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Comparative Study between Effect of Sleeve Gastrectomy and Mini-Gastric Bypass on Weight Loss and Improvement of Co-Morbidities

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ABSTRACT

Background: sleeve gastrectomy (SG) is one of the most popular procedures in the world. SG is a technically less complex procedure with short learning curve and effective weight loss, but it suffers from two outstanding disadvantages including high risk of weight regain and gastro- esophageal reflux disease (GERD). Mini-gastric bypass (MGB), also known as single anastomosis gastric bypass or omega gastric bypass, is a newly emerged procedure. Due to safe and simple process as well as effective outcomes, MGB has quickly become one of the most popular procedures in many countries.

Patients & Methods: the study included 60morbidly obese patients that were assigned to two equal groups as regards to the operation they underwent either Laparoscopic MGB or Laparoscopic SG. The primary outcome measured was change in weight and BMI. The secondary outcome was improvement of other co-morbidities like DM and lipid profile. Patients were followed up to 12 months after operation.

Results & Conclusion: after prospectively comparing the two procedures for a year, almost both procedures have near same effect on loss of weight and resolving or better control on co-morbidities as DM, and HTN. However, MGB patients in need for multi-vitamins and minerals costing more than 1500 Egyptian pounds per month. The statistical differences observed as regards to BMI, LDL and HDL are still clinically insignificant. So, the recommendation for Egyptian patient whatever their morbid obesity scale is Sleeve Gastrectomy except for patient complaining of GERD, they should undergo MGB, as the results showed better resolution for their complain post-operatively.

INTRODUCTION

Obesity became an epidemic disease. Physical, psychological, and economic complications are associated with obesity which leads to difficulty in caring of obese patients by physicians[(1)].

Globally, Type 2 DM spreads also in parallel to obesity as more than 171 million people are affected worldwide, causing 3 million deaths per year[(2)]. Obesity and metabolic syndrome are associated with multiple complications among them type 2 DM, HTN and dyslipidemia, and there is a great evidence that this can be managed with bariatric surgery.Indications for bariatric surgery include a BMI of 40 kg/m2 or higher, or a BMI between 35 and 40 kg/m2 with at least two obesity-related comorbidities, According to National Institutes of Health guidelines.

DM is the most important comorbidity that determines the risk of surgery, so bariatric surgery can be done for any obese patient with BMI 35 kg/m2withtype 2 DM who failed to lose weight with other weight-control approaches [(3)].

Roux-en-Y gastric bypass (RYGBP) and sleeve gastrectomy (SG) are two most popular procedures[(3)]. SG is one of the most popular procedures (37%) in the world[(4)]. SG is a technically less complex procedure with short learning curve and effective weight loss,but it suffers from two outstanding disadvantages including high risk of weight regain and gastro- esophageal reflux disease (GERD)[(5)].

Mini-gastric bypass (MGB), also known as single anastomosis gastric bypass or omega gastric bypass, is a newly emerged procedure originated from **Rutledge and Walsh**[(6)]. Due to safe and simple process as well as effective outcomes, MGB has quickly become one of the most popular procedures in many countries. Despite of popular status, the extension of MGB is still limited by some concerns such as gastric and esophageal bile reflux, marginal ulcer, and remnant gastric cancer[(7,8)].

AIM OF THE WORK

The aims of the current study are to determine and evaluate the impact of sleeve gastrectomy and mini-gastric bypass procedure on weight loss, cure of co-morbidities and postoperative complications rate 3 months, 6 months and 1 year postoperative.

PATIENTS AND METHODS

This is a prospective controlled clinical study was done in Al-Azhar University hospitals and Ahmed Maher Teaching hospital, which included 60 morbidly obese patients, and they were divided into two groups:

- **Group 1:** 30 patients who underwent sleeve gastrectomy (laparoscopically).
- **Group 2:** 30 patients who underwent Mini-Gastric Bypass (laparoscopically).

Inclusion Criteria:

- Age ranging between 20-50 years.
- Body Mass Index >40 or > 35 with co-morbidities as diabetes mellitus or hypertension.

