evaluation of laparoscopic one-anastomosis gastric bypass as a revisional procedure for failed vertical-banded gastroplasty and adjustable gastric banding compared with laparoscopic Roux-en-Y gastric bypass

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Back
ground Vertical-banded gastroplasty (VBG) and adjustable gastric banding (AGB) have been proven to be associated with high rates of weight-loss failure and long-term complications, this necessitates the search for the ideal revisional procedure. The aim of our study is to analyze the surgical outcome of one-anastomosis gastric bypass (OAGB) as a revisional surgery after failed restrictive procedures compared to the surgical outcome of LRYGBP in3years.

Patients and methods
From January 2018 to December 2020, 50 patients with either failed VBG or AGB operations underwent laparoscopic revisional bypass surgeries [33 OAGB and 17 Roux-en-Y gastric bypass (RYGB)], among them, 32 were after failed VBG and 18 were after failed AGB. The medical records, demographic, and surgical details, and outcomes of all patients who underwent revisional procedures were collected and analyzed.

Results
There were 50 patients, 35 females, and 15 males. The primary operation was AGB in 18 cases, VBG in 32 cases. These patients were subjected to laparoscopic OAGB (OAGB group=33 patients) or laparoscopic RYGB (RYGB group=17 patients). In all 18 failed AGB patients, band removal occurred during operation. All operations were completed laparoscopically as one-stage procedure. There were no major complications in all patients. Hospital stays averaged 3.2 days (range, 2–8) for the OAGB group and 4.6 days (range, 3–10) for the RYGB group. At 1 year, the excess weight-loss percentage was about 79.45±35.21% for the OAGB-group patients versus 71.63±35.24% for the RYGB-group patients.

Conclusion
Revisional bariatric procedures are technically challenging and carry a higher risk of postoperative complications than the primary procedures, RYGB was considered as the gold standard for revisional surgery; however, the OAGB achieved excellent success recently with relative simplicity, shorter operative time, and lower complication rates.

Keywords:
gastric bypass, laparoscopic, one-anastomosis, restrictive bariatric procedures, Roux-en-Y

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Introduction

Complications related to restrictive procedure such as adjustable gastric band (AGB) and vertical-band gastroplasty (VBG), like insufficient weight loss, and weight regain, are common indications to revisional procedure [1].

The causes of failure of AGB procedures include, primarily, inadequate weight loss (BMI>35 or excess weight loss%<50%), also, the complications like esophageal dilatation, intractable vomiting, band migration or slippages, and sometimes access-port problems [2].

The main cause of failed VBG was weight regains due to staple-line disruption, pouch dilation, and the change in patients' eating habits to become 'sweet eaters' [3].

The overall incidence of revisional surgeries after failed primary bariatric procedure varies widely in the global

literature and has been reported to be in the range from 5 to 56% [4].

The choice of revisional procedure depends on the primary failed restrictive procedures and the indications for such revision [5]. The main goals of revisional surgery for weight loss are either to restore gastric restrictive capacity, add a malabsorptive element, or both [6].

Although Roux-en-Y gastric bypass (RYGB) has been described to be the most effective as revisional procedures, recently also, one-anastomosis gastric bypass (OAGB) has been presented successfully as a revisional option for failed restrictive procedures [7].

Laparoscopic OAGB has gained great popularity in the recent years as it is a well-tolerated procedure, having excellent results in terms of weight loss and lower rates of complication and therefore has been well accepted as a revisional option [8].

Patients and methods

This study was conducted between January 2018 and December 2020, on 50 patients who were suffering from failed primary bariatric procedure, either failed VBG or AGB. Approval of the ethical committee was obtained before starting the study and all patients signed written consent after describing the procedure and the possible complication.

Inclusion criteria:

(1) Patients with insufficient weight loss of less than 50% of the excess body weight in 2 years after VBG or AGB.
(2) Weight regains after VBG or AGB.
(3) Patients with VBG or AGB-related complications such as stomal stenosis with intractable vomiting, symptoms of reflux esophagitis, esophageal dilatation, band migration or slippages, and sometimes access-port problems.

Exclusion criteria:

(1) Patients suffering from personality disorders.
(2) Patients with huge incisional hernias or previous major small-intestinal operations.
(3) Patients unfit for general anesthesia.
(4) Patients with drug addiction.

