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ORIGINAL ARTICLE

The effect of Laparoscopic Sleeve Gastrectomy on Metabolic Syndrome Parameters in morbidly Obese Patients

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Abstract

Background: ***The global epidemic of morbid obesity compelled modern medicine to take a multifaceted strategy, which resulted in the identification of metabolic syndrome (MS), one of the biggest causes of morbidity and death and a condition with self-aggravating elements. Metabolic surgery was developed in response to the demand for therapeutic approaches, providing opportunities for the safe and efficient treatment of all components of multiple sclerosis at the same time.***

Aim and Objectives: ***To assess how laparoscopic sleeve gastrectomy affects obese patients' metabolic syndrome parameters.***

Subjects and Methods: ***The present research is a prospective cohort investigation of fifty patients who underwent laparoscopic sleeve gastroplasties (LSGs) at the Al-Azhar University Hospital's General Surgery Department between January 2018 and January 2020. All patients were monitored for the third, sixth, and twelve months following surgery. In this investigation, all relevant guidelines and bioethical recommendations were followed.***

Result: ***The median age of the patients was 48, with a range of (42-58) years. About two-thirds were females (62%). 78% percent were hypertensive, and 54% were diabetics before surgery. At 12 months follow-up, significant improvements regarding all parameters were observed. A total reduction of 37 mg/dl in median glucose concentration was achieved, HbA1C dropped to 5.6 compared to 6.7 preoperatively, complete diabetes remission was observed in 44.4% of patients, 59% of the hypertensive patients were self-regulated, body mass index dropped from 49.2 to 32.4 kg/m2, patients lost 70% of their excess weight. Additionally, there was a large rise in high-density lipoproteins and a significant decrease in triglycerides, total cholesterol, and low-density lipoproteins.***

Conclusion: ***For comorbidities associated with obesity and metabolic syndrome, LSG is a useful treatment.***

Keywords: Laparoscopic Sleeve Gastrectomy, Metabolic Syndrome, Obesity

1. Introduction

Obesity is linked to reduced life expectancy and several concurrent disorders, such as arterial hypertension, hyperlipidemia, and type 2 diabetes mellitus (T2DM), which is characterized as metabolic syndrome (MetS). Consistent with the patterns of obesity, around 34% of adults suffer from metabolic syndrome. MetSLSG, an acronym for Metabolic Syndrome Lifestyle Support Group, is a very efficient intervention for treating metabolic syndrome and the associated health conditions linked to obesity.[1]

In Egypt, Aboulghate and colleagues documented that disorders caused by obesity impose a significant economic, humanistic, and clinical burden. In 2020, around 115 thousand deaths were attributed to obesity, accounting for 19.1% of the total expected deaths. The number of disability-adjusted life years (DALY) caused by it may have reached 4 million in 2020. The annual economic burden it imposes amounts to around 62 billion Egyptian pounds. This figure denotes the financial expenditure associated with the medical treatment of disorders directly attributed to obesity in adults.[2]

Nevertheless, noninvasive approaches may require a lengthier duration and may be inadequate for persons with hormone abnormalities or metabolic ailments.[3]

The LSG procedure is seeing rapid growth in bariatric surgery, making it the most prevalent choice in many countries.[4]

The objective of this study is to evaluate the impact of LSG on metabolic syndrome indicators in individuals who are obese.

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2. Patients and methods

This prospective cohort research includes 50 patients who had LSG at Al-Azhar University Hospital's Department of General Surgery between January 2018 and January 2020. Fifty patients with complete data from a 12-month postoperative follow-up were included in the study group. At the follow-up appointments, demographic and clinical information was prospectively collected with repeated measurements of specific laboratory indicators (3 months, six months, and 12 months following LSG). During the follow-up, analysis was done on 19 males and 31 females (38%/62%), whose average age was 50 (42-58) years. Each patient participating in this study gave written informed permission.

2.1.Inclusion criteria: represented by Individuals who met the LSG eligibility requirements and those who are 40-60 years old. Every patient who underwent an examination before being eligible for LSG satisfies at least three requirements for diagnosing MetS. This study employed MS diagnosis criteria based on the recommendations of the American Heart Association and the National Heart, Lung, and Blood Institute (AHA-NHLBI). They require the satisfaction of three out of five criteria: hypertension (systolic blood pressure > 135 or diastolic blood pressure > 85), dyslipidemia (triglycerides > 150 mg/dl, high-density lipoprotein cholesterol fraction < 40 mg/dl in men and < 50 in women), abdominal obesity (waist circumference > 80 cm in women and > 94 cm in men), and glucose intolerance (fasting glucose in serum > 100).

2.2.Exclusion criteria: represented by Patients who cannot adhere to a lifelong follow-up schedule or nutritional supplements; those who have had prior gastric surgery due to obesity, pregnancy, mental illness, or cancer; those who have active gastric ulcer disease; those who suffer from severe gastroesophageal reflux disease; those who abuse alcohol or drugs; and those who are unfit for surgery.

2.3.Surgical Technique

Patients are first arranged in a 30° reversed Trendelenburg positions posture with their legs abducted while supine on a surgical table. Following the insertion of the port, the pylorus is located and marked 4-6 cm below it as the conclusion of the dissection to preserve the pyloric antrum.