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- **Specific inclusion criteria for group 2:** patients who are suffering from GERD disease, peptic ulcer disease or sweet eaters.

Exclusion Criteria:

- Age <20 or >45 years.
- Obese patient with major cardiac, respiratory, renal or hepatic co-morbidities interfering with anesthesia.
- Previous abdominal surgeries.

These patients were enrolled in prospective study for 12 months. The results of treatment were evaluated in terms of weight loss, cure of comorbidities and early postoperative complication rate after both bariatric surgeries.

The primary outcome measure was the change of body mass index (BMI) after treatment at 6 and 12 months. Secondary outcome measures were control of diabetes mellitus, hypertension, hyperlipidemia and other associated comorbidities in addition to postoperative complications of surgery.

The study was approved by the Ethics Board of Al-Azhar University.

Procedure:

A. Preoperative evaluation: all studied patients were subjected to

I. Complete history taking:

1. Personal history: as age, sex, marital status.
2. Feeding history and if the patients like sweet much or not.
3. History of previous trials of weight loss.
4. Medical history for comorbidities: DM, Hypertension, Cardiac and respiratory problems, Previous deep venous thrombosis (DVT) and any other morbidities.
5. Past surgical history.
6. Questionnaire for psychological assessment of the patient.
7. Complete physical examination:

- Measurement of weight per Kg, height per meter then calculation of BMI = (weight Kg/height m^2).
- Abdominal examination for (scar for pervious surgery, hernia orifices, organomegaly, right hypochondrial tenderness).
- Cardiac and pulmonary evaluation.

II. Investigations:

- Laboratory investigation: Complete blood count, Liver function test, kidney function test, fasting blood sugar,
- 2hours Postprandial blood sugar, HbA1c, coagulation profile, serum Calcium, Na, K, Mg.
- Other investigation: Chest X-ray, Abdominal U.S, Pulmonary function test (if needed), and Upper gastrointestinal (UGI) endoscopy (if needed).

All patients were informed about the types of surgery underwent, details about the procedure, associated risks and complications, resulting dietary and lifestyle modifications, anticipated outcomes, and long-term effects. Every patient was provided with written informed consent before surgery.

B. Surgery: either Sleeve Gastrectomy or Mini-gastric Bypass was done under general anesthesia and under complete aseptic condition, and laparoscopically.

For LSG, mobilization of the gastric greater curve began 6 cm proximal to the pylorus, and continued to the angle of His with importance accorded to the total exposure of the left crural pillar. Gastric resection using generally five to seven vertical 60 mm staple cartridges over a 36 French bougie (Figure 1 & 2).

For LMGB, the gastric tube was created from the angle of the lesser curvature to the left crural pillar using generally four to five vertical 60 mm staple cartridges over a 36 French bougie 160-200 cm downstream the angle of Treitz, an ante-colic gastrojejunostomy is performed using a posterior 45-mm linear stapler (Figure 3 & 4). For both procedures, absence of gastric leak was verified by introducing methylene blue through a nasogastric tube at the end of the operation. Postoperatively, patients were allowed to drink if no complication was observed. Patients were usually discharged on day 3 or 4.

Figure (1): In LSG; dissection of greater omentum proximal then applications of 60-mm linear staplers (Green load staplers 4.8 mm)beginning at a point 4 to 6 cm proximal to the pylorus.