The patients were admitted at general surgery department (Ain University hospitals), El Merghany Hospital, and Abd Elkader Fahmy Hospital. Full clinical history was taken from all the patients together with detailed examination.

All the patients were assessed before operations by full routine labs in the form of complete blood count, blood chemistry with special attention to the nutritional assessment for serum iron, calcium, phosphorus, albumin, and vitamin B12. Also, all the patients were subjected to ultrasonography, upper endoscopy, virtual gastroscopy, and gastric computed tomography volumetry to choose the ideal operation for each patient.

All patients had full description and discussion of the surgical procedures with explanation of the possible complications and overall survival of the patients, and written consent was obtained from all patients. Then according to the size of the pouch that was suspected to be created, the choice of the operation was confirmed either OAGB if the vertical length of the gastric pouch was suspected to be long or RYGB in the cases where the vertical length of the pouch was suspected to be short.

Single-anastomosis gastric bypass

As regards VBG, adhesiolysis is carried out by separating the liver from the anterior surface of the stomach, until the angle of His and gastro-esophageal pad of fat are reached. The mesh is detected, and its proximal border is identified. Dissection is started on the lesser omentum close to the lesser curvature of stomach, until the lesser sac is reached. The stable line is identified, and construction of gastric pouch is started using endo-GIA 60 mm by creating a transverse cut proximal to the upper border of the mesh and stopping short of crossing the vertical stable line of VBG, then sequence of vertical application of endo-GIA 60 mm is carried out to reconstruct the vertical part of the pouch with care not to cross the vertical stable line of VBG constructing a slim long pouch.

The pouch is reconstructed using Bougie size 42 F. DJ flexure is identified, and biliopancreatic limb is measured 200 cm from DJ. A hole is made in SI at 200 cm from DJ at the antimesenteric border. Anastomosis is carried out using 30-mm endo-GIA.

Antireflux stitch is taken from antimesenteric border 2 cm proximal to anastomosis and sutured to the posterior wall of the stomach.

As regards band removal, adhesiolysis was done until the anterior aspect of the band is identified. The silicon

capsule of the band on the anterior surface of the fundus is separated from the stomach taking care not to injure the stomach and then constructing a slim long gastric pouch. The dissection started from lesser omentum directly on the lesser curvature of the stomach distal to the second branch of the crow's foot.

Roux-en-Y gastric bypass

The gastric pouch dissection started on the lesser omentum just distal to the first gastric branch of the left gastric artery. The dissection is carried out until the lesser sac is reached and the pouch is constructed along the same principle of the single-anastomosis gastric bypass taking care not to cross the stable line of VBG. The DJ is identified, then the small intestine is separated 50 cm from DJ. The distal portion is taken up antecolic for gastrojejunostomy and then alimentary limb is constructed 150 cm where entero-enterostomy between alimentary and biliopancreatic limb is made. Both the Peterson and mesenteric defect are closed.

Postoperatively, all patients were kept on antibiotics, analgesics, prophylactic anticoagulants, and proton-pump inhibitors. Patients were encouraged to walk 4 h after surgery, patients were kept on intravenous fluids until a dye study was done 24 h later, and then the patients started drinking clear liquids.

Then, after confirming the patient's postoperative status, they were discharged with all special instructions as regards the postoperative dietary regimen. Patients were followed up weekly for 1 month and then after 3 months, at 6 months, at 1 year, and then annually to monitor their postoperative outcome as regards general health condition, BMI, and complication.

All operative and postoperative data of the patients who underwent either OAGB or RYGB were collected, analyzed, and compared as regards the duration of surgery, intraoperative and postoperative complications, and length of hospital stay, also as regards to the parameters related to the weight loss, BMI, and also evaluation of postoperative nutritional status and improvement of associated comorbidities.

Statistical analysis

Data were collected, revised, coded, and entered into the Statistical Package for Social Science (IBM SPSS, Armonk, NY, USA), version 23. Data were presented as percentages. The differences in surgical outcomes between the two groups were compared using the Pearson χ^2 and Fisher exact tests. *P* values were reported where the results were significant with *P* value less than 0.05, highly significant with *P* value less than 0.01, and nonsignificant with *P* value more than 0.05.

