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Gastric Bypass versus Sleeve Gastrectomy in Morbid Obesity Management

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Abstract: Background: Obesity is caused by a combination of excessive food energy intake, lack of physical activity, and genetic susceptibility, although a few cases are caused primarily by genes, endocrine disorders, medications, or psychiatric illness. The main aim of obesity therapy is weight loss and maintenance by dietary interventions and increased physical activity. **Aim of the Work:** To review two of the most commonly performed modalities of weight loss namely Sleeve Gastrectomy, Gastric Bypass, and to study their early post-operative complications, outcomes, effects regarding excess body weight loss (EBWL), life style changes and sustainability. **Patients and Methods:** This is a prospective comparative randomize study included 40 patients presented with morbid obesity with BMI range between (40 to 60 kg/m^2) were treated 20 cases by laparoscopic sleeve Gastrectomy and 20 cases by laparoscopic Gastric Bypass (15 cases one anastomosis gastric bypass – 5 cases Roux-en-Y bypass) in Ain Shams Hospital during the period from October 2017 till May 2018. Cases were followed up monthly for 6 months and after 1 year. **Results:** Laparoscopic sleeve gastrectomy has higher incidence of complications (15%) than the incidence of complications of Laparoscopic Gastric Bypass (5%). **Conclusion:** Laparoscopic Sleeve Gastrectomy and Laparoscopic Gastric Bypass are both safe and effective procedures for the surgical management of morbid obesity. Laparoscopic Gastric Bypass has slightly higher mean of (EBWL%) than Laparoscopic sleeve gastrectomy at 6 months, and a higher mean of (EBWL%) than Laparoscopic sleeve gastrectomy at 1 year follow up.

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Key words: Gastric bypass, sleeve gastrectomy, morbid obesity

1. Introduction

Obesity is a complex, multifactorial chronic disease influenced by the interaction of several factors, such as genetic, endocrine, metabolic, environmental (social and cultural), behavioral, and psychological components. The basic mechanism involves energy intake that exceeds energy output [(1)].

The body mass index (BMI is defined as the weight in kilograms divided by height in meters squared). Overweight is defined as a BMI of 25 to 29.9 kg/m2. Obesity is defined as a BMI of ≥30 kg/m2. Morbid obesity is defined as a BMI ≥40 kg/m2 (or ≥35 kg/m2 in the presence of comorbidities) [(2)].

Obesity has several comorbidities: ***Neoplastic:*** Reported association with endometrial (premenopausal), prostate, colon (in men), rectal (in men), breast (postmenopausal), gall bladder, gastric cardial, biliary tract system, pancreatic, ovarian, renal, and possibly lung cancers, as well as with esophageal adenocarcinoma and multiple myeloma [(3)].

Cardio-Pulmonary: Obstructive sleep apnea and increased incidence of bronchial asthma. Coronary artery disease, essential hypertension, left ventricular hypertrophy, corpulmonale, Stroke, obesity-associated cardiomyopathy, accelerated atherosclerosis, and pulmonary hypertension of obesity [(3)].

Hepato-Biliary: Gall bladder diseases (cholecystitis, cholelithiasis), fatty liver infiltration.

Metabolic: Type 2 diabetes mellitus, metabolic syndrome, and dyslipidemia.

Endocrine: Anovulation, early puberty, infertility, hyperandrogenism, and polycystic ovaries (in women). Hypogonadotropichypogonadism (in men) [(3)].

Management of morbid obesity has many methods. The non-surgical method is a lifestyle intervention that is a combination of diet, exercise, and behavioral modification. Some patients require the addition of pharmacologic therapy or bariatric surgery to achieve or maintain weight loss [(4)].

Operations for weight loss include a combination of volume restrictive and nutrient malabsorptive procedures that affect satiety, absorption, and insulin sensitivity via hormonal or enteric derived factors, in conjunction with behavior modification to achieve and sustain weight loss [(5)].

