Laparoscopic Gastric Plication versus Laparoscopic Sleeve Gastrectomy as a Surgical Treatment of Morbid Obesity

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Abstract: Background: Morbid obesity increases the risk for many associated diseases including hypertension, type II diabetes, and cardiac diseases. The present study aims to compare between laparoscopic vertical sleeve gastrectomy and laparoscopic gastric plication as regarding the feasibility, complication and effectiveness in weight loss. **Methods**: This is a prospective comparative study conducted between June 2011 and May 2014, which included 60 patients, divided into 2 groups, group (A) included 30 patients (17 females and 13 males) who underwent laparoscopic vertical sleeve gastrectomy (LSG),and group (B) included 30 patients (16 females and 14 males) who underwent laparoscopic gastric plication (LGP). The mean BMI was 42.85±3.8 kg/m² for group (A) and 41.92±5.7 kg/m² for group (B). And mean age was 39.5±8.6 years for group (A) and was 40.2±3.6 years for group (B).Follow up for all cases were recorded at 1, 3, 6, and 12 months. The comparison between the 2 groups was done as regarding operative time, complications and percentage of excess weight loss. **Results:** In the present study, all procedures were done laparoscopically without the need for conversion. There were4 cases showed intra-operative bleeding in LSG group and 3 cases at LGP group. The mean operative time was 78±26 minutes for the LSG group and 90±7.5minutes for the LGP group ($P < 0.05$). The mean hospital stay was 3.2 ± 1.7 days in the LSG group and 3.9 ± 2.3 days in the LGP group ($P = 0.00473$). The excess weight loss (EWL) at 1, 3, 6,and 12 months was 19.8%, 30.4%, 48.6%,and 59.4% respectively for LSG group, while in LGP group, it was 18.7%, 28.9%, 45.8%, and 56.6%, respectively. There is no weight regain recorded up to date in all patients. **Conclusion:** Laparoscopic sleeve gastrectomy (LSG)and laparoscopic gastric placation (LGP), both are gastric restrictive technique for treatment of morbid obesity, but LSG is superior to LGP regarding percentage of EWL and operative time. However, long terms follow up and large prospective randomized controlled studies are still needed.

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Keywords: laparoscopic bariatric surgery, restrictive procedure, laparoscopic sleeve gastrectomy, gastric plication

1. Introduction

Obesity is a complex disease with multiple causes that results from unhealthy and inappropriate accumulation of stored fat in the body[1]. Morbid obesity increases the risk for many associated diseases including hypertension, type II diabetes, cardiac diseases, and sleep apnea[2]. Controlling this problem through diet, exercise and medication does not achieve significant long term weight loss[3]. Surgery should be considered as a treatment option for patients with BMI of 40kg/m^2 or greater who instituted but failed on adequate exercise and diet program, and for patients with BMI of 35kg/m^2 who present with obesity related co-morbid conditions such as hypertension, diabetes, hyperlipidemia and obstructive sleep apnea[4]. There are varieties of the surgical procedures which have been performed to achieve weight loss by reducing the size of the stomach, including either the insertion of medical device (gastric banding) or through removal of a portion of the stomach (vertical sleeve gastrectomy) or by creating restriction without the use of an implant or gastric resection by stapler (laparoscopic gastric plication)[5, 6]. The present study aims to compare between laparoscopic vertical sleeve gastrectomy and laparoscopic gastric plication regarding the feasibility, complication and effectiveness in weight loss.

2. Methods

This is a prospective comparative study that received approval from the local ethics committee. Inclusion criteria followed the NIH (National Institutional Health) criteria for bariatric surgery. Patients with BMI higher than 40kg/m^2 or BMI over 35kg/m²with at least one co-morbidity[7]. Exclusion criteria included pregnancy, lactation, moderate to severe gastroesophageal reflux disease, severe cardiopulmonary diseases and presence of liver cirrhosis or portal hypertension.