Results

This study was conducted on 50 patients that were complaining of failed primary restrictive bariatric procedure, either VBG (32 patients) or AGB (18 patients). These patients were subjected to laparoscopic OAGB (OAGB group=33 patients) or laparoscopic RYGB (RYGB group=17 patients).

Among the patients of OAGB group, 24 (72.7%) were females and nine (27.3%) were males with the mean age of 42.4±5.2 years (range, 26–58 years), while the patients of RYGB group were 11 (64.7%) females and six (35.3%) males with the mean age of 45.7±4.3 years (range, 24–56 years).

The mean time between the initial procedure and the revisional procedure was 78.8 months (range, 24–172 months) for the OAGB-group patients and 69.6 months (range, 32–180 months) for the RYGB-group patients.

As regards to the primary bariatric operation, it was VBG in 23 cases and AGB in 10 cases of the OAGB group and was VBG in 12 cases and AGB in five cases of the RYGB group, respectively (Tables 1–6).

As regards to the indications for revisional surgeries after the initial failed procedures, they were insufficient weight loss in 11 (33.33%) cases of the OAGB-group patients and five (29.4%) cases of the RYGB-group patients. Weight regain in 20 (60.6%) cases in the OAGB-group patients and 11 (64.7%) cases of the

Table 1 Demographic characters of the patients and characters of the initial procedure

Variables	OAGB group	RYGB group	*P* value
Mean age (years)	42.4±5.2	45.7±4.3	0.746 (NS)
Sex (male/female)	24/9	11/6	0.412 (NS)
Primary procedure (VBG/AGB)	23/10	12/5	0.931 (NS)
The mean time between the initial procedure and the revisional procedure (months)	78.8	69.6	0.215 (NS)

AGB, adjustable gastric banding; OAGB, one-anastomosis gastric bypass; RYGB, Roux-en-Y gastric bypass; VBG, vertical-banded gastroplasty.

Table 2 Indications of revisional procedures

Variables	OAGB group [*n* (%)]	RYGB group [*n* (%)]	*P* value
Insufficient weight loss	11 cases (33.33)	5 cases (29.4)	0.854 (NS)
Weight regain	20 cases (60.6)	11 cases (64.7)	0.935 (NS)
Symptoms of reflux esophagitis	2 cases (6.1)	1 case (5.8)	0.0486 (NS)

OAGB, one-anastomosis gastric bypass; RYGB, Roux-en-Y gastric bypass.

Table 3 The BMI and nutritional parameters before surgery

Parameters	OAGB group	RYGB group	*P* value
BMI (kg/m^2)	38.7±7.3	36.8±8.7	0.326 (NS)
Hemoglobin (g/dl)	11.2±2.4	11.6±2.9	0.561 (NS)
Albumin (g/dl)	3.7±0.9	3.9±0.7	0.915 (NS)
Calcium (mg/dl)	9.1±1.2	8.9±1.6	0.697 (NS)
Vitamin B12 (pg/ml)	620.2±136.5	660.8±160.2	0.178 (NS)

OAGB, one-anastomosis gastric bypass; RYGB, Roux-en-Y gastric bypass.

Table 4 Operative data and complications

Parameters	OAGB group	RYGB group	*P* value
Mean operative time (min)	153.6 ±37.5	202.7 ±58.5	0.023 (S)
Average length of hospital stays (days)	3.45 ±1.12	4.3±1.8	0.0673 (NS)
Complications	0	1	NS
Mortality	0	0	NS

OAGB, one-anastomosis gastric bypass; RYGB, Roux-en-Y gastric bypass.

RYGB-group patients. Symptoms of reflux esophagitis in two (6.1%) cases of the OAGB-group patients and one (5.8%) case of the RYGB-group patients.

The mean BMI before the revisional procedures was 38.7±7.3 kg/m^2 (range, 35.4–48 kg/m^2) for the OAGB-group patients and 36.8±8.7 kg/m^2 (range, 36.2–50 kg/m^2) for the RYGB-group patients. There were no marked nutritional abnormalities between the patients of both groups as regards to the serum levels of iron, calcium, phosphorus, albumin, and vitamin B12, also, there were no significant differences between both groups in the nutritional status.