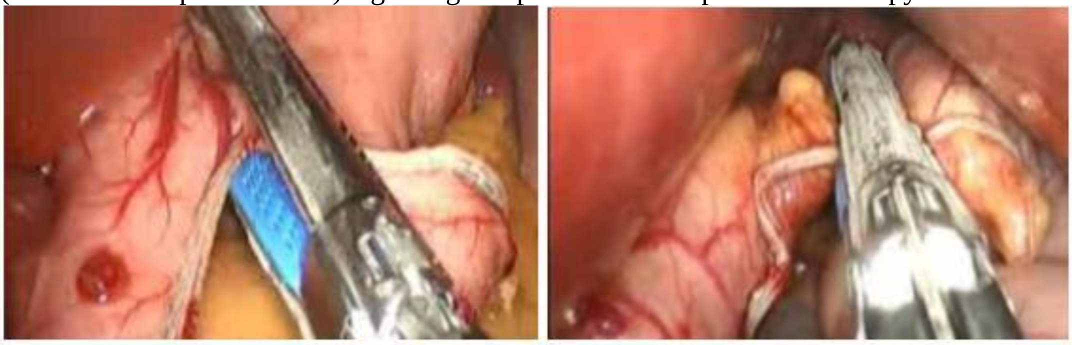

Figure 2: In LSG; sequential application of five to six 60-mm linear staplers (Blue load staplers 3.5 mm).

Figure 3: In LMGB sequential application of application of five to six 60-mm linear staplers (Blue load staplers 3.5 mm).

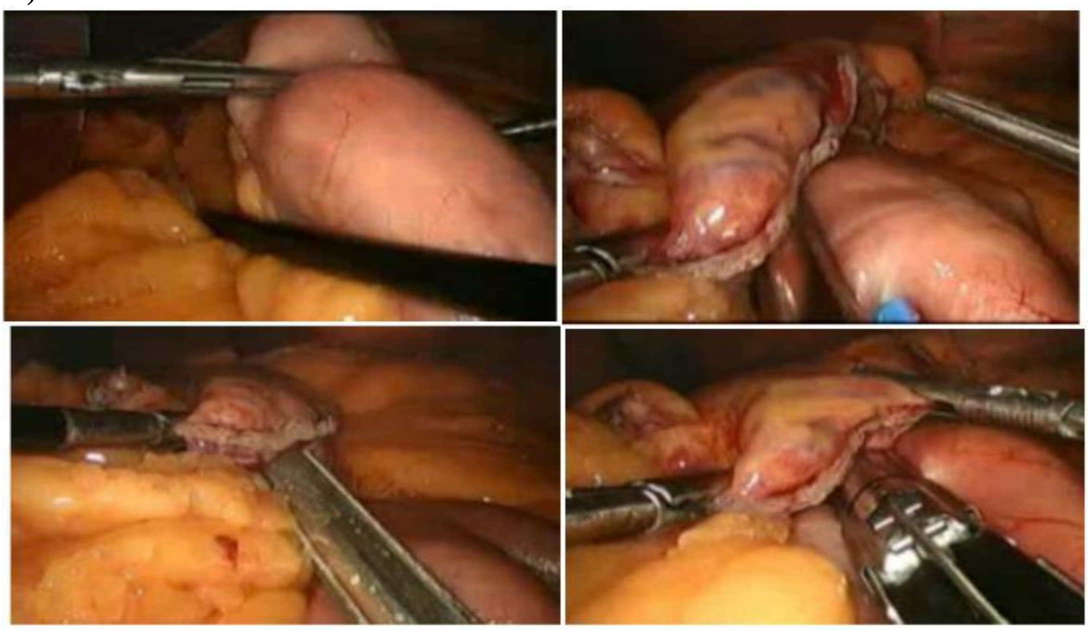

Figure 4: In LMGB; creation of gastrojejunostomy

C. Postoperative evaluation:

- **Immediate postoperative evaluation (during hospital stay):** Evaluation for early postoperative complications has been done for bleeding, early leak or persistent nausea and vomiting (acute stricture or stomal stenosis). The comparison between Sleeve Gastrectomy and Mini-Gastric Bypass as regards the following:

1. Postoperative pain (with its grades).
2. Postoperative hospital stays.
3. Postoperative short-term complications (complications that prolonged hospital stay and/or necessitated invasive treatment before 30 days of surgery).

- **Postoperative follow up program:** All patients will be subjected to follow up program with regular visits to surgeon scheduled as follows:

- Every 2 weeks during the first month.
- One-month interval during the next six months.
- 6 months interval afterwards.

