

Short Term Results of Revisional Laparoscopic Bariatric Surgery after Open Vertical Banded Gastroplasty (VBG): Sleeve Versus Bypass

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ABSTRACT

Vertical banded gastroplasty (VBG) considered by some surgeons as a valuable bariatric surgical option. The rate of failure of VBG was high in the long term due to specific complications. Many patients who had previously undergone a VBG need a revision to other bariatric surgeries, including Roux-en-Y gastric bypass (RYGB), sleeve gastrectomy (SG), or the biliopancreatic diversion with duodenal switch (BPD-DS). **Methods:** This prospective study included fourteen morbidly obese patients with history of previous open vertical banded gastroplasty. These patients underwent laparoscopic revisional bariatric surgery either, laparoscopic sleeve gastrectomy (LSG) or laparoscopic Roux-en-Y gastric bypass (LRYGB) between January 2011 & August 2014. Patients were evaluated by history, clinical examination and investigations. They followed up for short-term results over a period of 2 years after the operation for postoperative complications as bleeding, leakage and infection and for weight loss after 2 years. **Results:** The mean age of patients was 35 years. The majority of patients in this study (92.9%) were females. The duration between last VBG and revisional surgery ranged from two to six years with the mean of 4 years. The basic body mass index (BMI) of all patients in this study (before revisional surgery) ranged from 36.4 to 69.4 kg/m² with a mean of 47.3 kg/m². After 2 years, all patients' BMI ranged from 25.2 to 36.7 kg/m² with a mean of 30.0 kg/m². Regarding excess weight loss percentage (% EWL), the overall % EWL ranged from 57.4 % to 98.2 % with a mean of 78.7 %. In this study, there was no patients converted to laparotomy. There was no mortality in this study either intra or post-operative or during 2 years follow-up. The operative time of both groups ranged from 135 to 255 minutes with a mean of 184 minutes. Postoperatively, we had only one patient from group (A) developed gastric leakage (7 %). The hospital stay ranged from one to seven days with a mean of two days. **Conclusion:** Conversion of VBG to other bariatric procedures was not an easy procedure that required an experienced team. Weight loss percentage of these revisional surgeries was the same as the primary ones. There was no clear difference between conversion from VBG to either sleeve gastrectomy or Roux-en-Y gastric bypass regarding weight loss percentage or operative time. **Key words:** VBG, Laparoscopic sleeve gastrectomy, Morbid obesity, Revisional bariatric surgery, Open vertical banded gastroplasty, Roux-en-Y gastric bypass, VBG conversion

INTRODUCTION

Morbid obesity is a worldwide major health problem and currently only bariatric surgery provide longstanding effective treatment⁽¹⁾. The incidence of obesity has been growing persistently over the past 20 years, resulting in an increasing number of patients undergoing bariatric surgery⁽²⁾. Restrictive bariatric surgery was introduced in the mid-1970s in the form of transverse gastroplasty and has been established and upgraded since that time⁽³⁾. Vertical banded gastroplasty (VBG) used to be a popular restrictive bariatric procedure in the 1990s, but today it is out from the bariatric surgeons' selection due to its late complications and

insufficient long-standing weight loss⁽⁴⁾. In 1982, Mason originally describes VBG as a means to simplify bariatric surgery⁽⁵⁾. Vertical banded gastroplasty (VBG) has been largely used in the past and is still considered by some surgeons as a valuable bariatric surgical option⁽⁶⁾. In Egypt, open VBG is still a bariatric option, which preferred by some surgeons and many patients due to the low cost of the procedure.

On the other hand, the rate of failure of VBG can be as high as 56% in the long term due to specific complications such as gastro-esophageal reflux, gastric outlet stenosis, pouch dilation, gastro-gastric fistula due to erosion of the mesh, breakdown of the staple lines and weight regain^(7,8). Previous studies have documented that

25–54% of VBG patients eventually seek revisional surgery⁽⁹⁻¹²⁾. The Mayo clinic 10-year results after VBG was disappointing with a failure rate 79%⁽¹³⁾.