The mean operative time was 153.6±37.5 min (range, 145–210 min) for the OAGB group versus 202.7 ±58.5 min (range, 190–330 min) for the RYGB group. All operations were completed laparoscopically as one-stage procedure. There were no major complications among the patients of both groups apart from one case of the RYGB group that had intraoperative bleeding that was controlled during the operation. The average length of hospital stays was 3.45±1.12 days (range, 2–6 days) for the OAGB group versus 4.3±1.8 days (range, 3–8 days) for the RYGB group. There were no mortalities in both groups.

Table 5 Follow-up data after 6 months

Parameters	OAGB group	RYGB group	*P* value
Excess weight loss%	64.45±35.21	53.63±28.24	0.0315 (S)
Weight loss%	28.56±11.25	20.85±10.64	0.0241 (S)
BMI (kg/m^2)	29.95±8.85	32.95±10.65	0.0186 (S)
Hemoglobin (g/dl)	10.8±1.9	11.1±0.9	0.468 (NS)
Albumin (g/dl)	3.5±1.2	3.6±1.4	0.835 (NS)
Calcium (mg/dl)	9.3±1.3	8.6±1.8	0.482 (NS)
Vitamin B12 (pg/ml)	640.5±124.6	650.7±148.6	0.164 (NS)

OAGB, one-anastomosis gastric bypass; RYGB, Roux-en-Y gastric bypass.

Table 6 Follow-up data at 1 year

Parameters	OAGB group	RYGB group	*P* value
Excess weight loss %	79.45±35.21	71.63±35.24	0.542 (NS)
Weight loss %	39.56±11.25	32.85±10.64	0.631 (NS)
BMI (kg/m^2)	25.95±8.85	29.35±10.65	0.178 (NS)
Hemoglobin (g/dl)	11.25±1.6	11.6±0.7	0.742 (NS)
Albumin (g/dl)	3.7±1.4	3.5±1.1	0.891 (NS)
Calcium (mg/dl)	9.7±0.9	8.9±1.3	0.415 (NS)
Vitamin B12 (pg/ml)	680.4 ±135.26	670.55 ±168.4	0.314 (NS)

OAGB, one-anastomosis gastric bypass; RYGB, Roux-en-Y gastric bypass.

As regards to follow-up of the excess weight loss, BMI, and the remaining nutritional parameters, they were assessed at 6 months postoperative, after 1 year, and then annually where at 6 months, the excess weight-loss percentage was about 64.45±35.21% (range, 52–70%) for the OAGB-group patients versus 53.63 ±28.24% (range, 43–58%) for the RYGB-group patients, while total body weight-loss percentage was about 28.56±11.25% (range, 19–35%) for the OAGB-group patients versus 20.85±10.64% (range, 15–28%) for the RYGB-group patients. The BMI became 29.95 ±8.85 kg/m^2 (range 28–38) for the OAGB-group patients versus 32.95±10.65 kg/m^2 (range, 30–41) for the RYGB-group patients, while there were no differences to be mentioned in other nutritional elements like calcium, albumin, hemoglobin, or vitamin B12.

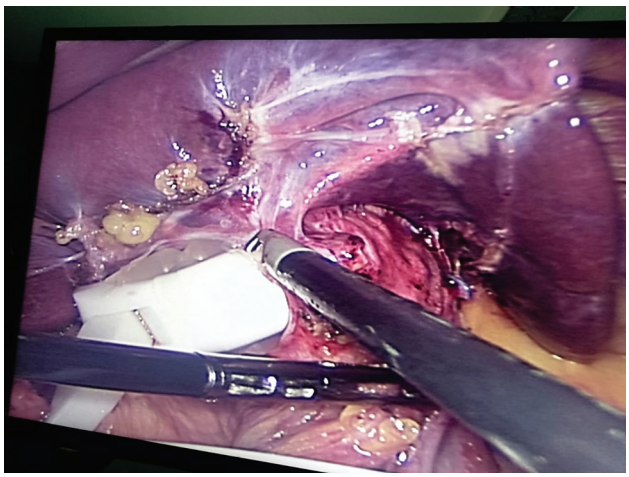
At 1-year follow-up, about 85% of the study patients were included where the significant differences in the

weight-loss parameters between the two groups declined, despite the persistent trend of higher weight loss for the OAGB group, the excess weight-loss percentage was about 79.45±35.21% (range, 68–85%) for the OAGB-group patients versus 71.63 ±35.24% (range, 59–78%) for the RYGB-group patients, while total body weight-loss percentage was about 39.56±11.25% (range, 28–42%) for the OAGB-group patients versus 32.85±10.64% (range, 22–34%) for the RYGB-group patients. The BMI became 25.95 ±8.85 kg/m^2 (range, 24–38) for the OAGB-group patients versus 29.35±10.65 kg/m^2 (range, 25–39) for the RYGB-group patients, while there were no differences to be mentioned in other nutritional elements like calcium, albumin, hemoglobin, or vitamin B12 (Figs 1–10).