Data analysis and Statistical Methods:

Data were analyzed using IBM SPSS Advanced Statistics version 20.0 (SPSS Inc, Chicago, IL). Numerical data were expressed as mean ±standard deviation or median and range as appropriate. Qualitative data were expressed as frequency and percentage. Chi-square test was used to examine the relation between qualitative variables. For quantitative data, comparison between two groups was done using parametric or non-parametric t-test. Comparison between 2 groups was done using parametric or non-parametric ANOVA test. A p-value < 0.05 was considered significant.

RESULTS

Table (1): Comparison between the two studied groups according to demographic data

	MGB (n = 30)		SG (n = 30)		Test of Sig.	p
	No.	%	No.	%		
Gender						
▪ **0 (Female)**	24	80.0	28	93.3	χ^2= 2.308	^{FE}p= 0.254
▪ **1 (Male)**	6	20.0	2	6.7		
Age (years)						
▪ Min. – Max.	23.0 – 39.0		22.0 – 49.0		t= 0.401	0.690
▪ Mean ± SD.	31.47 ± 4.78		30.87 ± 6.65			
Median	31.0		30.0			

Table (2): Comparison between the two studied groups according to preoperative assessment

Preoperative assessment	MGB (n = 30)		SG (n = 30)		Test of Sig.	p
Weight (kg)						
▪ **Min. – Max.**	113.50 – 178.0		114.0 – 180.0		t= 0.344	0.732
▪ **Mean ± SD.**	138.91 ± 18.59		137.27 ± 18.44			
▪ **Median**	139.90		138.0			
Height (cm)						
▪ **Min. – Max.**	163.0 – 180.0		150.0 – 180.0		$t= 3.125^*$	0.003^*
▪ **Mean ± SD.**	171.47 ± 4.36		166.80 ± 6.92			
▪ **Median**	171.0		167.0			
BMI (kg/m^2)						
▪ **Min. – Max.**	42.94 – 98.79		40.88 – 88.11		$t= 4.947^*$	0.522
▪ **Mean ± SD.**	65.37 ± 16.99		59.29 ± 5.32			
▪ **Median**	63.34		48.32			
Co-morbidities						
▪ **No Co-morbidities**	18	60.0	19	63.3	χ^2= 0.071	0.791
▪ **HTN only**	7	23.3	5	16.7	χ^2= 0.417	0.519
▪ **DM only**	6	20.0	7	23.3	χ^2= 0.098	0.754
▪ **HTN & DM**	2	6.7	3	10.0	χ^2= 0.218	^{FE}p=1.000
▪ **OA**	1	3.3	2	6.7	χ^2= 0.351	^{FE}p=1.000

Table (3): Comparison between the two studied groups according to postoperative follow-up

Postoperative follow-up		MGB (n = 30)	SG (n = 30)	t	P
3 Months	**Weight (kg)**				
	▪ Min. – Max.	89.19 – 139.0	93.0 – 141.47	0.154	0.878
	▪ Mean ± SD.	107.23 ± 15.01	107.77 ± 12.03		
	▪ Median	104.30	106.08		
	EWL%				
	▪ Min. – Max.	34.17 – 62.31	32.0 – 52.67	1.362	0.179
	▪ Mean ± SD.	45.63 ± 6.26	43.64 ± 5.02		
	▪ Median	47.36	45.08		
6 Months	**Weight (kg)**				
	▪ Min. – Max.	76.0 – 113.0	80.0 – 124.47	1.459	0.150
	▪ Mean ± SD.	92.26 ± 10.78	96.37 ± 11.04		
	▪ Median	90.30	95.07		
	EWL%				
	▪ Min. – Max.	56.95 – 87.33	49.45 – 76.79	4.396*	<0.001*
	▪ Mean ± SD.	68.61 ± 7.06	61.06 ± 6.22		
	▪ Median	68.28	60.13		
12 Months	**Weight (kg)**				
	▪ Min. – Max.	67.0 – 95.0	67.0 – 107.47	0.765	0.447
	▪ Mean ± SD.	82.90 ± 7.65	84.65 ± 9.96		
	▪ Median	83.40	82.84		
	EWL%				
	▪ Min. – Max.	68.0 – 108.29	68.98 – 106.15	1.646	0.105
	▪ Mean ± SD.	82.67 ± 8.94	78.94 ± 8.60		
	▪ Median	81.61	76.31		
	BMI				
	▪ Min. – Max.	22.44 – 38.37	24.02 – 34.70	2.753*	0.008*
	▪ Mean ± SD.	28.19 ± 3.56	30.39 ± 2.55		
	▪ Median	27.33	30.63		