From June 2011to May 2014, 60 patients{divided into 2 groups, group (A) and group (B)} were included in this study which was done at Elite Bariatric Center, Riyadh and Saudi German Hospital, Jeddah KSA.

Group (A) included 30 patients (17 females and 13 males) where laparoscopic vertical sleeve gastrectomy (LSG) was conducted, and group (B) included 30 patients (16 females and 14 males) where laparoscopic gastric placation (LGP) was conducted. Mean BMI was 42.85±3.8 kg/m^{2}for group (A) and 41.92±5.7 kg/m² for group (B). The mean age was 39.5±8.6 years for group (A) and 40.2±3.6 years for group (B). All patients involved in this study underwent a multidisciplinary evaluation by cardiologist, endocrinologist, psychologist and nutritionist. Preoperatively, all patients underwent upper GIT endoscopy to exclude gastritis or reflux disease. Preoperative investigations were done (blood tests, including complete blood picture, coagulation profile, liver function tests, renal function tests and ECG) and all patients had preoperative assessment by anesthesiologist. After full explanation about the surgical procedure and complications, all patients signed terms of informed consent.

Surgical procedure for laparoscopic sleeve gastrectomy

The patient was positioned in reverse Trendelenburg with both arms placed in abduction. Elastic and intermittent pneumatic compressing stockings were applied. The surgeon stands between the patient's legs, the assistant to the patient's left, and the cameraman to the patient's right. Pneumoperitoneum was achieved using a Veress needle placed in the left mid-clavicle sub-costal region. A five-port technique was employed: first trocar (10mm) was placed 15 cm below the xiphoid process slightly left to the patient's mid-line (telescope trocar); second trocar (12 mm) was placed at the location of the Veress needle in the left upper quadrant (surgeon's right hand); 3rd one (10mm) was placed in the right upper quadrant (surgeon's left hand); 4th one (5 mm) was placed high epigastric in the mid-line (flexible liver retractor); and 5th one (5 mm) was placed in the lateral left abdomen (assistant's 5-mm Babcock). Decompression of the stomach by nasogastric tube was done first, followed by gastrolysis using the Harmonic Scalpel started at the middle of the greater curvature then up to the angle of His and left cruse of the diaphragm and down to3-4 cm from the pylorus (Figure 1). Then by using the Endo GIA linear cutter tri-stapler (by Covidien), division of the stomach alongside a bougie (36 French) which was fitted to the lesser curvature was done (Figure 2 and 3). The bougie was then removed and the specimen was taken out of the abdominal cavity through the 12 mm port. Methylene blue test was done intraoperatively as a routine to detect leakage.

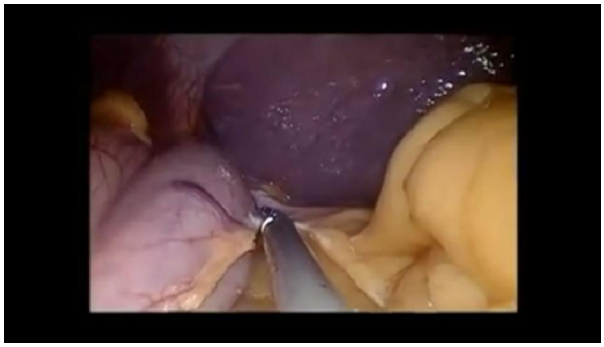

Figure 1: Gastrolysis with division of short gastric in LSG.

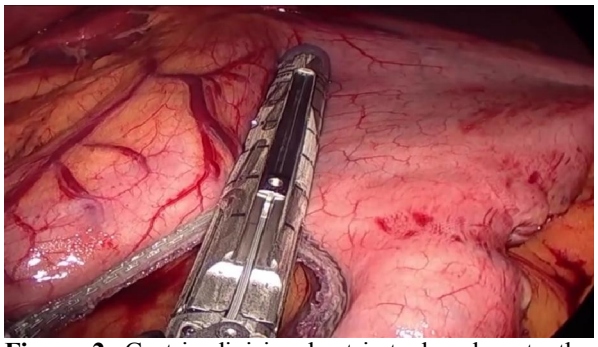

Figure 2: Gastric division by tri-stapler close to the inserted bougie.