Figure 1

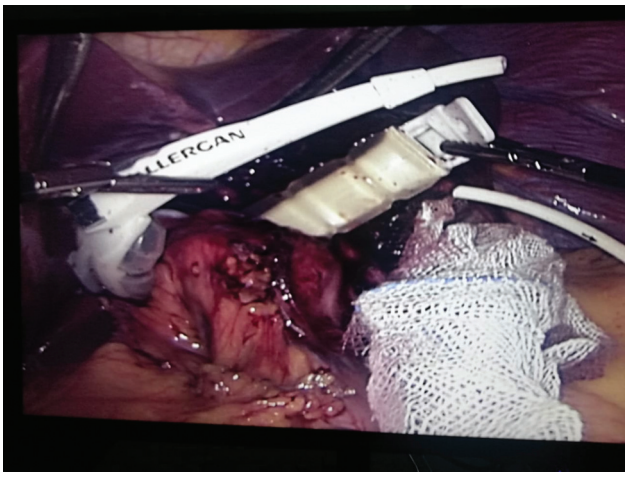
Overview showing adhesion from previous AGB. AGB, adjustable gastric banding.

Figure 2



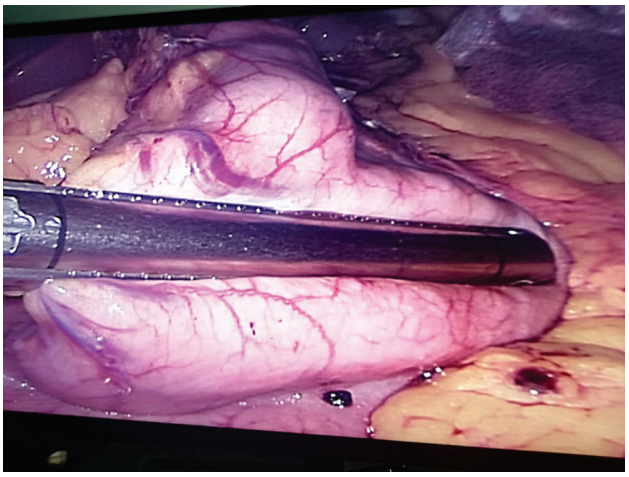
Dissection of the adhesion.

Figure 3



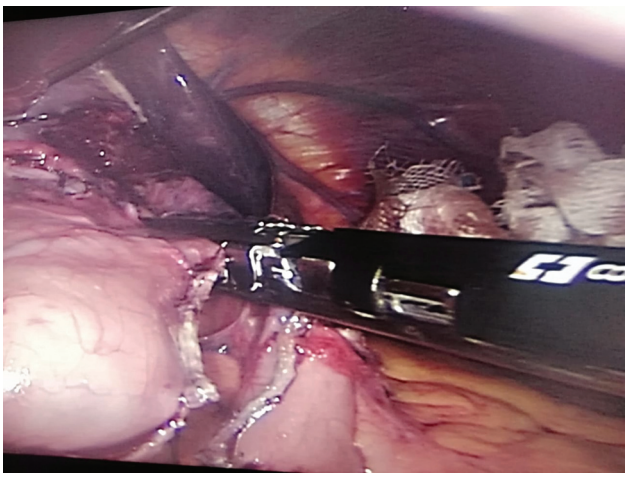
Removal of the band.

