Outcomes of Laparoscopic Sleeve Gastrectomy and Mini-Gastric Bypass as a Revision Surgery after Failed Gastric Banding

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ABSTRACT

Background: *Laparoscopic adjustable gastric banding (LAGB) is one of the frequently performed bariatric surgeries. Even with a high failure rate, revision procedures such as re-banding or laparoscopic Roux-en-Y gastric bypass (LRYGB) were commonly performed. Recently, conversions of LAGB to laparoscopic sleeve gastrectomy (LSG) or mini gastric bypass (MGB) were also reported.* ***Objectives:*** *To compare the intra- and postoperative complications of LSG and MGB as revision surgeries after failed LAGB, and the effect of both procedures on body mass index and weight loss at one year postoperative.* ***Patients and methods:*** *This study included 34 patients in the period from January 2013 to January 2016 who underwent a revision surgery, either LSG or MGB, following LAGB due to failure to achieve target weight loss or due to associated complications with one year follow up. Demographics, pre- and post-operative complications, percentage of excess weight loss (%EWL) and body mass index (BMI), were evaluated pre- and post-revision surgery.* ***Results****: This prospective randomized study included 19 patients who underwent LSG revision and 15 patients underwent laparoscopic MGB revision after failed LAGB. The overall operative complications were 21% and 20% in the LSG and MGB groups respectively. There was no statistically significant difference among both study groups as regard peri- and post-operative complications. There was no postoperative mortality in both study groups. Mean operative time was statistically significantly longer in the MGB group ($p<0.05$); also mean length of hospital stay was significantly longer in the MGB group ($p<0.05$). The mean difference in %EWL and BMI were non-significant among both study groups at 3 and 6 months postoperative; however, there was a statistically significant increase in % EWL and decrease in BMI at 9 months in MGB group more than in LSG group ($p<0.05$). The %EWL was significantly higher ($p<0.01$) and BMI significantly lower ($p<0.05$) in MGB patients at 12 months postoperative.* ***Conclusion:*** *Both LSG and MGB conversion after LAGB yield a positive outcome on BMI and % EWL with low complication rates.*

Key words: *Revision surgery, sleeve gastrectomy, mini gastric bypass, adjustable gastric banding, post conversion complications.*

INTRODUCTION

Bariatric procedures and surgeries are designed to cause significant and long-lasting weight loss in patients who are grossly obese. Laparoscopic adjustable gastric banding (LAGB) is one surgical procedure that falls under the subcategory of restrictive bariatric surgery. The FDA approved LAGB in the United States in 2001,[1] and became the most popular bariatric surgery for candidates with BMI of $\geq$ 35 with comorbidities or obesity-related medical conditions (diabetes mellitus type 2, hypertension, obstructive sleep apnea, hyperlipidemia, etc.) and who have failed to achieve sustained weight loss with non-surgical methods. The procedure involves placing a soft silicone ring with an expandable balloon in the center, around the top part of the stomach. It effectively creates a two-compartment stomach, with a much smaller top part above the band. Food eaten fills only this top part. Over time, after the meal, the food passes through the opening of the band into the remainder of the stomach, and digestion occurs normally.[2] Although reported short-term complications were very rare, recent evidence suggests a long-term complication rate of 40 to 50 % of LAGB procedures needing revisions or conversions.[3,4] Long term complications included implant malposition, erosion, frequent vomiting, or weight loss failure.[5,6] As a consequence of this, some patients may require a second surgical intervention due to presence of band complication or inadequate weight loss.[5] However, there is still no consensus regarding the best conversion procedure choice and remains

unclear in terms of early and long-term results.[7] A rescue procedure that is safe, effective, easy to perform and able to improve the restrictive eating pattern in dimension and consistency, is needed. Conversion from a LAGB to either laparoscopic gastric sleeve (LGS) or laparoscopic mini gastric bypass (MGB) are proposed to determine which procedure best enhances weight loss. Laparoscopic sleeve gastrectomy (LSG) was initially devised as the first step of the duodenal switch procedure but is increasingly offered as a primary independent bariatric operation. The laparoscopic MGB, first described by Rutledge in 2001[8], showed excellent results both as a primary bariatric operation[9,10] and as a revision surgery.[11.12]

The aim of our study was to compare the outcome of two bariatric surgeries, laparoscopic vertical sleeve gastrectomy and laparoscopic mini gastric bypass, as revision procedures, following failed laparoscopic adjustable gastric banding.