Table (4): Comparison between the two studied groups according to complications

	MGB (n = 30)		SG (n = 30)		Test of Sig.	p
	No.	%	No.	%		
Days						
• **Min. – Max.**	3.0 – 6.0		3.0 – 7.0		t= 2.786*	0.007*
• **Mean ± SD.**	3.87 ± 0.78		4.50 ± 0.97			
• **Median**	4.0		4.0			
Pain out of 10						
• **Min. – Max.**	2.0 – 8.0		2.0 – 7.0		t= 1.736	0.088
• **Mean ± SD.**	4.20 ± 1.61		4.90 ± 1.52			
• **Median**	4.0		5.0			
Complications						
• **No complication**	27	90.0	25	83.3	[illegible]	$^{MC}p=$ 0.851
• **DVT**	0	0.0	1	3.3		
• **Anastomotic ulcer**	1	3.3	0	0.0		
• **Biliary gastritis**	2	6.7	2	6.7		
• **Pneumonia**	0	0.0	1	3.3		
• **Duodenal Injury, convert to open surgery**	0	0.0	1	3.3		

Table (5): Comparison between the two studied groups according to HBA1C for diabetic cases

HBA1C follow-up	MGB (n = 6)	SG (n = 7)	t	p
Preoperative				
• Min. – Max.	7.90 – 11.60	9.70 – 11.20	0.611	0.554
• Mean ± SD.	10.30 ± 1.37	10.66 ± 0.68		
• Median	10.80	10.80		
3 Months postoperatively				
• Min. – Max.	7.10 – 10.10	7.80 – 8.50	1.365	0.222
• Mean ± SD.	8.77 ± 1.10	8.13 ± 0.35		
• Median	8.70	7.90		
6 Months postoperatively				
• Min. – Max.	6.80 – 8.70	7.0 – 7.80	1.311	0.216
• Mean ± SD.	7.77 ± 0.67	7.37 ± 0.40		
• Median	7.70	7.10		
12 Months postoperatively				
• Min. – Max.	5.90 – 7.50	6.50 – 7.30	0.384	0.709
• Mean ± SD.	6.82 ± 0.66	6.93 ± 0.37		
• Median	7.05	6.80		

Table (6): Comparison between the different studied periods according to different parameters in MGB group

MGB	Pre-operative	Post-operative (3 months)	Post-operative (6 months)	Post-operative (12 months)	p-value		
	No. = 30	No. = 30	No. = 30	No. = 30	p_1	p_2	p_3
Cholesterol							
Min. – Max.	176.8 – 247.0	158.0 – 226.0	149.0 – 206.0	143.0 – 194.0	<0.001*	<0.001*	<0.001*
Mean ± SD.	222.3 ± 20.80	199.6 ± 17.90	183.7 ± 15.03	172.8 ± 15.22			
Median	222.8	201.0	183.0	172.0			
TG							
Min. – Max.	133.0 – 259.0	98.0 – 193.0	83.0 – 142.0	59.0 – 118.0	<0.001*	<0.001*	<0.001*
Mean ± SD.	196.6 ± 38.25	147.6 ± 25.66	116.9 ± 15.08	90.27 ± 21.10			
Median	191.5	144.0	117.0	97.0			
LDL							
Min. – Max.	114.0 – 173.0	85.0 – 136.0	76.0 – 116.0	70.0 – 97.0	<0.001*	<0.001*	<0.001*
Mean ± SD.	139.3 ± 15.87	106.6 ± 14.0	89.93 ± 10.44	80.67 ± 7.94			
Median	136.0	107.0	87.0	80.0			
HDL							
Min. – Max.	32.10 – 48.20	39.0 – 51.0	42.0 – 54.0	49.0 – 60.0	<0.001*	<0.001*	<0.001*
Mean ± SD.	37.40 ± 4.63	44.0 ± 3.66	46.87 ± 3.40	52.60 ± 3.17			
Median	36.30	44.0	47.0	52.0			