Surgical operations for morbid obesity include: Adjustable gastric band, jejunoileal bypass, vertical banded gastroplasty, Gastric bypass (Roux-en-Y,

Mini), Sleeve gastrectomy, BPD (Bilio-pancreatic Diversion) and BPD-DS (Bilio-pancreatic Diversion with Duodenal Switch) [6].

Single anastomosis duodeno-ilialbypass (SADI) and Single anastomosis sleeve-ilialbypass (SASI) are recent surgical options [7].

Choosing the method that will be used for management of morbid obesity should be made only after a careful evaluation of risks and benefits. The first step is evaluation of the patient, which should include determination of the body mass index (BMI), the distribution of fat based upon the waist circumference, and investigations for comorbid conditions such as diabetes mellitus, dyslipidemia, hypertension, heart disease, sleep apnea, and symptomatic osteoarthritis [8].

Aim of work

The aim of this study is to review two of the most commonly performed modalities of weight loss namely Sleeve Gastrectomy, Gastric Bypass, and to study their early post-operative complications, outcomes, effects regarding excess body weight loss (EBWL), life style changes and sustainability.

2. Patients and Methods

This is a prospective comparative randomized study that was conducted on forty patients with morbid obesity in Ain Shams University hospital from October 2017 to May 2018, twenty cases of Sleeve gastrectomy, and twenty cases of Gastric bypass; according to approved standards to ethical committee of Ain Shams University.

The study included patients with a BMI $\geq$40 kg/m^2 with ages more than 18 years. While patients who has a BMI < 40 kg/m2 and patients who has a previous failed morbid obesity surgery.

Preoperative evaluation:

All patients were subjected to proper history taking and full clinical preoperative evaluation for assessment of degree of obesity, preoperative evaluation and detection of different complications of morbid obesity like hypertension, DM, sleep apnea, skeletal problems, infertility, hernias, history of psychotherapy.

Informed written consent was obtained with explanation of the possible complications that could occur in the peri-operative period was specifically addressed.

Patients were informed about the nature of the research, and each patient understood and agreed to the procedure.

All patients underwent a standard evaluation preoperatively. Blood tests were requested in the form of complete blood picture, Fasting blood sugar, HbA1c, Lipid profile (cholesterol, LDL, HDL, triglycerides) Clinical chemistries (serum albumin, ALT, AST, GGT, Urea, Creatinine) and Prothrombin time and concentration. Abdominal ultrasonography, chest X-ray and pulmonary function test. ECG and echo-cardiography.

Thromboembolic prophylaxis with subcutaneous low molecular weight heparin was administered on the evening prior to surgery and continued daily from the first postoperative day until the patient was ambulant for a maximum of 7 days post operatively.

Operative technique:

All procedures were performed under general anaesthesia with the patient in the supine position and the surgeon standing between the legs of the patient.

After applying compression stockings on the patient lower legs, the patient was firmly secured to the operating table to allow for elevation of the head of the table (anti-trendlenburg position).

A pneumoperitoneum was established to 15-mmHg pressure carbon dioxide using verus needle in the left hypochondrium for all cases maintaining a 15 mmHg intra-abdominal pressure and flow rate between 2-2.5 litres/minute to be increased up to 10 Litres/minute after ports insertion.

After creation of pneumoperitoneum, a five port technique was used placing a five ports in the upper abdomen in a “diamond-shaped” pattern.

A 5-mm subxyphoid trocar serves as a liver retractor. One 12-mm trocar between the subxyphoidal 5-mm trocar and the umbilicus serves as an optical port, and an additional two 12-mm working ports are placed 3-4 cm under the left and right costal margin pararectal, the left one serves as a channel for the linear stapler. Another 5-mm left subcostal anterior axillary line trocar for stomach traction.

A) Gastric bypass:

Creation of the Gastric Pouch

A long narrow gastric pouch about 20 ml was created. The dissection was started directly on the lesser curvature of the stomach at the junction of the body and antrum. The stomach was initially stapled & divided at a right-angle to the lesser curvature, proximal to the incisura.

A 32Frbougie was passed by the anesthesiologist into the stomach along the lesser curve and the stomach was stapled & divided upwards parallel to the lesser curvature. With approach to the gastro-esophageal (GE) junction, the surgeon divides the stomach lateral to the angle of His.