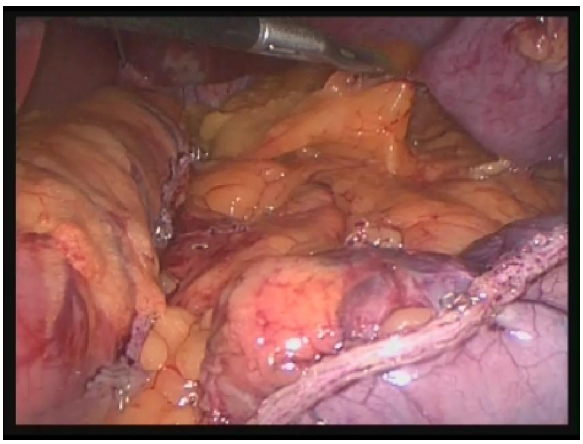

Figure 3: Final view of the remaining gastric sleeve.

Surgical procedure for laparoscopic gastric plication

All patients were placed in supine position with reverse Trendelenburg. After pneumo-peritoneum was created, the first trocar (10mm) placed at left to the mid line, 20 cm away from xiphoid angle (telescope trocar). Left and right hands of surgeon's trocars were inserted based on ergonomic assessment at this stage (left middle clavicular line at subcostal (insertion site of Veress needle) and right mid-clavicular line at 5 cm above the first trocar). The assistant surgeon's trocar (5mm) was inserted at right anterior axillary line.

Dissection of the greater omentum at its insertion on the greater curvature was performed with Ligasure5mm device (by Covidien). Dissection started 3 cm proximal to the pylorus and reached the gastroesophegeal junction. All adhesions at the posterior surface of the stomach (if present) were dissected. Plication of the greater curvature of the stomach was performed using two rows of sutures over a 36 French bougie, the first row was interrupted extra mucosal sutures. A Second row was running extra mucosal sutures. It was performed over the first one achieving more plication of the greater curvature. Finally the stomach appeared tubular in shape (as in sleeve gastrectomy) as shown below (figure 4-7).

Figure 4: Graphic image showing the gastric plication.

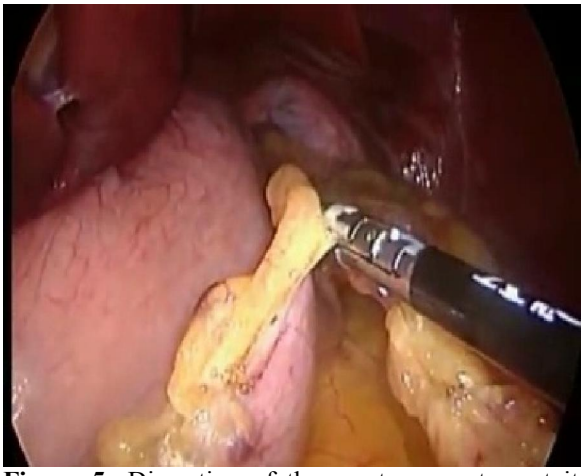

Figure 5: Dissection of the greater omentum at its insertion on the greater curvature of the stomach in LGP.

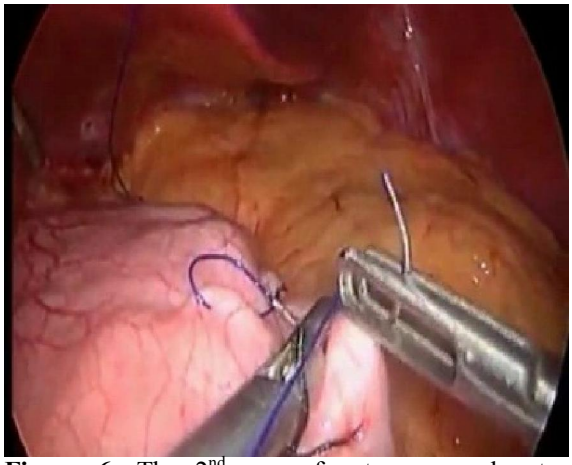

Figure 6: The 2nd row of extra mucosal sutures (continuous sutures).

