

Comparison between butterfly gastroplasty (a new modified gastroplasty technique) and sleeve gastrectomy

*Elsobky AS., MD; Mashaal Anas., MD; Mohammed Mahfous MD;
Marzouk M.A., MD; Youhanna S. Shafik, MD, MRCS, Eng;
Sherif Abdelhalim, MD*

Department of General Surgery, Ain Shams University, Cairo, Egypt.

Background: Vertical banded gastroplasty (VBG) and sleeve gastrectomy (SG) are purely gastric restrictive procedures designed to reduce appetite by decreasing the size of the stomach. Butterfly gastroplasty, is a modification of (VBG) in which a micro funnel shaped pouch was constructed limited to cardia in order to reduce the risk of long-term staple-line disruption. This study presents preliminary results of our early experience with both procedures.

Methods: From August 2010 till August 2012 (60) consecutive patients with morbid obesity (9 males and 51 females) divided into two groups, (group 1) underwent laparoscopic butterfly gastroplasty (30 patients) and (group 2) underwent laparoscopic sleeve gastrectomy (30 patients). This study aimed to compare the preliminary results of both procedures including operative morbidity and mortality, short and long-term complications, as well as follow-up rates and parameters of weight loss.

Results: There were 6/30 (20%) and 3/30 (10%) cases with intra-abdominal bleeding in butterfly gastroplasty and sleeve gastrectomy groups respectively. In butterfly gastroplasty group, one (1/30) early complication (3.3%) was encountered, late complications occurred in one (1/30) patient (3.3%) with no mortality occurred; two patients had persistent vomiting. In sleeve gastrectomy group, two (2/30) early complications (6.7%) (leakage arising from staple line of the stomach) were encountered with no late complications or mortality occurred. Substantial weight loss occurred in all patients. For butterfly gastroplasty group mean excess weight loss (EWL %) was 41.99 ± 6.17 % at 6 month and 64.02 ± 5.16 % at 1 year; while for sleeve gastrectomy EWL % was 41.12 ± 3.7 % at 6 month and 53.85 ± 5.44 % at 1 year. The rate of complete resolution of co-morbidities in butterfly gastroplasty was 100% for hypertension at 6 month and diabetes mellitus at 12 month, while in sleeve gastrectomy group resolution of hypertension was 90.9% and diabetes mellitus was 92.6 % at 12 month

Conclusion: Butterfly gastroplasty and sleeve gastrectomy are feasible and safe restrictive bariatric procedures, with good short-term results and low morbidity rates. In comparison to sleeve gastrectomy, Butterfly gastroplasty has higher intra-operative complication rate (in the form of bleeding), however it has also higher percentage of postoperative excess weight loss as well as reduction of associated preoperative morbidities.

Introduction:

Bariatric surgery is the most effective treatment for long-term reduction of body weight. Bariatric surgery should at least be considered for all patients with a BMI of more than 40 kg/m² and for those patients with a BMI of more than 35 kg/m² with important obesity related co-morbid conditions.¹

There are two major categories of weight-loss surgery: gastric restriction such as vertical banded gastroplasty (VBG), gastric banding, sleeve gastrectomy and intestinal malabsorption which include Roux-en-Y gastric bypass (RYGB), biliopancreatic diversion (BPD).² The sleeve gastrectomy (SG) is a restrictive procedure that creates

a 100- to 150-mL stomach by performing a partial gastrectomy of the greater curvature side of the stomach. The last 6 to 8 cm of antrum remains intact, and thus, the pylorus is preserved to help prevent gastric emptying problems.³ The vertical banded gastroplasty (VBG) is a restrictive procedure that consists of a vertically oriented proximal small pouch (less than 30 mL) that drains through a narrow (10–12 mm) gastric channel. The outlet channel is reinforced with a band of polypropylene (Marlex) mesh.⁴ With VBG procedure the stapling of the stomach carries the risk of staple-line disruption. In butterfly gastroplasty, a micro funnel shaped pouch was constructed limited to cardia⁵ this is assumed to reduce the incidence of complication rates after original VBG especially weight regains due to pouch dilatation and/or staple-line disruption.⁶ The aim of this study was to investigate and evaluate rate of weight loss and amelioration of obesity co-morbidities as well as the intra-operative and postoperative complications for the two bariatric procedures (Laparoscopic butterfly gastroplasty and Laparoscopic sleeve gastrectomy) for two years post-surgery at the Ain Shams University Hospital (El-Demerdash), Ain Shams Specialized Hospital, and Ahmed Maher Hospital.