One anastomosis Gastric Bypass:

After creation of the gastric pouch, attention was turned to the left gutter, the omentum was retracted medially to identify the ligament of Treitz. The bowel was run to ~200 cm distal to Treitz’ ligament. At this site, a side to side ante-colic gastro-jejunostomy was created using a 30 mm cartridge. Finally the defect was closed in 2 layers using vicryl 3-0.

About 2-3 side to side sutures between the jejunum just proximal to the gastro-jejunostomy and the gastric pouch were taken in order to hang the proximal jejunum parallel to the gastric pouch and divert the bile away from the stomach.

Roux-en-Y Gastric Bypass:

After creation of the gastric pouch, the bowel was run to ~70 cm distal to Treitz' ligament. At this site, a side to side ante-colic gastro-jejunostomy was created using a 30 mm cartridge and the defect was closed in 2 layers using vicryl3-0.

From the gastro-jejunostomy the bowel was run distally for about (120-150) cm -according to body weight-. At this site, a side to side anastomosis with the biliary limb was done using a 30 mm white cartridge and the defect was closed in a continuous manner using vicryl 3-0.

Finally the biliary limb was stapled & divided just proximal to the gastro-jejunostomy.

Bleeding from staple line was checked and controlled by clips and any mesenteric defects were closed by sutures.

After testing for leak, one drain was left in the lesser sac.

B) Sleeve Gastrectomy:

The vascular supply of the greater gastric curvature is divided starting 1-2 cm from the pylorus and proceeding to the angle of His. The gastroepiploic vessels along the greater curvature of the stomach and the short gastric vessels are divided using the LigaSure device. Dissection of adhesions between the back of the stomach wall and the pancreas is performed. A 32 Fr calibrating bougie was introduced by the anaesthesiologist into the stomach and advanced along the lesser curvature into the pyloric channel and duodenal bulb. The stomach was divided using Linear Stapler. A combination of green reload (4.1 mm) for the first firing and golden reloads (3.7 mm) for the upper stomach is used. An approximately 5–10-mm cuff of stomach was left at the level of the angle of His to avoid including the esophagus with the staple line.

Thereafter, a leak test with methylene blue was used to check the integrity of the stapler line. At the end of the procedure, the calibrating bougie was removed.

In all cases the resected stomach was removed via the 12mm port without the need to enlarge it further. Routine placement of suction drain at the operative bed was done in all cases.

Postoperative follow up:

All of the patients received care under a standard clinical pathway. In the postoperative period, all patients were given 3rd generation cephalosporins, anticoagulants, analgesics (paracetamol, opioids), proton pump inhibitors and anti-emetics. The patients were encouraged to ambulate on the same operative day. Oral feeding (clear fluids) was allowed to start on the first postoperative day. Patients were discharged on the second postoperative day if they felt able to return home, after removal of the drain.

Postoperatively, patients were followed up at outpatient clinic, gastro-gaffin or CT with oral contrast are done as follow up. Visits were scheduled, two weeks for fluids and food intake and early post-operative complications. After one month for (EBWL) Excessive body weight loss. Monthly for six months and after 1year for (EBWL) and life style changes.

The following data were recorded in each visit during the follow up period; the patient weight, BMI, reflux symptoms (pain or discomfort in the upper abdomen, heart burn, limitation of eating of a normal meal due to abdominal pain, sleep disturbance caused by heart burn) and any complications that may occur as vomiting, diarrhea, dumping and intestinal obstruction.

Statistical analysis:

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:

Independent-samples t-test of significance was used when comparing between two means. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following: Probability (P-value) P-value <0.05 was considered significant. P-value <0.001 was considered as highly significant. P-value >0.05 was considered insignificant.

3. Results

The results of this study is recorded as following:

A-According to Gender:

There were 27 females and 13 males.