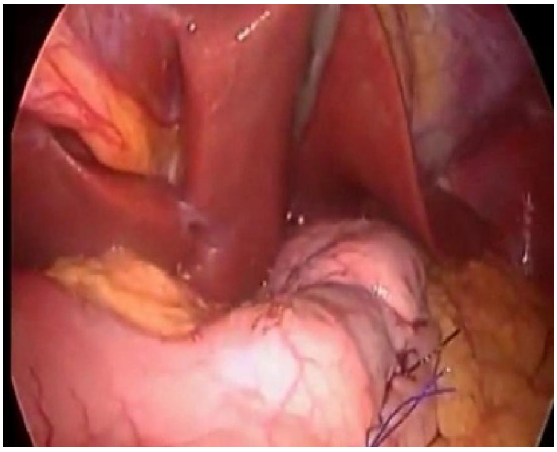

Figure 7: The final shape of the stomach at the end of the LGP.

All patients (group A and B), received intravenous antibiotics, one dose at time of induction of anesthesia, and then post operatively for the first 24 hours. Patients were kept on intravenous fluids for 12 to 24hours until the patients tolerated oral intake without vomiting. After that, patients were discharged from the hospital. Analgesics, antiemetic, and antispasmodics were given for the first week. Proton pump inhibitors were taken for one or two months depending on the patient's symptoms. At home, patients were allowed to take liquid diet for two weeks, blended diet for the next two weeks, and semi-solid diet for another two weeks after that patients returned gradually to normal diet according to the patient's compliance and acceptance. Operative times in minutes, hospital stay in days, post operative complications were recorded for both groups. Postoperatively, follow up visit after 7 days is scheduled for removal of stitches. Then follow up data

for all cases were recorded at 1, 3, 6, and 12 months for both groups.

Results

From June 2011 to May 2014, 60 patients were divided into 2 groups, group (A) (30 patients underwent LSG) and group (B) (30 patients underwent LGP) at Elite Bariatric Center, Riyadh and Saudi German Hospital, Jeddah. KSA.

All procedures were completed laparoscopically without the need for conversion to open. Mean age for group (A) was 39.5±8.6 years and for group (B) was 40.2±3.6 years (Table 1). The mean operative time was 78±26 minutes for the LSG group and 90±7.5 minutes for the LGP group (P =0.001) (figure 8). No patient required reoperation due to an early complication. The mean hospital stay was 3.2 ± 1.7 days in the LSG group and 3.9 ± 2.3 days in the LGP group (P = 0.00473) (Table 2). The main BMI was 42.85±3.8 kg/m^2 for LSG group while for LGP it was 41.92±5.7kg/m^2. There were 6 patients (20%) in group (A) complained of transient nausea that subsided within one week in all patients, compared to 7 patients (23.3%) in group (B). 4 patients (13.3%) in group (A) complained of vomiting for 2 to 3 days while 5 patients (16.7%) in group (B) did. There were 4 cases in LSG group that had intraoperative bleeding without the need for blood transfusion except for one case that received 2 units of blood. In the LGP group, 3 cases had intraoperative bleeding without the need for transfusion. No post-operative leak recorded in 2 groups (Table 3). The excess weight loss (EWL) at 1, 3, 6 and 12 months was 19.8%, 30.4%, 48.6% and 59.4% respectively for LSG group, while in LGP group, it was 18.7%, 28.9%, 45.8% and 56.6% respectively (Table 4) (figure 9). Mean BMI (kg/m^2) at 3 and 6 months was 34±2.5 and 30±8.7, respectively at LSG group, compared to37.7±4.9 and 34.2±3.2 for LGP group (Table 5) (figure 10).