Methods:

From August 2010 till August 2012 (61) consecutive patients (9 males and 52 females) underwent restrictive procedures for their morbid obesity. They were divided into two groups, (group 1) with laparoscopic butterfly gastroplasty (31 patients) and (group 2) with laparoscopic sleeve gastrectomy (30 patients). One patient of group (1) was converted to open procedure due to bleeding from one of short gastric vessels, splenectomy and standard VBG was done. So this patient was excluded from this study. The net result that we had two groups of patients, group (1) with laparoscopic butterfly gastroplasty (30 patients = 50%) and group (2) with laparoscopic sleeve gastrectomy (30 patients = 50%). All the patients met the inclusion/exclusion criteria followed the by INH

Bariatric guidelines.⁷ More than 18 years old, BMI >35 with diabetes or other important co-morbidities, no alcohol abuse or concurrent psychiatric illness. With the exclusion of all patients who were sweet eaters and patients who had upper abdominal or revisional surgeries. Ideal body weight was determined according to the Metropolitan Life Insurance height/weight tables.⁷ A comprehensive, multidisciplinary, bariatric management program was tailored for the preoperative preparation and postoperative management of patients. The program included support groups and ancillary personnel to provide nutritional, exercise, and psychological care). Data sources included office charts, hospital charts, follow-up notes, telephone calls, and e-mail messages.

Preoperative evaluation: The preoperative evaluation is almost the same for both procedures. The risks, benefits, and long-term consequences of both procedures were discussed in detail during the initial encounter with the surgeon and the dietician. Written informed consent was obtained from all patients before being assigned to surgery. An extensive preoperative evaluation including history, physical examination, and indicated specialty consultations was performed. Routine laboratory evaluation was done. All patients received preoperative low molecular weight heparin and antibiotic prophylaxis, and IV proton pump inhibitors two hours before surgery.

Operative technique:

Laparoscopic butterfly gastroplasty: The position of the patient and trocars are similar to any hiatal procedures. Anterior and posterior layers of the gastro-splenic ligament are divided from the level of splenic vessels up to the angle of Hiss. The first articulating endo cutter (blue 45) is applied from the angle of Hiss downward with complete exclusion of gastric fundus. At the level of the first branch of left gastric artery, retro-gastric spaces were completely dissected and the second endo cutter cartridge (blue 34) was applied to perform the butterfly shaped pouch with accurate adjustment of the pouch

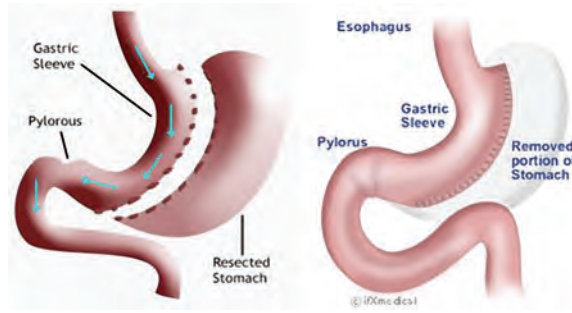


Figure (1): Diagram show sleeve gastrectomy procedure

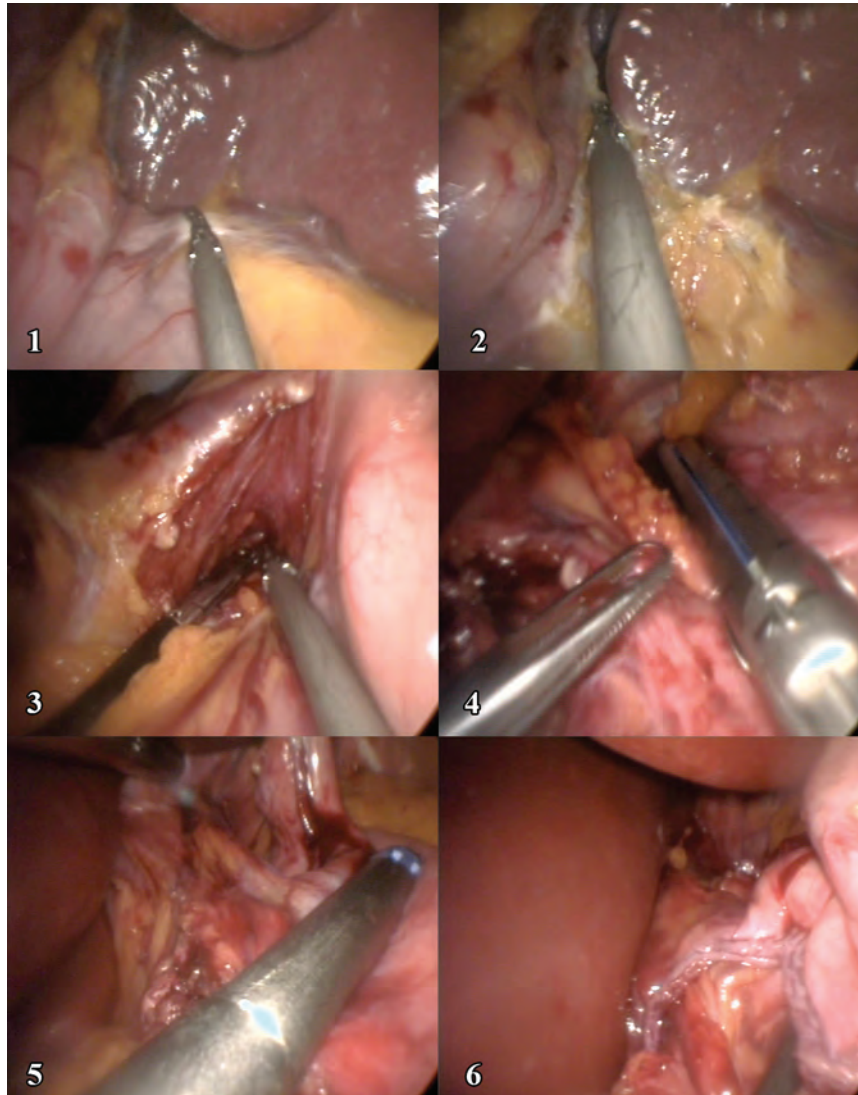


Figure (2): Butterfly gastroplasty 1) Opening first layer of gastro-splenic lig. 2) Opening second layer of gastro-splenic lig. 3) Opening in lesser omentum at level of Lt. gastric artery. 4) Applied first endo-cutter. 5) Applied second endo-cutter. 6) Funnel shaped pouch at cardia.