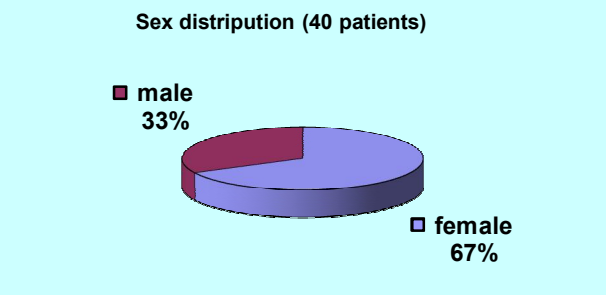

Figure 1: Sex distripution (40 patients).

B-According to Age:

The age of the patients ranged between 18 years and 58 years. (Mean = 38 years).

C - According to Complications:

Sleeve Gastrectomy Group:

Complications occurred in 3 patients (15%), and the distribution of surgery related complications were as following:

One patient (5%) complicated Post-operatively by bleeding, from the staple line and treated conservatively.

One patient (5%) complicated by stable line leakage had been detected 2nd day post-operative when the patient started oral fluid through the drain and was managed by laparoscopic re-exploration and repair by over-sewing.

One patient (5%) complicated by vomiting and reflux symptoms, and treated with proton pump inhibitors and IV fluids.

Gastric Bypass Group:

1 patient who had one anastomosis gastric bypass (5%) complicated by GERD symptoms and upper GIT Endoscopy revealed grade-A esophagitis.

There is no leakage cases of all bypass group. Early postoperative complications were defined as complications occurring within 30 days after surgery; late complications were defined as those occurring >30 days after surgery.

Table 1: Early post-operative complications.

Type of complication	*No. of patients of*		*Comments*
	Bypass	*sleeve*	
Stable line bleeding	0	1	Conservative management.
Stable line leakage	0	1	Laparoscopic re-exploration and repair.
GERD, Vomiting	1	1	Proton pump inhibitors and IV fluids.

Minor Complications occurred to 1 patient of sleeve gastrectomy group (5%) in the form of post-operative vomiting and GERD that were managed conservatively, while minor Complications occurred to 1 patients of gastric bypass group (5%) in form of GERD and also managed conservatively.

Major complications occurred to 2 patients of sleeve gastrectomy group (10%) in form of early post operatively stable line leakage was managed laparoscopically, and early post operatively stable line bleeding that was managed conservatively, with no major complications in gastric bypass group.

D - According Excess Body Weight Loss (EBWL):

The mean Excess body weight loss (EBWL%) at 6 and 12 months following the laparoscopic sleeve gastrectomy operation was 51% (37%-65%), and 71.5% (55%-88%) respectively.

And following laparoscopic Gastric bypass was 51.5% (46%-57%), and 82.5% (80%-85%) respectively. as shown in table (3).

Table 2: Percent excess body weight loss (%EWL).

Time after operation (months)	**Mean %EWL Of Sleeve**	**Mean %EWL Of Bypass**	**t-test**	**p-value**
6	51% (37%-65%)	51.5% (46%-57%)	0.174	0.862
12	71.5% (55%-88%)	82.5% (80%-85%)	2.548	0.013*

Using: Independent Sample t-test; p-value <0.05 S

E - Resolution of co-morbidities:

During the follow up period for all patients in two groups,5 (83.3%) out of 6 hypertensive patients showed clinical improvement with discontinuation of treatment in Sleeve gastrectomy group. and the other 1 (16.7%) patient continued on a small dose of treatment.

Regarding Gastric bypass group, 3 (75%) out of 4 Diabetic patients showed clinical improvement with discontinuation of treatment, while one patient (25%) continued on small dose of insulin.

4. Discussion

Obesity is a common disease affecting more than 300 million adults worldwide. It is defined as a body mass index >30 kg/m^2 [(2)].

Interestingly, Laparoscopic Sleeve Gastrectomy and Gastric Bypass (Roux-en-Y /One anastomosis) have emerged as new and effective weight loss procedures [(9)].

The laparoscopic sleeve gastrectomy was adopted as a primary procedure. Over time it has become the most popular bariatric operation worldwide. It is effective for weight loss and results in improvement and even resolution of co-morbidities. The procedure is relatively safe with low morbidity and mortality. [(10)].