PATIENTS AND METHODS

This prospective randomized study included thirty four (34) patients who had LAGB and regained weight or had related complications such as epigastric pain, dysphagia or reflux in the postoperative period. The study was done in the period from January 2013 to January 2016. The patients were recruited from the bariatric surgery clinic at General Surgery Unit, Ain Shams University hospitals in Cairo, Egypt, who came to seek another surgical option for losing weight or relieving their medical complaint. Two alternative surgical treatment options were discussed with every patient individually. They were offered and counseled for either LSG or laparoscopic MGB following gastric band removal. Patients were randomly allocated to either group 1 (LSG group) or group 2 (MGB group) by the coin flip technique. The pros and cons of either procedure were fully explained for each patient individually. A full medical history, clinical examination and laboratory evaluation was performed for all patients. A clear history of the date of the LAGB procedure, the preoperative BMI before the LAGB and weight loss following the procedure was recorded for all patients. All patients' medical complaints related to the LAGB were recorded. Gastrografin meal study was performed for all patients to draw the shape of the stomach and the pouch after LAGB and plan for surgery. Also, all patients underwent upper gastrointestinal endoscopy to detect any band complications. Preoperative BMI was recorded. The pre-, peri- and post-operative outcomes of these 34 patients (19 female and 15 male) were prospectively recorded. The reason for gastric band removal and interval between removal and revision procedure were documented. Revision surgery followed the guidelines of the NIH criteria for bariatric procedures.[13]

Revision surgery was done at the same session (single stage) if the band was not complicated by gastric erosion as shown by preoperative endoscopy. If erosion was detected, the band was removed then the revision surgery was held 3 months later to allow for healing of the stomach (two stages).

A written informed consent was obtained from all patients before they were assigned to revision surgery. Preoperatively, patients received low molecular heparin and antibiotic prophylaxis.

Surgical Technique:

At the laparoscopic conversion to either procedure, an orogastric tube of 36F is inserted at the beginning of the procedure to decompress the stomach and to be used for examining the integrity of the stomach by the end of the procedure. Exploration of the abdomen followed by dissection of adhesions is done using Harmonic scalpel. Then, band catheter is pulled and followed till the junction with the band. Adhesions with the liver were dissected carefully only as far as to expose the band and avoiding injury to Glisson's capsule. The scarred tissue around the band and catheter junction was divided to create a space for the scissors to pass behind the band. The band was then divided and the catheter cut close to its junction with the port. The tip of the catheter is grasped with forceps and introduced through the 10-mm port from which it is finally retrieved. If VSG was to be performed, we started our stapling 6 cm from the pylorus and reaching up to the angle of His guided by the orogastric (36F) tube. Care was given for not to get close to the angle of Hiss and to avoid postoperative leakage. On laparoscopic MGB, we started at the incisura and formed a narrow stomach tube guided by the orogastric (40F) tube reaching up to the angle of Hiss. Care was also given for not to get close to the angle of Hiss. Then gastrojejunostomy was performed at a

200cm distance from the duodenojeujunal flexure. At the end of both procedures, methylene blue dye was injected through the orogastric tube to check for leakage and stomach integrity.

All patients were advised early postoperative ambulation within the first 24 hours. The duration of the surgical procedure and postoperative hospital stay were recorded. Fluids were resumed 24 hours postoperatively after doing contrast study. Following discharge, patients were instructed on their daily dietary guidelines and nutritional support. All patients were seen once in the immediate postoperative period then before hospital discharge. Patients were given a follow-up schedule at one week postoperative then at 3 monthly intervals thereafter, for one year. At every postoperative visit, all patients had a body weight, a BMI and percentage of excess weight loss (%EWL) measured. Data collected from both groups was recorded and subjected to statistical analysis.

Statistical analysis:

The data were presented as the mean ± standard deviation. The *t* test and Chi-square $(\chi)^2$ tests were used to compare the two groups of patients. For all statistical tests, a *P* value <0.05 was considered significant. All calculations were performed by using the SPSS software package version 23.0 (SPSS Inc., Chicago, IL).