outlet (1.2cm). The outlet of the pouch was banded with a proline mesh (4 ×1.5 cm). An omentoplasty was always performed using omentum to cover the mesh. Naso-gastric tube and abdominal drainage were left in place.

Laparoscopic sleeve gastrectomy: Surgical Technique LSG was performed according to the technique described by Gagner.² The division of the gastric greater curvature vascular supply, starting at 7-8 cm from the pylorus and proceeding upwards until the

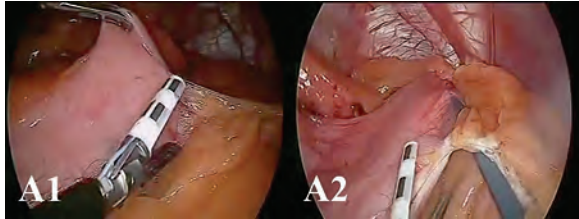


Figure (3a): (1-2): The division of the gastric greater curvature vascular supply, starting at 7-8 cm from the pylorus.

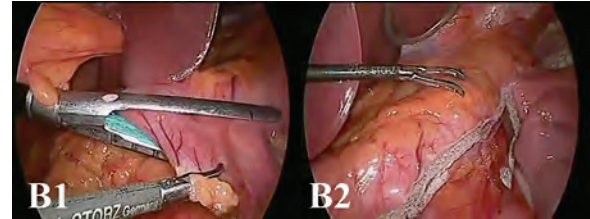


Figure (3b): (1-2): The LSG is created using a linear stapler (Endo GIA).

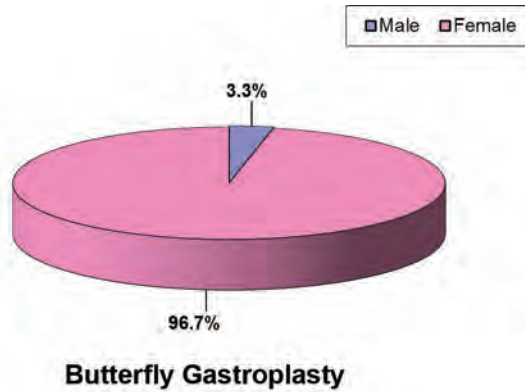


Figure (4): Gender among the studied groups

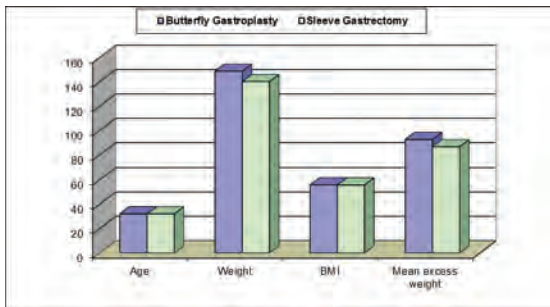


Figure (5): Comparison between the studied groups regarding to age, weight, BMI and mean excess weight.

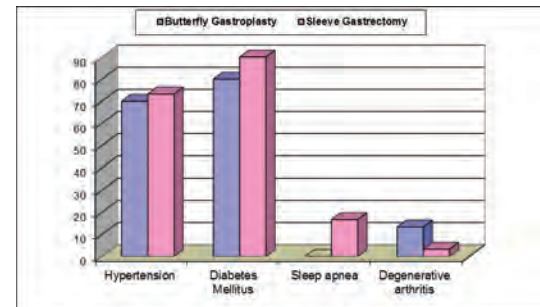


Figure (6): Associated Co-morbidities for both groups.



Figure (7): Staple-line leakage after LSG, treated with percutaneous drainage.

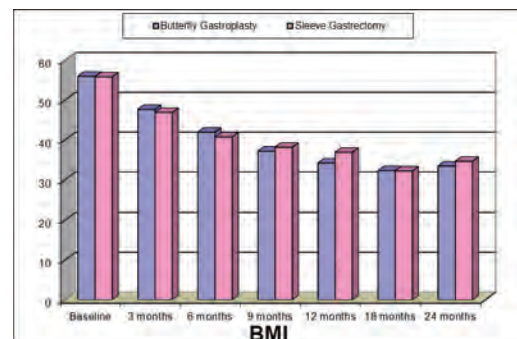


Figure (8): Postoperative BMI for both groups for 2 years.

angle of His, was carried out with Harmonic Scalpe, (Ethicon).The LSG was created using a linear stapler Endo GIA, with two

sequential 60-mm green load firings for the antrum, followed by two or three sequential 60- mm blue loads for the remaining gastric

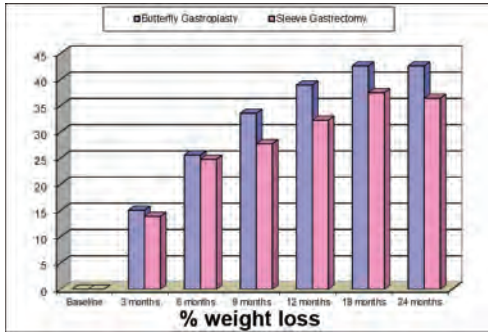


Figure (9): Postoperative percentage of weight loss for both groups for 2 years.