The preferred surgical operation after failed restrictive procedures including the VBG is the Roux-en-Y gastric bypass (RYGBP)⁽¹⁵⁻¹⁹⁾. Many patients who had previously undergone a VBG need a revision to other bariatric surgeries, including RYGB, sleeve gastrectomy (SG), or the biliopancreatic diversion with duodenal switch (BPD-DS)^(20,21). A history of former VBG, especially when done openly, is considered by many surgeons as a relative contraindication to a laparoscopic approach for conversion to RYGBP. The experience reported in the literature with the latter has been very limited and with a very small number of cases (less than 20 cases)⁽²²⁻²⁵⁾.

The aim of this study is to assess the technical feasibility, complications and the short-term effectiveness of laparoscopic conversion of morbidly obese patients with history of open VBG to sleeve gastrectomy or Roux-en-Y gastric bypass.

PATIENTS & METHODS

Study design:

This study included fourteen prospectively selected patients, carried out on morbidly obese patients with history of previous open vertical banded gastroplasty. These patients underwent laparoscopic revisional bariatric surgery either, laparoscopic sleeve gastrectomy (LSG) or laparoscopic Roux-en-Y gastric bypass (LRYGB). These operations carried out at Cairo University Hospitals (Kasr El-Aini) and Military Production Specialized Medical Centre between January 2011 & August 2014. Those patients were evaluated by history, clinical examination and investigations. They were followed up for short-term results over a period of 2 years after the operation for postoperative complications as bleeding, leakage and infection (surgical site infection or peritonitis) and for weight loss after 2 years.

Patient inclusion criteria:

These patients should fulfill certain criteria for choice:

1. History of failure to reach an optimum weight loss or regain weight after 2 years

from doing open vertical banded gastroplasty (VBG).

2. Patients should have BMIs of 40 kg/m² or more, or between 35 kg/m² and 40 kg/m² with other significant obesity related comorbidities.
3. Both sexes (males and females)
4. Patients are generally fit for anesthesia and surgery.
5. Patients commit to the need for follow up.

Patient exclusion criteria:

1. patients with psychiatric problems
2. severe cardiopulmonary disease or other serious organic disease making the subject a high-risk surgical candidate, uncontrolled hypertension, and portal hypertension
3. pregnancy or lactation
4. drug or alcohol abuse

Pre-operative preparation:

All patients underwent a standard evaluation preoperatively. Blood tests requested in the form of complete blood picture, Fasting blood sugar, clinical chemistries (serum albumin, ALT, AST, GGT, Urea, and Creatinine) and Prothrombin time and concentration. Abdominal ultrasonography, chest X-ray, Pulmonary function tests, ECG and Echocardiography performed preoperatively. Patients informed about the nature of the research, and each patient understood and informed consent was obtained. The selection of the operation either sleeve or bypass depended on patients' choice after full discussion with them. One to two weeks pre-operatively the patients asked to consume very low caloric diet. All patients requested to do upper GI endoscopy to detect staple line dehiscence between gastric pouch and fundus, to detect gastric outlet stenosis at the site of mesh at the lower end of the pouch and to detect presence of gastro-esophageal reflux.

Surgical Procedures:

Anesthesia and Positioning:

All surgical procedures took place under general anesthesia. Patients were placed in supine position with 30 degrees reverse trendelenberg, legs open, and with elastic stockings to avoid DVT and pulmonary embolism and a prophylactic dose of anticoagulant given subcutaneously.

Insufflation and Trocar sites:

Pneumoperitoneum induced using Veress needle introduced through the left subcostal

region at midclavicular line; then the first 12mm cannula introduced in the left midclavicular line about 15 cm below the costal margin, with the camera through visual trocar to avoid injury of any bowel adherent to the abdominal wall in the upper midline incision. This cannula used as a working port after introduction of the other ports. Usually, this port changed with 15 mm cannula to allow introduction of green cartridges of Endo-GI stapler® (Covidien), especially in sleeve cases. Then, 3-5 cannulas were inserted in the following sites, the first three were mandatory with two more were cannulas inserted according to the actual anatomical situation:

Three mandatory cannulas, introduced as follow:

1. One camera port 12 mm, about 15 cm below the xiphisternum in the midline.
2. One working port in the right midclavicular line either, 12 mm or 15 mm according to the need of using green or blue cartridges.
3. One 5mm port for the assistant in the left anterior axillary line.

Two optional cannulas, introduced as follow:

1. One 12mm port for liver retraction 2 cm below the xiphisternum in the midline, if the liver did not suspend to the abdominal incision.
2. One more 5 mm port for assistant, if needed.