Table (7): Comparison between the different studied periods according to different parameters in SG group

SG	Pre-operative	Post-operative (3 months)	Post-operative (6 months)	Post-operative (12 months)	p-value		
	No. = 30	No. = 30	No. = 30	No. = 30	p_1	p_2	p_3
Cholesterol							
Min. – Max.	213.0 – 235.0	190.0 – 226.0	179.0 – 203.0	166.0 – 190.0	<0.001*	<0.001*	<0.001*
Mean ± SD.	225.2 ± 6.25	206.1 ± 8.71	188.1 ± 6.61	176.2 ± 7.54			
Median	227.0	205.0	188.0	175.0			
TG							
Min. – Max.	137.0 – 220.0	121.0 – 180.0	95.0 – 134.0	69.0 – 102.0	<0.001*	<0.001*	<0.001*
Mean ± SD.	191.8 ± 24.33	150.4 ± 16.09	115.7 ± 10.14	85.13 ± 10.61			
Median	198.0	149.0	117.0	83.0			
LDL							
Min. – Max.	124.0 – 178.0	105.0 – 145.0	89.0 – 123.0	76.0 – 112.0	<0.001*	<0.001*	<0.001*
Mean ± SD.	153.4 ± 16.42	127.0 ± 10.78	101.9 ± 11.0	89.47 ± 10.88			
Median	158.0	128.0	101.0	88.0			
HDL							
Min. – Max.	35.0 – 49.0	42.0 – 54.0	47.0 – 58.0	51.0 – 61.0	<0.001*	<0.001*	<0.001*
Mean ± SD.	42.67 ± 4.56	47.80 ± 3.64	51.40 ± 3.58	56.13 ± 3.04			
Median	43.0	48.0	50.0	58.0			

DISCUSSION

Between 1980 and 2008, the mean global body mass index (BMI) was increasing by 0.4–0.5kg/m2 per decade for both men and women[1, 2]. Obesity and related comorbidities reduce life expectancy and add economic burden, which highlights the significance of bariatric. The most effective therapy to treat obese and related comorbidities is bariatric surgery, in which Roux-en-Y gastric bypass (RYGBP) and sleeve gastrectomy (SG) are two most popular procedures[3].

SG is a technically less complex procedure with short learning curve and effective weight loss [8,9]. But it suffers from two outstanding disadvantages including high risk of weight regain and gastro-esophageal reflux disease (GERD)[5]. Mini-gastric bypass (MGB), also known as single anastomosis gastric bypass or omega gastric bypass, is a newly emerged procedure originated from Rutledge[6]. Due to safe and simple process as well as effective outcomes, MGB has quickly become one of the most popular procedures in many countries[8,9].

Despite of popular status, the extension of MGB is still limited by some concerns such as gastric and esophageal bile reflux, marginal ulcer, and remnant gastric cancer[7]. During the past decade, many observational studies have proved the considerable short-term and long-term outcomes of MGB [10], but comparative studies between MGB and SG are still scarce. For this reason, we conducted this study to compare the efficacy and safety of the two procedures.

In this study, the first observation was that in the first 3 months the results of the two procedures were similar without any significant statistical differences as regards to EWL and weight, nevertheless, after 6 months, EWL was significantly lower in patients with SG technique than patients with MGB although these differences were not obvious when comparing weight as a single measure.

After 12 months, there were no significant statistical differences between the two techniques as regards to weight and EWL, however, the BMI was significantly lower in MGB group. This refers to in a far perspective, MGB may have superior outcome but without a big difference than SG.