RESULTS

From January 2013 to January 2016, 34 patients underwent a revision bariatric surgical procedure, either LSG or MGB after failure of LAGB. All patients had a regular 3-monthly follow-up visit for one year postoperatively. The indications for the revision procedure are shown in Table (1). The most frequent indication for revision surgery, in both groups, was failure to lose adequate weight, (68% versus 53%) in the LSG and MGB groups respectively.

Table (1): Indications for revision surgery.

	LSG group n= 19	*MGB group n= 15*
Weight loss failure	13 (68%)	8 (53%)
Pouch enlargement	1 (5.3%)	2 (13.6%)
Esophageal dilatation	1 (5.3%)	1 (6%)
Gastric erosion	1 (5.3%)	2 (13.6%)
Band slippage	3 (15.7%)	2 (13.6%)

Comparing all demographic data among both groups showed insignificance. As shown in Table2, The overall mean age was 31 years (range 20–53), 64 % were females and 36% males. The mean age in the LSG group was 31.1±9.1 years versus 30.7± 8.4 years in the MGB group. The mean length of time between the LAGB and the revision surgery, was 35.2±16.4 months in the LSG patients, and 44.8±19.7 months in the MGB patients. The mean pre-band BMI was 43.8±4.8 versus 49.7±8.3 in the LSG and MGB respectively. The mean percentage of maximum excess weight loss after LAGB was 27.4±7.6% in the LSG revision patients compared to 29.3±5.8% in the MGB revision surgery patients. The mean BMI before revision surgery was 41.6±7.3kg/m^2 and 43.1±6.2 kg/m^2 in the LSG and MGB procedures respectively. The mean operative time was significantly lower in the LSG revision (89.8±31.4 min) compared to (171.4±33.6 min) MGB revision surgery (p<0.05). The mean length of hospital stay was again significantly shorter (2.78± 1.42 versus 4.6± 2.50 days (p<0.05) in LSG and MGB respectively. No mortality was reported among patients in both groups.

Table (2): Pre- and peri-operative Parameters (mean ± SD).

	LSG group n= 19	*MGB group n= 15*	*P-value*
Age (years)	31.1 ± 9.1	30.7 ± 8.4	NS
Length of LAGB to revision (months)	35.2 ± 16.4	44.8 ± 19.7	NS
Pre-band BMI	43.8 ± 4.8	49.7± 8.3	NS
% EWL after LAGB	27.4±7.6	29.3± 5.8	NS
BMI before revision	41.6± 7.3	43.1± 6.2	NS
Operative time (minutes)	89.8± 31.4	171.4± 33.6	<0.05
Length of hospital stay (Days)	2.78± 1.42	4.6± 2.50	<0.05

Intra- and postoperative complications are shown in Table (3). The overall complication rate occurred in 26.3% of cases in the LSG revision group and 26.6% of the MGB revision patients. Intraoperative bleeding was statistically non-significant among both studied groups, occurred in one case (5.3%) in the LSG group and one case (6.6%) in the MGB group. Bleeding was well controlled intraoperatively in both cases. Gastric leakage and postoperative wound infection were statistically insignificant among both groups. Gastric leakage was managed conservatively, no patients required reoperation but only one case after LSG that required insertion of a mega stent that was introduced endoscopically and removed two months later. Wound infection was treated according to the hospital policy for wound infection and patients recovered well. Deep venous thrombosis occurred in one patient (5.3%) in the LSG who received appropriate therapy and recovered satisfactorily. Conversion to open surgery occurred in only one patient (5.3%) in the LSG group due to excessive intra-abdominal adhesions.

Table (3): Intra- and postoperative complications.