Procedure:

Adhesions was the main problem of revisional laparoscopic surgery. At the beginning of the procedure after insertion of the first left midclavicular under vision and insertion of one or more ports, adhesiolysis was carried out using Harmonic scalpel® (Ethicon Endo-Surgery) to create sites for the other ports to be inserted. Adhesiolysis carried out until separating the stomach from the left lobe of the liver and restoration of the normal anatomy. Usually, there were strong adhesions between the liver and the

stomach at the lesser curve at the site of the implanted mesh at the lower end of the VBG gastric pouch.

In sleeve cases, failure to pass 36 Fr bougie was important to continue the procedure otherwise; Roux-en-Y gastric bypass was the procedure of choice. Dissection of greater curvature started flush to the greater curvature using Harmonic scalpel® (Ethicon Endo-Surgery) until the gastro-esophageal junction and releasing the posterior adhesions between the stomach and the pancreas. It was important to continue the dissection up to the left crus of diaphragm, dividing the gastrophrenic ligament and making the gastric fundus completely free. In order to excise, then a 36 Fr bougie was inserted until the pylorus then the stapler introduced through the right operator port with a green cartridge then the following cartridges (green cartridges) introduced through the left operator port. A grasper then used to close the pylorus and methylene blue injected under pressure to test for leakage. Finally, a drain placed and the resected removed through the left working port (figure 1).

In Roux-en-Y gastric bypass, dissection carried out above the mesh, passing between the stomach lesser curve and the lesser omentum, about six cm below the gastro-esophageal junction. Green cartridges were used to create a gastric pouch. Gastro-jejunostomy 3 cm long was carried out using either green or blue endo-GI cartridges. Jejun-jejunostomy carried out using white 6 cm endo-GI cartridges, with the enteric limb 150 cm from the gastro-jejunostomy. Separation of the enteric from the biliopancreatic limb done using white 6 cm endo-GI cartridges. Methylene blue injected under pressure to test for leakage. Finally, a drain placed (figure 2).

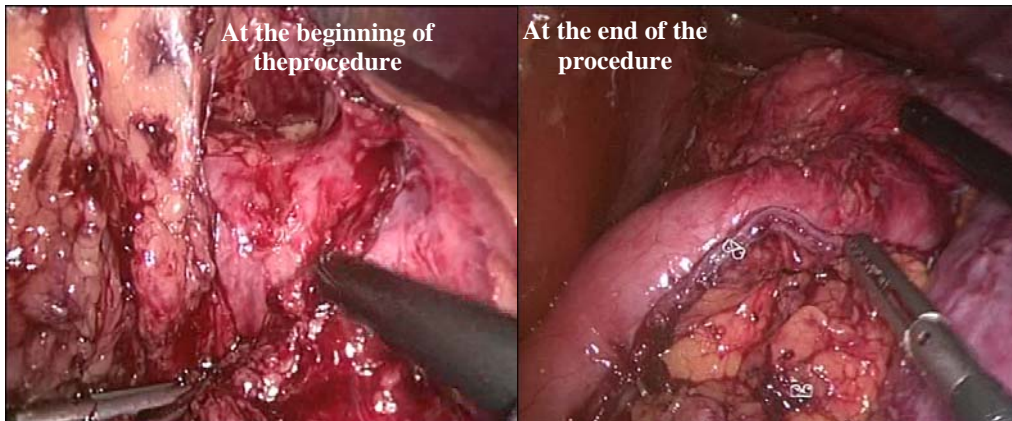


Figure (1): Laparoscopic revisional sleeve gastrectomy.