These findings highlight the well-known discrepancy of very significant differences in %EWL versus no significant differences in total weight loss and BMI reduction between the two groups. Several statistical and clinical reasons can be implicated for this disparity. It has been shown that the percentage of excess weight loss varies significantly based on initial BMI, i.e., the higher the BMI of the patient, the lower the percentage of excess weight loss. This effect is further magnified by short follow-up, which does not allow sufficient time for higher-BMI individuals to lose sufficient weight to reach their target. This variation by initial BMI disappears using percentage of total weight loss. However, on using percentage of total weight loss instead of percentage of excess weight loss, a very significant correlation with postoperative weight is not found although differences are still demonstrated as in our study further supporting our findings [6].

This was in complete accordance with **Musella *et al.***[9] who aimed to define the efficacy of both mini gastric bypass or one anastomosis gastric bypass and sleeve gastrectomy in EWL and type 2 diabetes mellitus remission in morbidly obese patients. They conducted their study on 313 patients, however, only 206 reached the 1 year follow up visit. They found that after one year the mean body mass index (BMI) for MGB pts was 33.1±6.6, and the mean BMI for SG pts was 35.9±5.9 ($p<0.001$), so they concluded that MGB had obvious merits on BMI on 1 year follow up basis. This also was in accordance with **Wang *et al.***[11] who conducted a recent systemic literature review aiming to compare safety and effectiveness of laparoscopic mini-gastric bypass versus laparoscopic sleeve gastrectomy.

Another study that matched our results is **Madhok *et al.***[12]. They compared results with 19 mini gastric bypass and 56 sleeve gastrectomy in super-super obese patients. They found that patients with MGB patients experienced significantly higher weight loss compared to sleeve gastrectomy patients at 6 months, 1 year, and 2 years after surgery.

However, some studies did disagree with our results as **Lehmann *et al.***[13] found, in contrary to the current study, that MGB may offer better results than LSG in terms of weight loss in patients over 50 years of age. Their results showed that in a total of 86 patients, 54 underwent LSG and 32 underwent MGB, the mean percentage of excess weight loss at the end of 1 year was 60.19 ± 17.45 % after LSG and 82.76 ± 34.26 % after MGB. **Lynch *et al.***[14] also mismatched our results in that they found MGB was superior to SG in terms of weight loss after 1 year follow up.

The possible explanation of these finding is that reduced calorie intake after MGB is usually a consequence of significantly smaller meal sizes, and reduced calorie content of food eaten compensated only partially by increased meal frequency. A dramatic decrease in daily energy intake, 600–700 kcal, during the first month post-surgery increases to 1000–1800 kcal during the first year [15]. An average reduction of 1800 kcal per day from pre-operative intake can be sustained for several years. Protein intake during the first year after surgery is often lower than recommended at 0.5 g/kg, rather than the recommendation of at least 1.5 g/kg/day. The mechanisms are unclear, but may be due to temporary intolerance of higher protein diet and dairy foods [16]. Relative intake of fat and carbohydrates decrease during the first-year post-surgery, but return to the baseline after 1 year, although the contribution of high and low glycaemic index carbohydrates may change. Many patients reduce their intake of high glycaemic index carbohydrates and increase their intake of lower glycaemic index carbohydrates. Changes in behavior associated with eating after MGB were reported using structured interviews that suggested that patients reached satiety more quickly, with the most common reason given as a 'lack of desire' for food [17].

MGB could be exerting its effects on food selection and preference through any one of the taste function domains important in normal physiology such as sensory-discriminative (stimulus identification), hedonic (ingestive motivation) and physiological (digestive preparation) [18]. Affective responses to taste stimuli, which can be considered an example of ingestive motivation, can be both conditioned and unconditioned. It remains controversial which of these three domains are involved and what their interactions are to determine food preferences after MGB surgery. For example, MGB could have effects directly on the central gustatory pathways related with feeding and reward through gut hormonal mediators. Alternatively, changes in the sensory signals could alter the intensity or the quality of tastants, but also lead to an unconditioned change in palatability. If MGB causes visceral malaise after ingestion of fat, then it is possible that the palatability of fat could alter through a process of learning (conditioned response) [18].