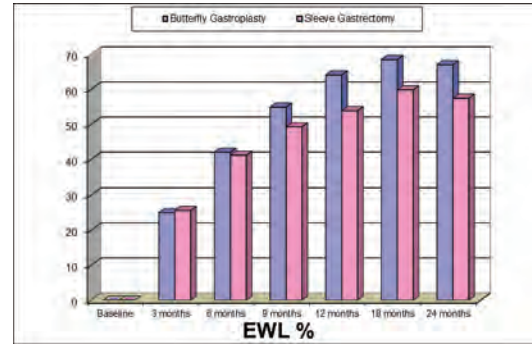


Figure (10): Postoperative Excess weight loss for both groups for 2 years.

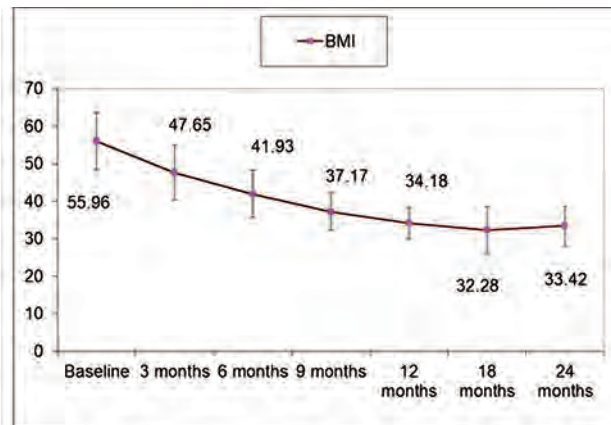
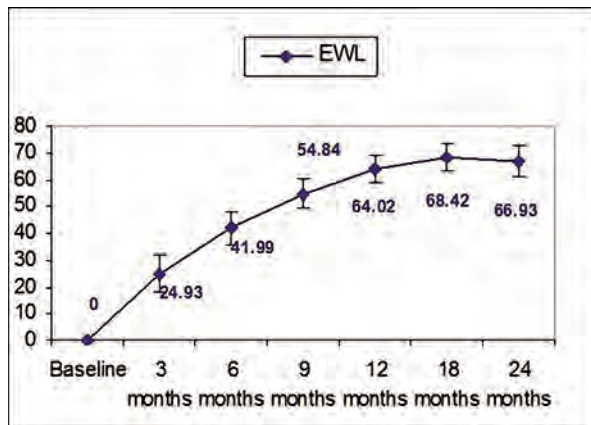


Figure (11): Postoperative EWL and BMI after Butterfly Gastroplasty group for 2 years.

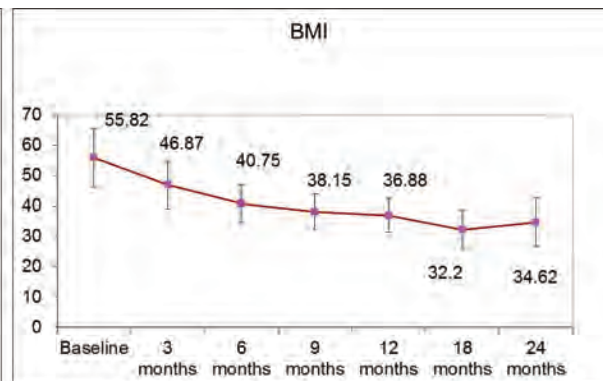
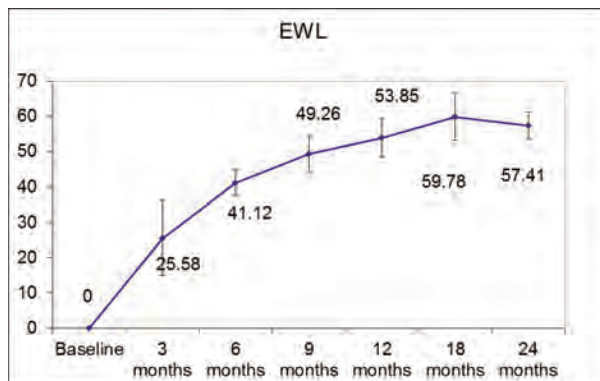


Figure (12): Postoperative EWL and BMI after Sleeve Gastroplasty group

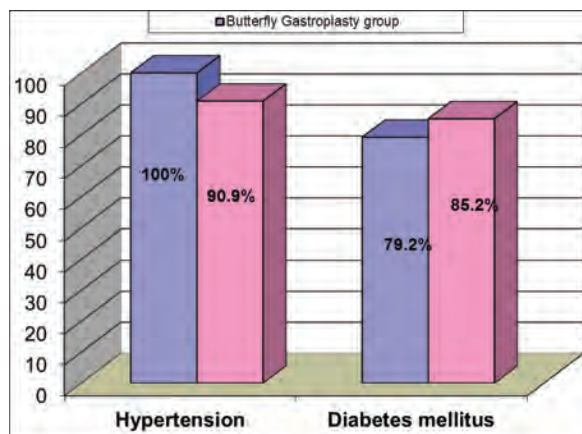


Figure (13): Amelioration of the comorbidities after 1 year.