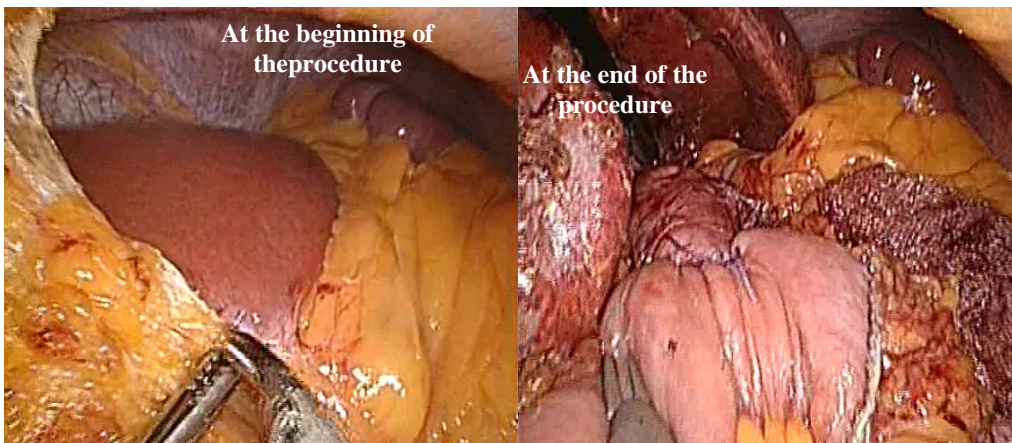


Figure (2): Laparoscopic revisional Roux-en-Y gastric bypass.

Post-operative measures:

In day one, gastrograffin study was performed to exclude leakage then the drain removed and the patient discharged when he was able to take liquid diet, with no fever tachycardia or chest pain. Patients continued on liquid diet for three weeks followed by pureed foods for another three weeks then soft diet for two weeks, then regular diet afterwards. All patients discharged on vitamin B12 vial every month for one year, calcium tablets twice daily for one year; PPI for the first three months and multivitamins for one year in addition to iron tablets in bypass cases once daily for one year.

All patients examined monthly during the first six months, then every 3 months until the end of the 2nd year for BMI changes and post-operative complications as bleeding, leakage, infection or nutritional deficiencies. Every three months

investigations were done including, serum iron, ferritin, calcium, complete blood pictures and albumin level. Abdominal ultrasound was done every three months. Body weight monitoring was done every three months and percentage of estimated weight loss was calculated.

Statistical methods:

Microsoft Excel (Microsoft Co., Redmond, WA, USA) was used for the data management. Data analyzed included; patient age, gender, BMI (pre and post), operative time, intraoperative bleeding, laparotomy conversion, complications (as leakage, hemorrhage) and weight loss percentage. Data collected and presented as median (range) and mean for continuous variables and frequency percentages for categorical variables. The degree of weight loss was assessed by excess weight loss percentage (% EWL).

RESULTS

This was a prospective study carried out on morbidly obese patients with history of previous open vertical banded gastroplasty. These patients presented to our department in Cairo University Hospitals (Kasr El-Aini) and Military Production Specialized Medical Centre at the period from January 2011 to August 2014, where fourteen patients underwent laparoscopic revisional bariatric surgery either, laparoscopic sleeve gastrectomy (LSG) or laparoscopic Roux-en-Y gastric bypass (LRYGB). These patients grouped into two groups; group (A) laparoscopic sleeve gastrectomy (LSG) and group (B) laparoscopic Roux-en-Y gastric bypass (LRYGB).

The patients' ages at time of revisional operation ranged from 22 to 47 years old with a mean of 35 years. Group (A), ages ranged from 27 to 47 years with a mean of 33 years while group (B), ages ranged from 22 to 47 years with a mean of 38 years. The majority of patients in this study (92.9%) were females. The duration between last VBG and revisional surgery ranged from two to six years with the mean of 4 years, as shown in table (1).

Table (1): Age characteristics of patients (at time revisional and last VBG)

	All Patients	Group A	Group B
Age at revisional surgery			
Minimum Age	22	27	22
Maximum Age	47	47	47
Mean Age	35	33	38
Age at last VBG			
Minimum Age	20	23	20
Maximum Age	43	43	42
Mean age	31	29	34
Mean duration between last VBG and revisional surgery	4		

Table (3): BMI changes of patients

	All Patients		Group A		Group B	
	Before	After	Before	After	Before	After
BMI (Kg/m²)						
Minimum	36.4	25.2	36.4	25.2	40.8	27.4
Maximum	69.4	36.7	69.4	36.0	52.5	36.7
Mean	47.3	30.0	47.2	29.5	47.4	30.7