Figure 4



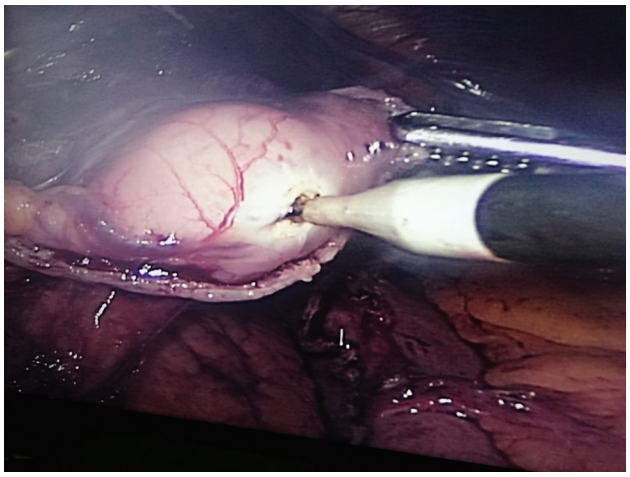
Creation of gastric pouch.

Figure 5



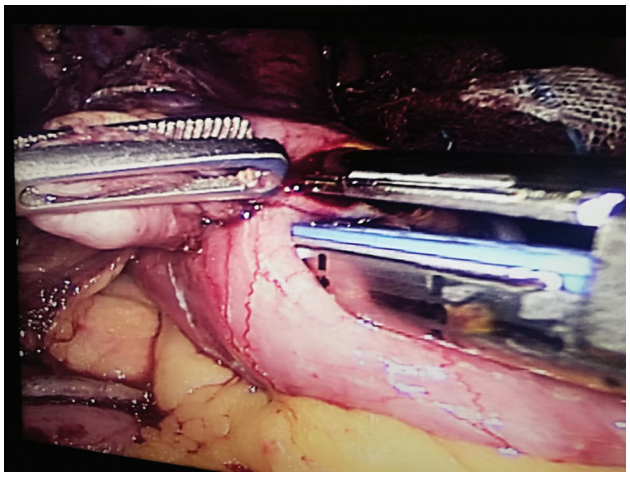
Creation of gastric pouch.

Figure 6



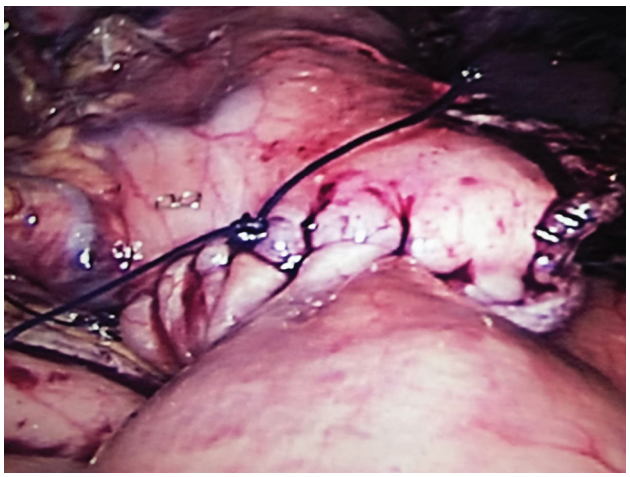
Fashioning of gastrostomy.

Figure 7



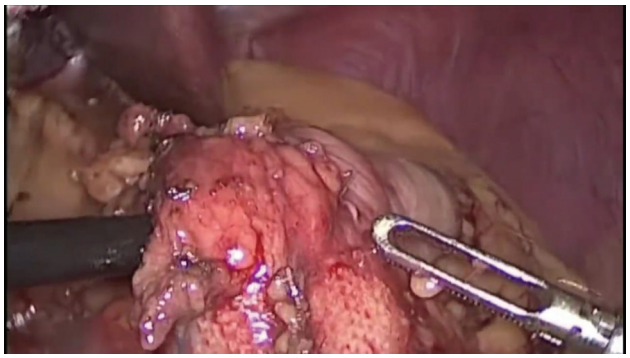
Gastrojejunostomy.

Figure 8



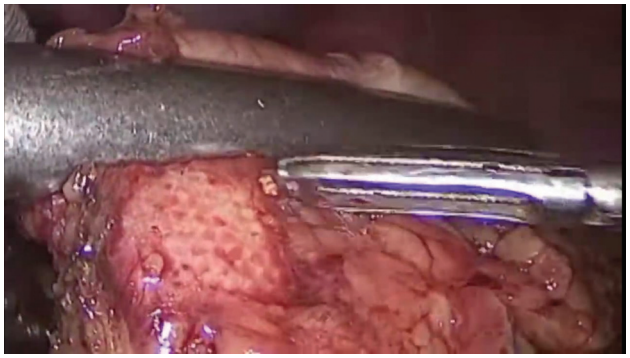
Gastrojejunostomy after its completion.