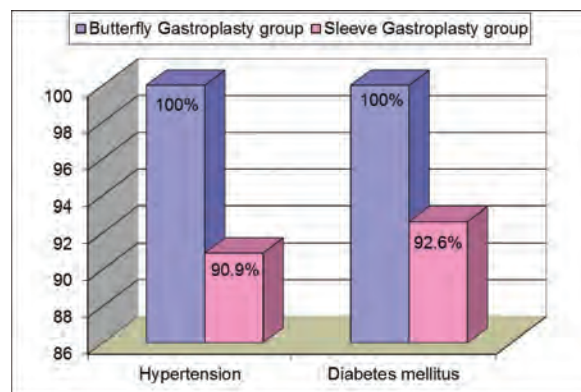


Figure (14): Amelioration of the comorbidities after 2 years.

Table (1): Demographic distribution of patients underwent butterfly gastroplasty and sleeve gastrectomy.

	Butterfly gastroplasty N: 30	Sleeve gastrectomy N:30	P. value
Age	32.13±9.06 (18-49)	32.04±7.59 (21-44)	0.965
Gender Female/male	29/1	22/8	0.026
Weight	148.78±25.76 (108-200)	140.17±30.44 (98-207)	0.237
BMI	55.96±7.75 (41.6-71.3)	55.82±9.74 (37.8-70.2)	0.952
Mean excess weight	92.67±23.32 (60-137)	86.7±27.48 (44-141)	0.368

Value expressed as Mean ±SD (range)

Table (2): Associated co-morbidities for both groups .

Co-morbidities	Butterfly gastroplasty N:30	Sleeve gastrectomy N:30	P. value
Hypertension	21/30 (70%)	22/30 (73.3%)	1.000
Diabetes mellitus	24/30 (80%)	27/30 (90%)	0.472
Sleep apnea	0	5 (16.7%)	0.052
Degenerative arthritis	4 (13.3%)	1 (3.3%)	0.350

Table (3): Intra-operative complications for both procedures:

Complications	Butterfly gastroplasty N:30	Sleeve gastrectomy N:30	P. value
Bleeding	2 (6.7%)	1 (3.3%)	1.000
Injury to solid organ (liver tear)	4 (13.3%)	2 (6.7%)	0.667
Injury to gastrointestinal tract	0	0	NA
Staple line failure	0	0	NA

corpus and fundus. The stapler was applied alongside a 48 Fr calibrating bougie strictly positioned against the lesser curve, to obtain a 120-150 ml gastric pouch. The resected stomach is extracted by enlargement of the 15-mm port-site up to 25 mm opening. Nasogastric tube and abdominal drainage were left in place.

Postoperative care:

All the patients were monitored in the recovery room and were transferred to the wards or to the intensive care unit. Early postoperative ambulation was strongly encouraged with patients getting out of bed the evening of the surgery and walking by the first postoperative day. In butterfly gastroplasty a clear liquid diet was started on

Table (4): Post-operative complications for both procedures:

Complication	Butterfly gastroplasty N:30	Sleeve gastrectomy N:30	P. value
Early morbidity (\leq 30 days)			
Staple-line leakage	0	2 (6.7%)	0.492
Vomiting	1 (3.3%)	0	1.000
Wound infection	0	0	NA
Lung atelectasis	0	0	NA
DVT & pulmonary embolism	0	0	NA
Late morbidity ($>$ 30 days)			
Port-side hernia	0	0	NA
Stomal stenosis	1 (3.3%)	0	1.000
Bowel obstruction	0	0	NA
Bile reflux	0	0	NA
No. of patients re-operated	1	1	1.000
Death	0	0	NA

1st postoperative day, was advanced to pureed food 2 weeks later, and to solid food by the 4th postoperative week, however in sleeve gastrectomy upper gastrointestinal contrast (Gastrografin study was routinely performed on the second postoperative day, followed by at discharge, the same dietary instructions as mentioned before. Patients were advised to take daily multivitamins and supplemental minerals, as well as proton pump inhibitor (PPI) prophylaxis for 6 months. Follow-up appointments with the surgeon and the dietitian were scheduled at 2nd week, 1, 3, 6, and 12 months postoperatively, then twice a year.