Table (2): Other patients' characteristics

Variable	Value
Sex	
- Male	1 (7.1%)
- Female	13 (92.9%)
Body weight at revision (kg)	128 (104–189)
BMI at revision (kg/m ²)	47.3 (36.4–69.4)
Number of previous VBGs	1.3 (1–2)
Causes of revision	
- Weight regain	11 (78.6%)
- Inadequate weight loss	3 (21.4%)

Seventy-nine percent (11 cases) of patients in this study, regained weight after lost more than 40 % of their excess body weight in 2 years. Twenty-one percent (3 cases) of patients failed to reach adequate weight loss 40 % of their excess body weight in 2 years, as shown in table (2). The pre-revisional weight of all patients ranged from 104 to 189 kg with a mean of 128 kg. Group (A), patients' weight ranged from 104 to 189 kg with a mean of 130 kg while group (B) ranged from 104 to 143 kg with a mean of 125 kg. The basic body mass index (BMI) of all patients in this study (before revisional surgery) ranged from 36.4 to 69.4 kg/m² with a mean of 47.3 kg/m². Group (A), basic BMI ranged from 36.4 to 69.4 kg/m² with a mean of 47.2 kg/m² while group (B) ranged from 40.8 to 52.5 kg/m² with a mean of 47.4 kg/m². After 2 years, all patients' BMI ranged from 25.2 to 36.7 kg/m² with a mean of 30.0 kg/m². Group (A), 2 years BMI ranged from 25.2 to 36.0 kg/m² with a mean of 29.5 kg/m² while group (B) ranged from 27.4 to 36.7 kg/m² with a mean of 30.7 kg/m², as shown in table (3) and figure (3 and 4).

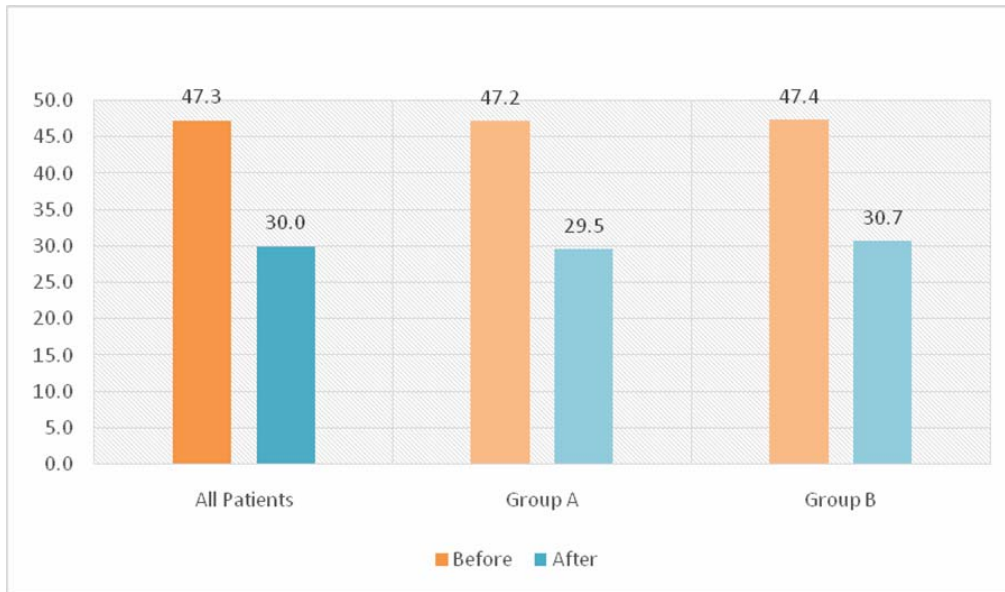


Figure (3): Mean BMI of patients (before and after revisional surgery)