Complication	*LSG group n= 19*	*MGB group n= 15*	*p-value*
Bleeding	1 (5.3%)	1 (6.6%)	NS
Gastric leakage	1	2 (13.3%)	NS
Deep venous Thrombosis	1 (5.3%)	0	NS
Infection	1 (5.3%)	1 (6.6%)	NS
Conversion	1 (5.3%)	0	NS

All patients complied with follow-up and a secretary was assigned to contact the patients before their follow-up appointment to confirm their attendance to the clinic. The three months postoperative visit showed a mean BMI lower in the MGB group compared to the LSG group (37.5±4.1 versus 38.7±2.9) but the difference was not statistically significant. However, there was a significant difference in mean BMI at 6 months postoperative (34.1 ± 3.77 kg/m^2) compared to mean BMI before revision (43.1±6.2 kg/m^2) ($P < 0.001$) in the MGB group and (36.4±8.3kg/m^2) compared to (41.6 ± 7.3 kg/m^2)($p<0.05$) in the LSG group. There was no significant difference in mean BMI between the MGB and the LSG group at 6 months postoperative (34.1±3.77 versus 36.4±8.3 kg/m^2). The mean BMI was significantly lower and % EWL was significantly higher in the MGB revision compared to LSG revision at the 9 month follow up visit as shown in Table 4. By the end of the study period, one year, the mean % EWL was significantly higher in the MGB group (35.4±9.1%) than in the LSG group (33±1.4%) ($p<0.05$); and the BMI significantly lower, in the MGB group (30.6±4.7 kg/m2) versus (33.6±5.1kg/m2) in LSG ($P <0.01$).

Table (4): Postoperative BMI and %EWL (mean ± SD).

Parameter	*LGS group n=19*		*LMGB group n=15*		*p-value*	
	BMI	**%EWL**	**BMI**	**%EWL**	**BMI**	**%EWL**
3months	38.7±2.9	30.2±4.3	37.5±4.1	30.6±6.1	NS	NS
6 months	36.4±8.3	32.1±4.4	34.1±3.77	31.8±5.3	0.13	0.09
9 months	35.3±6.6	32.9±7.9	31.8±3.4	34.2±5.5	**0.05**	**0.05**
12 months	33.6±5.1	33±1.4	30.6±4.7	35.4±9.1	**0.05**	**0.01**

DISCUSSION

The alarming increase in obesity prevalence worldwide makes bariatric surgery increasingly popular.[14] Furthermore, strong evidence suggests that bariatric surgery is superior to conventional therapy for weight loss. Although LAGB is still a frequently performed bariatric procedure,[15] reported failure rate reaches of up to 50% at 5 years postoperative and a high risk of complications. It is generally agreed on the fact that a revision surgery is the best option in case of failure of LAGB,[16,17] but there is lack of significant data as which surgery is appropriate. Although there is a trend in favor of LSG, the MGB has been proved to be a valuable option according to the excellent results presented by Rutledge and Noun both as a primary bariatric operation and as a revision procedure.[18,19] Peri- and postoperative adverse outcomes, in terms of morbidity and mortality, assessed following revision LSG or MGB due to failed LAGB have been reported by few observational studies.[20,22] In our study, we used two surgical revision procedures: LSG and laparoscopic MGB. The main reason for revision surgery in this study was largely due to ineffective weight loss following LAGB, and to a lesser extent, presence of associated complications. We reported a low rate of complications in both study groups (26.3% and 26.6%) respectively.

A recent systematic review demonstrated fewer postoperative complications after LSG than after MGB as a revision procedure for failed LAGB.[21]

The leak was reported in two cases of MGB revision. It was lower than that reported by previous literature.[22] There were no statistically significant differences between conversion to LSG or MGB in terms of complications, length of hospital stay, and % EWL at 3 and 6 months postoperative .The mean length of hospital stay was also shorter than that previously reported.[23] There are many studies showing that MGB as a revision procedure is better in terms of weight loss when compared to the LSG.[24] In our study, we found that weight loss was better in the MGB group compared to the LSG group at 9 and 12 months postoperatively. The mean interval between LAGB and MGB in our study was 45±16.4 months and between LAGB and LSG was 44±19.7 months this was in agreement with that reported in previous studies.[21]

Conclusion and our experience recommendations:

Revision surgeries, both LSG and MGB, after failed LAGB are safe, easy to perform and satisfactory in terms of weight loss. Both procedures were successful as revision surgeries as regards intra and postoperative complications. However, due to the small sample size and the short follow up period larger studies with longer follow-up are required to determine whether one procedure out-weighs the other as a revision procedure for failed LAGB.

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