Endpoints:

The primary endpoints included comparison between butterfly gastroplasty and sleeve gastrectomy procedures as regard the operative mortality (within 30 days of surgery), short-term complications (complications that prolonged hospital stay and/or necessitated invasive treatment before 30 days of surgery), and long-term complications (occurring after 30 days of surgery). In addition, we analyzed the follow-up rates and parameters of weight at each time point for both procedures as well as the effect on associated co-morbidities.

Results:

Demographic distribution of the patients is summarized in **Table (1)**, the mean age was 32.13 ± 9.06 years, average (18-49y) and 32.04 ± 7.59 years, average (21-44y) for butterfly gastroplasty and sleeve gastrectomy groups respectively. The mean pre-operative body mass index was 55.96 ± 7.75 kg/m², average (41.6-71.3) and 55.82 ± 9.74 kg/m², average (37.8-70.2), and the mean pre-operative weight was 148.78 ± 25.76 kg, average (108-200kg) and 140.17 ± 30.44 kg, average (98-207kg) for both groups.

Clinical data and associated obesity co-morbidities are illustrated in **Table (2)**, 21/30 patients (70%) and 23/30 patients (73.3%) had hypertension in butterfly gastroplasty and sleeve gastrectomy groups respectively, diabetes mellitus in 24/30 (80%) and 27/30 (90%), and degenerative arthritis in 4/30 (13.3%) and 1/30 (3.3%) in butterfly gastroplasty and sleeve gastrectomy groups respectively. Only 5 patients (16.7%) had sleep apnea in sleeve gastrectomy group.

Outcome:

The incidence of intra-operative complications is presented in **Table (3)**. There was higher incidence of intra-operative

Table (5): Weight loss parameters for 2 years after butterfly gastroplasty and sleeve gastrectomy.

	Butterfly gastroplasty N:30	Sleeve gastrectomy N:30	P. value
0 month			
Weight (kg)	148.87±25.76	140.17±30.44	0.237
BMI (kg/m ²)	55.96±7.75	55.82±9.74	0.952
%weight loss	0	0	
EWL %	0	0	
3 month			
Weight (kg)	126.67±23.89	120.4±24.66	0.322
BMI (kg/m ²)	47.65±7.3	46.87±7.8	0.694
%weight loss	15.04±3.06	13.87±1.86	0.080
EWL %	24.93±7.1	25.58±10.56	0.779
6 month			
Weight (kg)	111±21	104.87±20.4	0.256
BMI (kg/m ²)	41.93±6.26	40.75±6.1	0.463
%weight loss	25.56±2.3	24.75±2.9	0.231
EWL %	41.99±6.17	41.12±3.7	0.510
9 month			
Weight (kg)	98.97±17.49	98.17±19.27	0.867
BMI (kg/m ²)	37.17±4.97	38.15±5.78	0.484
%weight loss	33.53±2.12	27.73±7.48	0.000
EWL %	54.84±5.62	49.26±5.24	0.000
12 month			
Weight (kg)	90.63±14.56	94.17±17.98	0.406
BMI (kg/m ²)	34.18±4.21	36.88±5.51	0.037
%weight loss	38.9±2.59	32.2±3.28	0.000
EWL %	64.02±5.16	53.85±5.44	0.000
18 month			
Weight (kg)	78.55±13.52	81.23±15.51	0.478
BMI (kg/m ²)	32.28±6.28	32.2±6.54	0.961
%weight loss	42.57±3.23	37.45±5.87	0.000
EWL %	68.42±4.80	59.78±6.67	0.000
24 month			
Weight (kg)	79.15±34.6	82.42±9.08	0.618
BMI (kg/m ²)	33.42±5.27	34.62±7.94	0.493
%weight loss	42.57±3.23	36.41±7.52	0.000
EWL %	66.93±5.73	57.41±3.75	0.000

complications in the form of intra-abdominal bleeding 6/30 (20%) in butterfly gastroplasty than patients with sleeve gastrectomy 3/30 (10%), (Significant). In butterfly gastroplasty group, bleeding in two patients was due to injury of one of short gastric vessels. The other four patients (13.3%) presented by tear in liver tissue with variable depth

mostly caused by liver retractor. In sleeve gastrectomy group, one patient (3.3%) had intra-operative bleeding from vessels along greater curvature of the stomach, and the other two patients (6.7%) had injury in liver tissue by means of liver retractor. In all cases bleeding was controlled, with inventible postoperative course.

Table 6: Amelioration of the co-morbidities after 2 years in both groups.

Co-morbidities Butterfly Gastroplasty N:21		1 year			2 years		
		Butterfly Gastroplasty N:21	Sleeve Gastrectomy N:22	P. value	Butterfly Gastroplasty N:21	Sleeve Gastrectomy N:22	P. value
Hypertension	Cure	21/21 (100%)	20/22 (90.9%)	0.488	21/21 (100%)	20/22 (90.9%)	0.488
	Not cure	0	2 (9.1%)	0.256	0	2 (9.1%)	0.256
Co-morbidities		Butterfly Gastroplasty N:24	Sleeve Gastrectomy N:27	P. value	Butterfly Gastroplasty N:24	Sleeve Gastrectomy N:27	P. value
Diabetes mellitus	Cure	19/24 (79.2%)	23/27 (85.2%)	0.718	24/24 (100%)	25/27 (92.6%)	0.492
	Not cure	5 (20.8%)	4 (14.8%)	0.421	0	2 (7.4%)	0.257