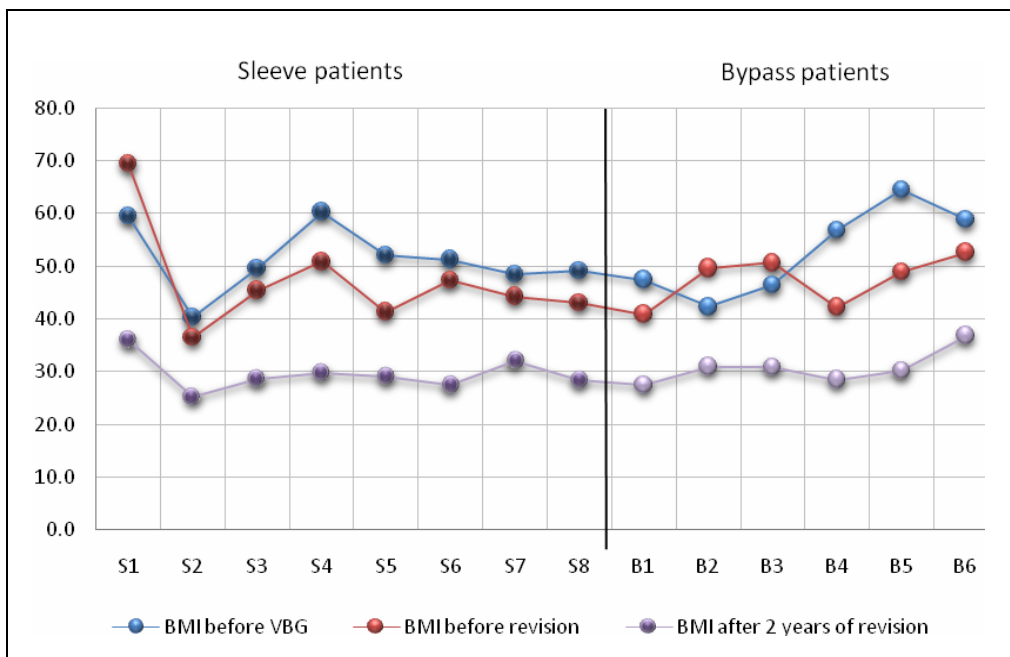


Figure (4): BMI changes of patients (before VBG and before and after revisional surgery)

Regarding excess weight loss percentage (%EWL), the overall %EWL ranged from 57.4 % to 98.2 % with a mean of 78.7 %. Group (A) showed % EWL that ranged from 63.5 % to 98.2 % with a mean of 80.8 %, while group (B) showed % EWL that ranged from 57.4 % to 84.6 % with a mean of 75.8 %. Two years %EWL of each patient as shown in figure (5).

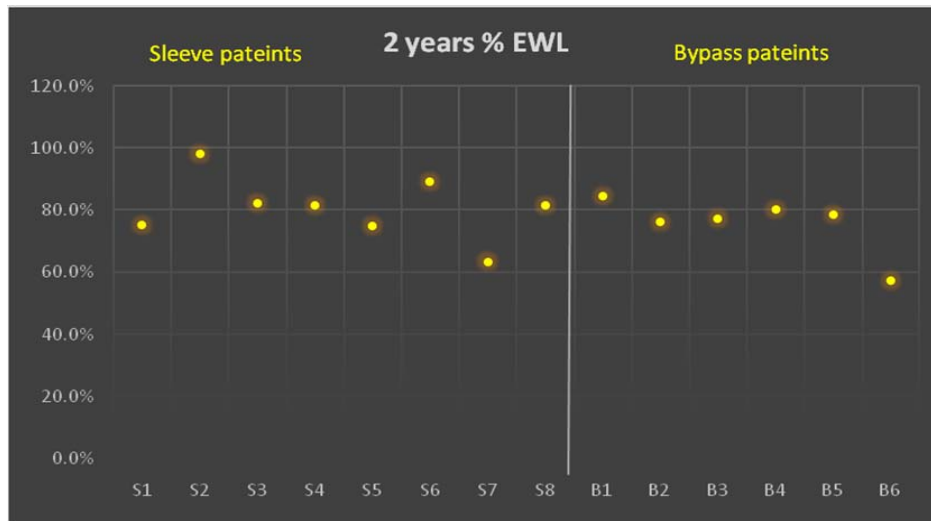


Figure (5): Distribution of %EWL among patients after two years from revisional surgery.

In this study, VBG was done more than one time in four patients (28.6 %) with two patients in each group, the other ten patients, VBG was done once. Two patients had gastro-esophageal reflux and stricture at the site of the implanted mesh for which laparoscopic Roux-en-Y gastric bypass (LRYGB) was done to relieve the reflux symptoms. Upper GI endoscopy failed to pass easily through these strictures. Three patients had VBG staple line dehiscence with reconnection between the gastric pouch and the fundus of the stomach for which laparoscopic sleeve gastrectomy (LSG) was done. Seven patients (50 %) were sweet eaters, four of which gastric bypass done.