Table 1: The demographic data for all patients.

	LSG	**LGP**	**P –VALUE**
Age (in years)	39.5±8.6	40.2±3.6	0.3760
Gender F/M	17/13	16/14	
BMI (kg/m^2)	42.85±3.8	41.92±5.7	0.1837

Table 2: The mean operative time in minutes and the mean hospital stay in days.

	LSG	**LGP**	**P –value**
Operative time (in minutes)	78±26	90±7.5	<0.0001
Hospital stay(in days)	3.2 ± 1.7	3.9 ± 2.3	0.00473

Table 3: Showing the numbers and percentage of early post-operative complication (within the first month).

Variable	**LSG**	**LGP**
Nausea	6 patients (20%)	7 patients(23.3)
Vomiting	4 patients (13.3%)	5 patients (16.7%)
Intraoperative bleeding	4 patients (13.3%)	3 patients (10%)
Leakage	No (0%)	No (0%)

Table 4: The percentage of EWL during the follow up visits at 1, 3, 6 and 12 months.

	LSG	LGP	P-VALUE
1 Month	19.8%	18.7%	0.0734
3 months	30.4%	28.9%	0.0062
6 months	48.6%	45.8%	0.0030
12 months	59.4%	56.6%	0.0012

Table 5: Mean BMI at 3 and 6 months for both LSG and LGP groups.

Mean BMI	LSG	LGP	P-VALUE
3 months	34±2.5	37.7±4.9	0.00614
6 months	30±8.7	34.2±3.2	0.00458

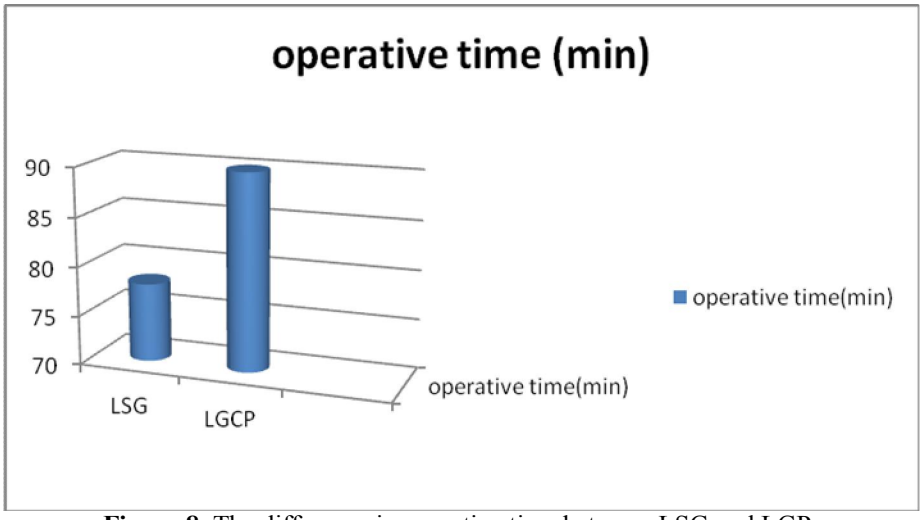

Figure 8: The difference in operative time between LSG and LGP.