The incidence of early and late post-operative complications was illustrated in **Table (4)**. In butterfly gastroplasty (group 1), one (1/30) early complication (3.3%) was encountered, late complications occurred in one (1/30) patient (3.3%) with no mortality occurred; one patient had persistent vomiting in 1st post-operative week, proved by contrast study (gastrografin meal) to be due to pouch outlet obstruction, this patient was re-operated laparoscopically and proven to be stomal obstruction by the inserted mesh at the stoma, and mesh re-position was done. The other one developed intolerance to semi solid food 3 month postoperatively, on contrast study stomal stenosis was diagnosed, endoscopic balloon dilatation was satisfactory to overcome this condition.

In sleeve gastrectomy group, two (2/30) early complications (6.7%) were encountered with no late complications or mortality occurred; two patients had leakage arising from staple line of the stomach, the 1st developed signs of acute abdomen with discharge of gastric juice per drain on the 4th postoperative day, this patient underwent open revisional surgery on 5th post-operative day, staple line was closed by means of interrupted non absorbable sutures. In contrast, in the other case with leakage, the patient was haemo-dynamically stable, with low output per drains (200 cc amount / 24h) The condition was successfully controlled

by conservative measures for 2 weeks which included broad spectrum antibiotics, total parental nutrition and percutaneous drainage of accumulated intra-abdominal fluid **Figure (7)**.

Changes of mean BMI, weight, percentage of weight loss, percentage excess weight loss are shown in **Table (5)**. Substantial weight loss occurred in all patients. For butterfly gastroplasty group mean excess weight loss (EWL %) was 64.02 ± 5.16 % at 1 year and 66.93 ± 5.73 % at 2 years, while for sleeve gastrectomy group EWL % was 53.85 ± 5.44 % at 1 year and 57.41 ± 3.75 % at 2 years. It can be seen that butterfly gastroplasty was better than sleeve gastrectomy in terms of mean excess weight loss and this difference is significant ($P < 0.05$) through 2 years. The rate of complete resolution of co-morbidities in butterfly gastroplasty was 100% for hypertension at 1 year and diabetes mellitus at 2 years, while in sleeve gastrectomy group resolution of hypertension was 90.9% and diabetes mellitus was 92.6 % at 2 years postoperatively **Table (6)**.

Discussion:

It is generally accepted that there is no ideal bariatric operation and that the bariatric surgeon should choose the most appropriate procedure for each individual patient based on specific selection criteria by creating a flexible treatment algorithm.⁷ Restrictive

procedures are generally considered safe and quick to perform, and usually lead to satisfactory short-term weight loss results.⁸ LSG originally proved to be a beneficial procedure for interval weight loss as the first stage of a two-staged bypass procedure.³ More recently, LSG is showing promise as a primary bariatric procedure for appropriate candidates.⁹ Vertical banded gastroplasty (VBG) is an excellent weight loss option for people who are morbidly obese. In fact, this procedure is one of the first successful types of weight loss surgery for people who fall into this category.

VBG staple line breakdown has been reported to occur in almost 50% of patients. Dehiscence of the vertical stapled partition eliminates the restrictive nature of the surgery, leading to ingestion of larger portions and subsequent weight gain. Our new restrictive technique the butterfly gastroplasty, first described by Abdel Galil et al,⁵ is a modified VBG, it depends on creation of micro pouch limited to the cardia of the stomach in order to avoid the cardinal complications of the vertical banded gastroplasty (VBG). VBG is blamed of being responsible for that 35% of patients who underwent this procedure regained weight after five years.¹⁰

Patients who underwent VBG usually present with intolerance of solids or persistent vomiting. This occurs in up to 40% of VBG patients.¹¹ While the incidence of vomiting in this study is 3.3% for the butterfly technique and that's related to the funnel shape of its pouch.

The reported incidence of staple line dehiscence after LSG ranges from 0% to 5.5% and with overall complication rates ranging from 0% to 24%.¹² In this study, the incidence of staple line dehiscence after LSG was (6.7%) , while no case with such problem occurred in the butterfly group. It has been evident that in LSG a subgroup of patients do regain weight after the year, and the authors speculate that this proportion will rise with a longer follow-up. Dilatation may be the first cause of failure.¹³ It may be a result of an excessively large pouch being created at the initial operation because of missed posterior

gastric folds.¹⁴ Baltasar and colleagues reported excess body weight loss (EWL) of 56% (4–27 months after LSG) in the super obese group.¹² It's proved in this study during follow up for 2 year post-operative that the butterfly gastroplasty achieved mean excess weight loss (64%) more than that for LSG (54%). In addition the rate of complete resolution of co-morbidities (hypertension and diabetes mellitus) was higher in butterfly gastroplasty than sleeve gastrectomy group for 2 years follow up. In Korean study, the excess weight loss from sleeve gastrectomy was 71.6% at 6 months and 83.3% at 1 year, when defining the success of surgery in Korea, the patient's postoperative dietary habits and long-term follow-up visits play important roles in weight loss. Koreans consume mainly carbohydrates and less protein and fat, tend to dine under pressure due to Confucianism, which leads to fast eating, and the meal (appetizer, main course, drinks) is served at once on one table, not in courses.¹⁵

Wiener et al. noted that LSG is not a simple procedure, and owing to the fact that the procedure is irreversible, surgeons should strive to avoid complications.¹⁶ With butterfly gastroplasty using of only two endo-cutter cartridges in constructing the funnel shaped pouch made it to a great extent easy technique with less costs comparable to any other technique. In this study both butterfly gastroplasty and sleeve gastrectomy has the same percentage of post-operative complications (6.7%) but with more serious complication for sleeve gastrectomy, staple line leak, with percentage of 6.7% and none for the butterfly.