Some recent studies also proposed that the weight loss effect of MGB is primarily driven by the surgery-induced changes in the gut microbiome. MGB induces a strong and conserved shift in the gut microbiome manifested by a relative increase in aerobic and facultatively anaerobic bacteria, most commonly belonging to phylum Proteobacteria, in humans and rodent models. Moreover, transfer of fecal material from rodents or humans that had the surgery into germ-free mice leads to fat mass reduction in the recipient animals [19]. Surgery-induced microbiome shift is very rapid, occurring before significant weight loss (within a week of post-op) and persistent for at least a decade. The effect of the surgery on the microbiome is not due to changes in diet, food intake pattern or adiposity. This was first demonstrated by Liou et al, where the authors showed that sham surgery animals, which were weight matched to MGB animals via caloric restriction, did not get an increase in aerobic bacteria, unlike MGB surgery animals. More recently, clinical measurements directly comparing gut microbiome of patients with MGB or gastric banding showed that only MGB induced a shift in the microbiota composition, despite similar food intake levels after both surgeries [20].

However, not all authors matched our observations. **Kansou *et al.***[21] reported higher rate of complication with MGB when compared to SG. **Lynch *et al.***[14] also showed that MGB had a lower 30-day complication rate in comparison with SG. The results of **Madhok *et al.***[12] were inconsistent with our results as they reported significantly lower rate of complications with MGB than SG, nevertheless, none of patients in both groups had a major postoperative event.

Another important finding of this study is the effect of both techniques on co-morbidities specially

DM control. It was found that both techniques had significant improvement in control of DM without significant statistical differences between the two techniques.

The main explanation of this significant ability of the two procedures to control DM is the fact that the primary risk factor for type 2 diabetes is obesity, and 90 % of all patients with type 2 diabetes are either overweight or obese. The National Health and Nutrition Examination Survey III (1988–1994) data demonstrated that the risk for chemical diabetes is approximately 50% with a BMI greater than or equal to 30 kg/m^2 and over 90 % with a BMI of 40 kg/m2 or more [22]. Since Pories' first report in 1995 [23], a powerful body of published evidence has shown the efficacy of bariatric surgery in determining T2DM remission.

These results were in consistent with the previous study of **Musella *et al.***[9] who found that at univariate and multivariate analyses, MGB seems to outperform significantly SG as regards as DM control. The recent meta-analysis of **Wang *et al.***[11] also found that MGB was superior to SG as regards to control of all morbidities which included HTN and OSA in addition to DM.

Finally, the last observation was that both procedures were effective according to postoperative lipid profile, however, the SG had significantly higher LDL and HDL. In partial accordance to our results, other studies [10, 24] found that both techniques had a similar post-operative lipid profile. Nevertheless, other studies **Kansou *et al.***[21] and **Kular*et al.***[25] found MGB was superior to SG according to hyperlipidemia control.

STRENGTHS AND LIMITATIONS

The present study has many strengths points like the prospective nature of the study and insignificant differences between the two cohorts as regards to all preoperative data including demographic data, weight and lab investigations. However, the study did have some limitations which were mainly the relatively short period of follow up & relatively small size of the study material regarding the effect of the two procedures on different co-morbidities like HTN, DM and OSA.

CONCLUSION AND RECOMMENDATIONS

After prospectively comparing the two procedures for a year, almost both procedures have near same effect on loss of weight and resolving or better control on co-morbidities as DM, and HTN. However, MGB patients in need for multi-vitamins and minerals costing more than 1500 Egyptian pounds per month.The statistical differences observed as regards to BMI, LDL and HDL are still clinically insignificant. So, the recommendation regarding Egyptian patients whatever their morbid obesity scale is Sleeve Gastrectomy except for patient complaining of GERD, they should undergo MGB, as the results showed better resolution for their complain post-operatively.

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