In this study, there was no patient converted to laparotomy. There was no patient got iatrogenic injury of any bowel or the spleen during adhesiolysis. No patient got major iatrogenic liver injury. There was no mortality in this study either intra or post-operative or during 2 years follow-up. The operative time of both groups ranged from 135 to 255 minutes with a mean of 184 minutes. The mean of blood loss during surgery was 160 ml with a range of 100 to 250 ml. These numbers were the same in both groups. The numbers of ports needed during surgery ranged from four to six ports with a mean of five ports and equal in both groups. No intraoperative leakage found in this study. Only one drain left in all patients, as shown in table (4).

Table (4): Operative outcomes of revisional surgery

Variable	Value
Type of revisional surgery	
• LSG	8 (57.1%)
• LRYGB	6 (42.9%)
Conversion to laparotomy	0
Number of ports used	5 (4 – 6)
Intraoperative blood loss	160 (100 – 250)
Operative time (min)	184 (135 – 255)
• Group (A)	174 (135 – 210)
• Group (B)	198 (180 – 255)
Intraoperative complications	
• Iatrogenic splenic injury	0
• Major iatrogenic liver injury	0
• Iatrogenic intestinal injury	0
• Intraoperative Mortality	0

Postoperatively, we had only one patient from group (A) developed gastric leakage (7 %) near the gastro-esophageal junction on day one. During surgery on this patient, the stomach wall was thick, there was a failure of the GI stapler with green cartridge to fire, and to avoid the thick part we went away from the gastro-esophageal junction, however, she developed leakage at this site (no intervention with the leakage site done due to its fragility). In day two, reoperation done laparoscopically to make a proper drainage of the collection that diagnosed by CT abdomen with

gastrographin dye. In the next day, upper GI endoscopy and stenting done to close the site of leakage. Upper GI endoscopy found that the leakage site was the same site of the failed cartridge with necrotic areas of the mucosa, as shown in figure (6). One more patient from group (B) developed port site bleeding (7 %) and managed conservatively with no need for second intervention.



Figure (6): A case of leakage after sleeve gastrectomy (upper GI endoscopy)

The hospital stay of patients ranged from one to seven days with a mean of two days. Group (A), patients stayed in hospital for one to seven days with a mean of two days, while Group (B), patients stayed in hospital for one to five days with a mean of two days also. The drains were left in all patients for one to seven days with a mean of two days.

Table (5): Postoperative outcomes of revisional surgery

Variable	Value
Length of hospital stay (day)	2 (1 – 7)
Post-operative complications	
Leakage	1 (7.1%)
Intra-abdominal bleeding	0
Port site bleeding	1 (7.1%)
Mortality	0
Need for reoperation (laparoscopically)	1 (7.1%)
Need for upper GI endoscopy and stenting	1 (7.1%)

DISCUSSION

Obesity is a very common worldwide health problem that increases with time. The number of bariatric procedures done increases each year⁽²⁶⁾. Laparoscopic VBG is a restrictive bariatric surgical procedure, originally described by Mason in the early 1980s⁽⁵⁾. In the 1990s, VBG became popular restrictive bariatric procedures⁽²⁰⁾. VBG was a very common procedure especially in Egypt as its cost is cheaper than other procedure especially open VBG. The number of patients underwent VBG decreased with time; however, there was many patients prefer it due to its cheaper cost. In the 1990s, VBG became popular bariatric procedures, as it is simple and effective weight loss operation, with low complication rates^(8,20). In the beginning, good results achieved with a 54–58% weight loss⁽²⁷⁾. However, longer follow-up showed high rates of failure and its starting success had not survived for long time (20–56%) demanding revisional surgery^(7,8,28). Many patients have a progressive tendency to modify their eating habits and shift to a liquid or semi-liquid high-energy diet⁽²⁹⁾. This modification of eating habits was the main influence for non-survival of this procedure.

Revisional bariatric surgery comprises 5%–15% of total cases of bariatric surgery (3–3%). Several procedures used as a revisional surgery for VBG. Conversion of VBG to RYGBP, DS, or BPD⁽³³⁾ and sleeve gastrectomy (SG) are existing procedures⁽²⁰⁾. Most of these revisions can be done either as open or laparoscopically. However, the number of studies done by open method were very limited with small number of patients⁽²²⁻²⁵⁾. After restrictive procedures be unsuccessful, surgeons confronted with the problem of revision of the original surgery or converting to alternative operation, either restrictive or malabsorptive⁽³⁴⁾.