Compared to gastric bypass and sleeve gastrectomy seems to have a smaller risk of complications. The most feared complications after Sleeve Gastrectomy and Gastric Bypass are leakage and hemorrhage [(11)].

An overall complication rate for Sleeve Gastrectomy of 0–24% and a mortality rate of 0.39%[12].

While the highest overall complication rate in Gastric Byass was 9% among all enrolled in the studies [13].

Kular and colleagues [14] found that The Sleeve Gastrectomy group had a greater percentage of complications (46%) than the Gastric Bypass group (25.6%) in their study.

In our study we had a greater percentage of complications among Sleeve Gastrectomy group (15%) than Gastric Bypass (5%). which goes hand in hand with the international results. However we had lower percentage of total complications compared to kular and colleagues.

Despite LSG's success, staple-line leakage after the procedure continues to be the most serious complication (1%–3% in large published series) [15].

It is the most frequent causes of death after bariatric surgery including LSG [16].

Staple-line disruption is the most life-threatening complication after LSG, with a mean incidence of 2.7% from 24 studies with 1749 patients [17].

Leaks after LSG commonly occur at the proximal aspect of the staple line immediately below the gastroesophageal junction because of the creation of a high internal pressure [18].

The pathophysiology of staple-line leaks after LSG is unclear. Compromise of blood supply, especially at the angle of His near the crura, stapler device failure, poor technique, and postoperative gastroparesis with an intact pylorus causing increasing intragastric pressure have all been implicated [19].

Leaks occur in the immediate post-operative period, typically within the first 30 days after surgery, and present with signs of abdominal sepsis (such as abdominal pain, tachycardia, abdominal distention, and fevers [20].

Dapri and colleague concluded that the leak rate was 4% to 6%, which is consistent with the leak rate of 3% to 4% in Jean Knapps systematic analysis [18].

Smith and colleague [21] and Aurora and colleague [22] reported2.4% leakage of LSG in two large meta-analyses.

In our study there was one case (5%) of early gastric leak (second postoperative day) at the gastroesophageal junction confirmed by CT scan with oral contrast, and it was successfully managed by laparoscopic re-exploration and surgical repair by over sewing the staple line and drainage.

Anastomotic leakage remains a leading cause of death following gastric bypass. Patients presented with leakage arising from the gastic tube, gastrojejunal anastomosis, jejuno-jejunal anastomosis and the excluded stomach. Leak managed by suturing of the tube and drainage or percutaneous drainage. Noun and colleagues had a total of 0.42% with leakage divided as 0.21% from the gastric tube, 0.21 from the excluded stomach and 0% from the GJ anastomosis [23].

While musella and colleagues had a total leakage of 10% divided as 0.2% from the excluded stomach, 0.5% from the gastric tube and 0.3% from the GJ anastomosis [24].

There was no anastomotic leakage developed among the Gastric Bypass patients in our study.

The major disadvantage of Sleeve Gastrectomy is the severity of the major postoperative bleeding one of the most serious complications [18].

The first priority in managing these patients should be adequate resuscitation, close monitoring, and assessment of the severity of the bleeding. It is one of the Immediate complications are usually dealt with by the operating team [25].

Regarding Gastric Bypass the most common complication encountered was intra-abdominal bleeding requiring transfusions. It was likely related to staple-line bleeding (not proven) that occurred in 12/923 (1.3%) in primary Gastric Bypass and 5/77 (6.4%) in revisional Gastric Bypass [23].

Kular and colleagues had intraoperative bleeding of 3.3% in Sleeve Gastrectomy, while in Gastric Bypass achieved a much lower rate of 0.98% [14].

There was one case (5%) of post-operative bleeding from staple line and was managed conservatively, in Sleeve Gastrectomy group in our study, However, in the Mini Gastric Bypass group bleeding did not occur. This denotes that the incidence of bleeding in Sleeve Gastrectomy group is higher than that in Gastric Bypass group and that is consistent with other international publications.