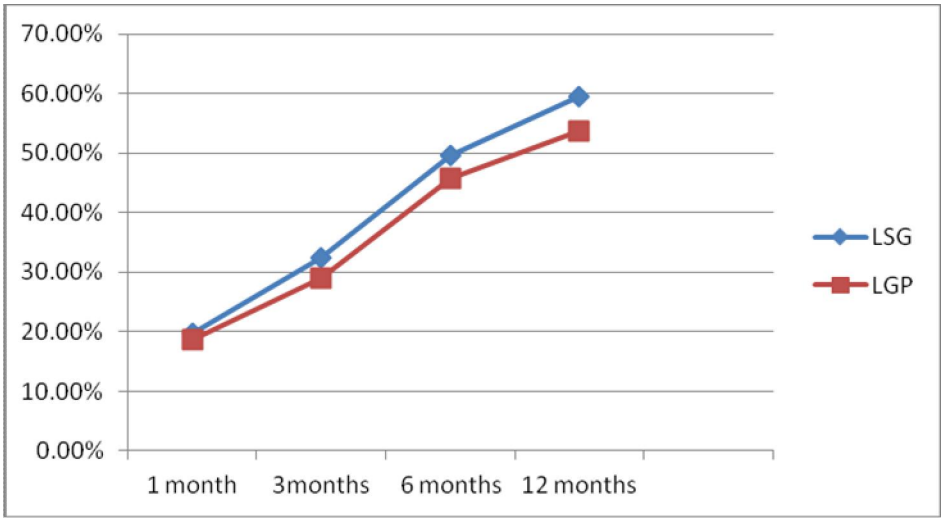

Figure 9: The comparison between LSG and LGP groups regarding percentage of EWL.

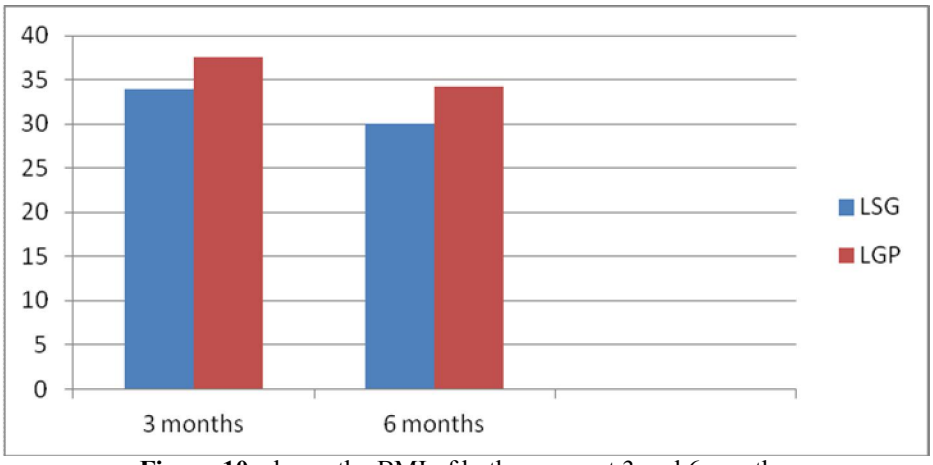

Figure 10: shows the BMI of both groups at 3 and 6 months.

4. Discussion

Morbid obesity is one of the major health problems of the 21st century, the obesity rate has increased dramatically in the last15 years, from 2% to 10% among boys and from 2% to 9% among girls, and bariatric surgery has been shown to be more effective than the medical treatment of morbid obesity [8]. There are different surgical techniques for achieving weight loss in bariatric surgery field, with the Roux en Y gastric bypass being the most effective as far as excess weight loss is concerned. Gastric restrictive procedures are accepted mechanisms used to achieve weight loss, including LSG and LGP. Laparoscopic sleeve gastrectomy considered as a widely accepted bariatric surgical operation and considered also as the first option especially for high risk patients, with satisfactory results [9]. Laparoscopic gastric plication was first presented in 2006 by Talebpouras a cheap alternative to LSG, initially named total vertical gastric plication, better known today as laparoscopic greater curvature plication. It appears to be gaining ground as its theoretical advantages of technical simplicity and low complication rate[10,11].

Laparoscopic sleeve gastrectomy has many advantages include: technical efficiency, there is no intestinal anastomosis, normal intestinal absorption, has no risk of internal herniation, no insertion of a foreign body, pylorus is preserved (no dumping syndrome),and finally LSG may be considered the most appropriate option in extremely obese patients [12].Laparoscopic gastric plication also has many advantages as a gastric restrictive procedure with lower risk of complications such as leak and fistula or the risk of erosion or dislodgement as in adjustable gastric band.