Some authors^(20,35-37) have proposed the conversion from a VBG to a sleeve gastrectomy. In the study of Jacobs et al.⁽³⁴⁾, patients choosing not to have an LRYGBP, and wanting another alternative or there was a contraindication to malabsorptive procedure, the clear choice was a sleeve gastrectomy⁽⁸⁾. They stated that the benefits of sleeve gastrectomy is not only a restrictive procedure, but there is little doubt that a sleeve gastrectomy offers other non-restrictive benefits as rapid gastric emptying and a

decrease in appetite^(34,38,39). In the study of Jacobs, converting from restrictive procedure to a sleeve gastrectomy is safe, feasible, and leads to approximately 60 % EWL at greater than 2 years. There was eight patients (28%) failed to achieve 40% EWL after conversion; however, over 70% of patients achieved EWL of greater than 45%⁽³⁴⁾. In our study, we found that the mean weight loss percentage of group A was 80.8 % EWL with no patients below 40% EWL at 2 years duration. The minimum % EWL was 63.5 % and the maximum was 98.2 %. The complications rate in our study was 12.5 % (one out eight patients in group A got leakage). However, these results are not statistically conclusive due to the small number of the study. However, many studies mentioned that there was a high complication rate for conversion from VBG to SG, including that of staple line hemorrhage and leakage, so surgeons have been discouraged from undertaking these operations^(20,21). Endoscopy should be done preoperatively, especially in conversion from VBG to sleeve as difficulty to pass the endoscope before the operation through this new ring make sleeve gastrectomy not feasible as it may lead to stricture of the sleeved stomach. Another endoscopic importance is the prevention of formation of a blind pouch and detection of leakage and intraluminal hemorrhage at the time of the operation⁽⁸⁾. In addition, endoscopic gastric stenting is a feasible intervention that can overcome gastro-esophageal leakage in that case in our study.

Conversion of VBG to RYGBP was not an easy procedure; however, the complication rate in this study was not high. Only one patient developed port site bleeding. There were no patients developed any leakage or intra-peritoneal hemorrhage. In many other studies, they reported that there was a high morbidity rates after VBG conversion to RYGBP^(24,40,41). However, it is not obvious whether these aggravated results caused by a higher BMI, prior open surgery, or the VBG technique itself⁽²⁰⁾. In contrary, several authors have shown conversion of VBG to RYGBP as a safe and more effective re-do procedure because it leads to better weight loss and maintenance and is associated with smaller amount of long-term complications^(7,30,42,43). The conversion of VBG to RYGBP is a procedure that can safely be performed in experienced hands, with a satisfactory morbidity and mortality⁽²⁹⁾. Lönroth et al.⁽⁴⁴⁾

found that the results of conversion of VBG to RYGBP regarding weight loss is the same as the primary RYGBP. In our study, the mean weight loss was 75.8 % EWL with a range of 57.4 % to 84.6 % EWL. There was no clear difference in our study regarding weight loss percentage or operative time between the two groups. Moreover, these procedures were not that easy as the primary cases and need more experience of the bariatric team.

The presence of mesh at the lower end of new gastric pouch create a lot of adhesion especially between the mesh and the left lobe of the liver, that make the operation laparoscopically very difficult and take much time to release these adhesions to reach the upper part of the stomach. To overcome the intra-operative difficulties and avoid injury of any bowel during first port entrance, it is better to introduce the lens inside a visual port away from the midline incision. Usually adhesions present between the abdominal wall, falciform ligament and greater omentum, which should be released completely to facilitate delivery of the small intestine to the gastric pouch in LRYGB.

CONCLUSION

Conversion of VBG to other bariatric procedures was not an easy procedure that required an experienced team. Weight loss percentage was the same as the primary ones, with no clear difference in our study regarding weight loss percentage or operative time between conversion from VBG to either sleeve gastrectomy or Roux-en-Y gastric bypass. Endoscopy was a very important part of preparation to avoid strictures.

Disclosure

None of the authors has any conflict of interest in relation with this manuscript.

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