Gastroesophageal reflux disease was defined as the presence of reflux symptoms with epigastric pain/discomfort. [14].

Main drawback of LSG is the development of reflux esophagitis, 15% of the patients exhibited symptomatic reflux esophagitis at 5 years after surgery. The result concurs with the reported incidence of reflux rate of 11–33%[26].

The possible explanations for this high incidence include an increased prevalence of hiatal hernia, increased intragastric pressure after stapling, delayed gastric emptying, and dysfunction of the lower esophageal sphincter. However, the relationship between LSG and reflux esophagitis is intriguing because various studies have reported either improvements or worsening of reflux symptoms following surgery [27].

Therefore, it is currently recommended that LSG is to be avoided for patients with pre-existing reflux esophagitis symptoms and that hiatal defect should be searched for and repaired when found during LSG in

patients without preexisting reflux symptoms. In patients with severe reflux esophgitis after LSG, the only definite treatment is conversion to RYGB [28].

New onset GERD is more common after LSG and is mostly seen after 3 years. GERD remission of 72% in the Gastric Bypass and 33% in the Sleeve Gastrectomy group although there has been 21% persistent GERD after LSG at 5 years and could be attributable to the dilation of stomach after 3 years. Himpens et al. reported 21% new onset acid reflux after 3 years of LSG [29].

Another 5 year study of LSG by Rawlins, et al; shows 11% new onset acid reflux [26].

Post-operative bariatric patients are maintained on acid-suppressing medications for the first several months after surgery and continued for longer if necessitated by patient symptoms or complications [20].

The new onset GERD was 16% post Sleeve Gastrectomy, started mostly 3 years after LSG, but it was 2.8% after Gastric Bypass. All these patients underwent UGI endoscopy and marginal ulcer was detected in one case. These patients were managed with proton pump inhibitors (PPIs) [14].

In our study routine PPI was prescribed for all patients for 6 months as a prophylactic measure, in early post-operative period in Sleeve Gastrectomy group 1 case (5%) complicated by vomiting and reflux symptoms and improved with proton pump inhibitors and IV fluids, in Gastric Bypass group 1 case (5%) complicated by GERD symptoms and upper GIT Endoscopy revealed grade-A esophagitis.

The (EBWL)% was significantly better after one year in Gastric Bypass: 66.2% (± 13.9%) versus 57.3% (± 19.0%) in Sleeve Gastrectomy. [30].

Primary LSG resulted in up to 70% EBWL. These results concur with recent reports of the long-term results of LSG. [28].

The average percentage of EBWL for Gastric Bypass vs Sleeve Gastrectomy was 63 vs 69% at 1 year and 68 vs 51.2% at 5 years. Weight loss is similar in two methods in the first years, but lesser% EBWL with LSG at 5 years [14].

The percentage of EBWL% was 77 ± 5.1% in Gastric Bypass [24].

In our study the mean EBWL% was 51% at 6 months and 71.5% at 1 year after Sleeve Gastrectomy and was 51.5% at 6 months and 82.5% at 1 year after Gastric Bypass.

The mortalities were low reported in 0.0%-0.18% after Gastric Bypass [31]. Regarding Sleeve Gastrectomy the mortality rate was 0.8% [18]. In our study, we had no reported mortalities among both groups.

Conclusion

Laparoscopic Sleeve Gastrectomy and Laparoscopic Gastric Bypass are both safe and effective procedures for the surgical management of morbid obesity. Laparoscopic sleeve gastrectomy early post-operative complications include leakage, bleeding and GERD. Laparoscopic Gastric Bypass early post-operative complications are as well as Laparoscopic sleeve gastrectomy. As regarding our study results and observations: Laparoscopic sleeve gastrectomy has higher incidence of complications (15%) than the incidence of complications of Laparoscopic Gastric Bypass (5%). Laparoscopic Gastric Bypass has slightly higher mean of (EBWL%) than Laparoscopic sleeve gastrectomy at 6 months, and a higher mean of (EBWL%) than Laparoscopic sleeve gastrectomy at 1 year follow up.

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