Figure 9



Identification of the proximal part of the mesh.

Figure 10



Making a transverse cut just above the mesh.

Discussion

Obesity is a worldwide health problem of rising trend and is a great risk factor for premature death and developed morbidities such as type-2 diabetes mellitus, hypertension, hyperlipidemia, obstructive sleep-apnea syndrome, and osteoarthritis [9]. Bariatric surgery is recently the most effective long-term therapy for morbid obesity and other related health problems [10].

With this rising demand for bariatric surgery, there are increasing numbers of patients who require revisional surgeries due to the undesirable results of their primary restrictive bariatric procedures [11]. As a result of the growing numbers of primary bariatric surgeries, bariatric surgeons now deal with more patients who have had a previous failed and/or complicated bariatric-restrictive procedure, especially VBG and AGB [12].

There are specific causes of failure for each restrictive procedure, in VBG, the most common causes of failure are pouch dilatation, stoma dilatation, and staple-line disruption causing gastrogastric fistula, all these causes will finally lead to weight regain [13]. In AGB, the

causes include insufficient weight loss, band slippage, erosion into the stomach, esophageal dilation, intolerance to the device, and ultimately a decreased quality of life [14].

In our study, the main indication for failure and revision was weight regain (60.6% of the OAGB-group patients and 64.7% of the RYGB-group patients) followed by insufficient weight loss (33.33% of the OAGB-group patients and 29.4% of the RYGB-group patients) where these results were nearly consistent with the results obtained by a study done by Almalki *et al.* [15] where weight regain was the main indication for revision in about 51% of the patients and inadequate weight loss was the indication in about 31% of the patients.

In our study, 6.1% of OAGB-group patients and 5.8% of the RYGB-group patients, respectively, were presenting with symptoms of reflux esophagitis that were improved on the clinical follow-up of the patients, these results were comparable with the results of the study done by Kermansaravi *et al.* [16] that showed that 81.7% of the patients with GERD improved or had remission following bypass surgery.

Although RYGB is considered by many as the gold-standard revisional procedure after failed restrictive surgery [17], but recently, OAGB was reported to be an alternative procedure for RYGB with a safer profile and better weight loss [18].

In our study, the mean operative time was 153.6 min for the OAGB group, which was significantly shorter than the mean operative time for the RYGB group that was 202.7 min, and these results were comparable with the results of the study done by Salama and Sabry [19] where the mean operative time was 145 min for OAGB group versus 185 min for the RYGB group. There was no significant difference between both groups as regards to average length of hospital stays, complications, and mortality, and this was consistent with the results of the study done by Velotti *et al.* [20]. It is well established that patients with previously restrictive procedures that had minimal response to weight loss may achieve good results from a conversion to the gastric bypass [21].

Even though the real differences in the mechanisms between OAGB and RYGB remain controversial and need to be fully studied, the reasons for a better weight loss in OAGB than in RYGB might be attributed to a better restrictive effect of long-sleeved gastric bypass and a longer biliopancreatic bypass limb [22].

In our study, at 6 months, there were significant differences in excess weight loss (64.45±35.21% for the OAGB group and 53.63±28.24% for the RYGB group), the body weight-loss (28.56±11.25% for the OAGB group and 20.85±10.64% for the RYGB group) BMI that became 29.95±8.85 for the OAGB group and 32.95±10.65 for the RYGB group, while at 1-year follow-up, the differences in these parameters were not significant, this reflects that OAGB could achieve a better short-term weight loss than RYGB, while after that, the difference in the weight loss will decrease or even become equal. These results were comparable with the results obtained from the study performed by Almalki *et al.* [15].

The main limitations in this study were the relatively small number of the patients included, short follow-up period, and to a lesser extent the patients' noncompliance.

Conclusion

Revisional bariatric surgeries are more difficult and technically demanding than the primary procedures. OAGB appears to be a simple, safer option, feasible, and effective alternative to RYGB. However, long-term outcomes for revisional OAGB for a failed restrictive procedure have not yet been heavily followed up and analyzed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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