In this study we made a comparison between LSG and LGP. The main BMI was 42.85±3.8 kg/m^2 for LSG group, while for LGP group it was 41.92±5.7 kg/m^2 with no significant statistical difference (P = 0.1837). The mean operative time was 78±26 minutes for LSG group compared to 90±7.5 minutes for LGP group with a significant statistical difference (P < 0.05). In a similar comparative study, Daunia et al. [10], found that the mean operative time was 72.44±14.72 min in the LGP group and 75±38.05 min in the LSG group, these results were shorter for operative time compared to our results. While the operative time for LGP was 98 minutes in the original study done by Talebpour[11], which is near to our results for LGP group.

Mean hospital stay was 3.2 ± 1.7 days and 3.9 ± 2.3 days for LSG and LGP group respectively, despite being statistically significant (P= 0.00473), there was no difference between both groups regarding postoperative major complication. The longer hospital stay in LGP group can be explained by the higher incidence of nausea and vomiting, or may be due to the relative infancy of the procedure with the pattern of complications not fully understood, which indirectly affected the decision of patients discharge (13-15).

Excess weight loss at 1, 3, 6 and 12 months for LSG group was 19.8%, 30.4%, 48.6% and 59.4% respectively while it was 18.7%, 28.9%, 45.8% and 56.6% for LGP group with significant statistical deference (Table 4). Similar results regarding EWL in LGP were reported by Ramos et al. [14]; 20% EWL at 1 month, 32% EWL at 3 months, 47% EWL at 6 months, and 57% EWL at 12 months. Talebpour [11] reported better results than us in a large series of LGP, with EWL of 21.4% after one month, 54% after 6months and 61% after 12 months. Two major reasons may be implicated in the difference of percentage of excess weight loss between the two procedures, first, the abrupt decline in plasma ghrelin level after LSG, this mechanism is lacking in LGP where the fundus is preserved with few data are available on the hormonal effects of LGP [13-16]. The other mechanisms that can explain the different rates of weight loss may be related to gastric receptive relaxation, that the stomach muscle relaxes during eating and the capacity of the stomach enlarges to keep the internal pressure of the stomach stable. After surgery, the gastric volume may be similar in both procedures, but more stomach wall is preserved in LGP, resulting in a greater stomach capacity [17,18].

As regarding the complications in this study LSG group showed nausea in 6 patients (20%), vomiting in4 patients (13.3%), intraoperative bleeding in4 patients (13.3%) and there was no leak. While in LGP group, that complications were: 7 patients (23.3%), 5 patients (16.7%), 3 patients (10%), 3 patients (10%), respectively and also there was no leak. In a similar study, **Daunia et al**[10], reported a major complication rate of 28.9 % in the LGP group and 8.8 % in the LSG group , with a P value < 0.0001.In the LSG group, 2 cases of acute anemia, treated with transfusion and two late (after 3 months) stenosis of the gastric lumen, treated with endoscopic dilation. While in LGP group, the cases presented with fistula, acute gastric prolapse, acute abdominal pain and persistent vomiting. In another comparative study Georgios. et al.[15] reported (8.8%) complications (12/135) patients underwent LGP. Seven cases presented with prolonged postoperative nausea and vomiting and one case of minor leak that required readmission and treated conservatively while one case of mesenteric thrombosis and 3 cases of acute gastric obstruction

that treated surgically. In this study we do not report any weight regain, but the number of cases rolled in our study was only 60 cases (30 LSG and 30 LGP) and postoperative follow up period were only for 12 months, so long period of follow up, and a higher number of cases are needed.

Conclusion:

Laparoscopic sleeve gastrectomy (LSG) and laparoscopic gastric plication (LGP) are safe, feasible, and efficient gastric restrictive techniques for treatment of morbid obesity, but LSG is superior to LGP as regarding percentage of EWL and operative time. Longer follow up and large number of patients are still needed.

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