The VBG procedure does not appear to be effective in the treatment of GERD. In fact the VBG may accentuate reflux possibly by increasing intra gastric pressure and providing reservoir (long tubular pouch) for reflux. It is found that the gastroplasty increased the prevalence of esophagitis even in the presence of weight loss.¹³ One mechanism is potential decrease in acid production in the gastric pouch. Anatomic studies have shown that the cardia of the stomach is absent of parietal cells. Rather they can be

seen to traverse down the lesser curvature of the stomach. In theory a small gastric-cardia based pouch would produce little in the way of acid reflux.¹⁷ The butterfly gastroplasty is developed to overcome operative difficulties and risks of original VBG, sleeve gastrectomy and other restrictive procedures. It offers the advantages of a simple and reproducible technique, with good outcome, and low morbidity and mortality.

Conclusion:

We recommend the use of this micro, funnel-shaped banded pouch using the gastric cardia only (butterfly gastroplasty) as it is proposed theoretically to solve intraoperative technical problems, markedly reduces the costs and prevents the cardinal complications of the original VBG mainly weight regain, persistent vomiting, reflux disease and marginal ulceration. Follow up for two years confirmed particularly this theoretical concepts.

Reference

- 1- Marielle JF Bult, Thijs van Dalen, Muller Alex F, et al: Surgical treatment of obesity. *European Journal of Endocrinology* 2008; 158: 135–145.
- 2- Blackburn G, Olbers T, Schneider B, et al: Surgical management of obesity and postoperative care. *Nutrition and Metabolism* 2009; 6: 329–345.
- 3- Trelles N, Gagner M: Sleeve gastrectomy. *Oper Tech Gen Surg* 2007; 9: 123–131.
- 4- Gagne D, Dovec E, Urbandt J, et al: Restrictive procedures: Laparoscopic revision of vertical banding to gastric bypass. *Obesity Surgery Principles and Practice* 2008; 33: 269–276.
- 5- Abdel-Galil E, Abbas AS: Laparoscopic butterfly gastroplasty - a new modified gastroplasty technique. Euro-Mediterranean & middle east laparoscopic meeting- Bordeaux (France), 2008.
- 6- Miller K, Pump A, Hell E, et al: Vertical banded gastroplasty versus adjustable gastric banding: Prospective long-term follow-up study. *Surgery for Obesity and Related Diseases* 2007; 3(1): 84–90.
- 7- Buchwald H: A bariatric surgery algorithm. *Obes Surg* 2002; 12: 733–746
- 8- O'Brien PE, Dixon JB: Laparoscopic adjustable gastric banding in the treatment of morbid obesity. *Arch Surg* 2003; 138: 376–382.
- 9- Frezza EE: Laparoscopic vertical sleeve gastrectomy for morbid obesity. The procedure of choice? *Surg Today* 2007; 37:275–281.
- 10- Mason EE, Cullen JJ: Management of complications in vertical banded gastroplasty. *Curr Surg* 2003; 60: 33–37.
- 11- Mongol P, et al: Roux en Y gastric bypass after failed vertical banded gastroplasty. *Obes Surg* 2007; 11: 1431–1434.
- 12- Baltasar A, Serra C, Perez N, et al: Laparoscopic sleeve gastrectomy: A multi-purpose bariatric operation. *Obes Surg* 2005; 15(8): 1124–1128.
- 13- Gallagher SF, et.al: Indications for revisional bariatric surgery. In: Laparoscopic Bariatric Surgery. Inabnet WB, DeMaria EJ, Ikramuddin S (eds.). Philadelphia, Lippincott Williams & Wilkins 2005; 153–173.
- 14- Gagner M, Rogula T: Laparoscopic re-operative sleeve gastrectomy for poor weight loss after bilio-pancreatic diversion with duodenal switch. *Obes Surg* 2003; 13(4): 649–654.
- 15- Brethauer SA, Hammel JP, Schauer PR: Systematic review of sleeve gastrectomy as staging and primary bariatric procedure. *Surg Obes Relat Dis.* 2009; 5: 469–475.
- 16- Weiner RA, Weiner S, Pomhoff I, et al: Laparoscopic sleeve gastrectomy-influence of sleeve size and resected gastric volume. *Obes Surg* 2007; 17: 1297–1305.
- 17- Deitel GC (ed.): Update: Surgery for the morbidly obese patients. FD-communications, 2000; Chapter 16, p. 135 and Chapter 20, p. 171.