The greater curvature is fully dissected when the left crus is easily seen and exposed and joins at the right crus's center. Any hernias in the hiatus were treated. Following dissection, a 40 French blunt-tipped bougie tube is gradually pushed to the pylorus level under direct observation.

The sleeve starts to form between 4 and 6 cm in front of the pylorus. It is necessary to see the bougie tube traveling along the lesser curve distal to the stapler before firing the device. Initially, a green (60mm) staple cartridge with a 4.8mm height of staples is included with the stapler to handle the thick antrum. The thickness of the stomach tissue may then determine a decrease in the staple height for the ensuing firings. With lateral traction, it is essential to correctly expose the stomach to oppose the anterior and posterior portions. Extreme caution must be exercised to prevent the incisura angularis from narrowing.

After the sleeve is made, it is advisable to do a leak test using Methylene Blue. Once the integrity of the staple line has been verified, hemostasis is achieved by either oversewing the staple line or using metallic clips. Subsequently, the excluded stomach is extracted via the 15-mm port site.

2.4.Presurgery and postsurgery:

Postoperative evaluations were conducted at three, six, and twelve months. Regarding obesity, the initial main component of MetS, it is noteworthy that waist circumference was not included in a separate assessment of abdominal obesity. We considered that this MetS criterion had been met for all of the patients in our study because they all had preoperative BMIs above 40 kg/m2, and abdominal obesity is uncommon at such BMI values.

2.5.Statistical analysis:

Data management and analysis were carried out with the help of SPSS version 23. Numbers and ranges were used to summarize numerical data, whereas numbers and percentages were used to summarize categorical data. Kolmogrov-Smirnov and Shapiro-Wilk tests were used to examine numerical data for normality. The Friedman test was employed to determine if the mean rankings of the repeated measurements varied in a way that was statistically significant overall. Post hoc analysis was done to identify which assessments deviated from the first one. Statistical significance was defined as a p-value of less than 0.05.

3. Results

In this study, 50 people with MetS were included; the majority of these subjects (n=31, 62%) were female. The patients' median age ranged from 42 to 58 years, with a median BMI of 49 kg/m2. The patients were followed up for a period of 12 months. LSG was performed on each patient. The two most prevalent comorbidities in our study group were diabetic millet (DM) and arterial hypertension (AH), two of the main components of MetS that were diagnosed in 39 patients (78%) and 27 patients (54%) respectively prior to the LSG.

A few metrics related to glucose metabolism were examined in conjunction with the impact of

LSG on DM treatment. From the first to the twelve months of the study, there was a progressive decline in the median fasting glucose serum level, which culminated in a 37 mg/dl drop in the medium glucose concentration by the end of the follow-up, table 1.

The median HbA1 C at three, six, and a year postoperatively was 6.3, 5.9, and 5.6, respectively, compared to the median postoperative value of 6.7. This indicates a considerable decrease in the levels of glycosylated hemoglobin, Table 1.

Table 1. Showing the change in glucose metabolism over the follow up period.

Parameter	Follow-up time				P-value
	Day (0)	3 months	6 months	12 months	
HBA1c	6.7 (5.9-8.2)	6.3 (5.7-8.0)*	5.9 (5.4-7.8)*	5.6 (5.1-7.7)*	< 0.001
Fasting blo glucose	132.0 (96.0-176.0)	119.5 (91.0-171.0)*	108.0 (89.0-164.0)*	95.0 (85.0-150.0) *	< 0.001

Data are presented as median (range), HBA1c: hemoglobin A1c. * Highly significant from day 0 measurement ($p < 0.001$).

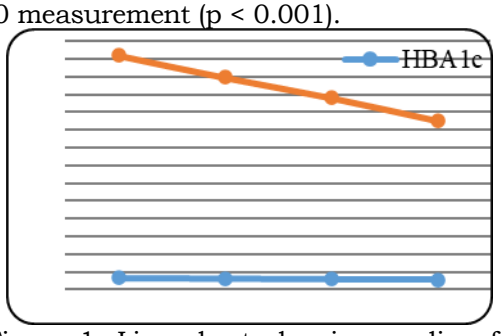

Figure 1. Line chart showing median fasting blood glucose and HBA1c change.

In 44.4% of cases, complete diabetic remission was noted. Of the patients, 14.8% had attained partial remission, 37.1% had improved, and 3.7% had their status remained stable, Figure 1.

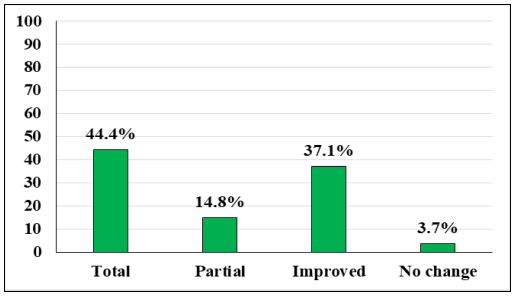

Figure 2. Bar chart showing remission rates of diabetic patients.

As for obesity, Median preop BMI was 49.2 kg/m2. After three months of follow-up, median BMI values dropped to 41.3 kg/m2. BMI was reduced to 36.2 kg/m2 at the 6th month then to 29.3 kg/m2 after a year of observation, Table 2.

Excess weight loss (EWL) was used to provide a more accurate interpretation of weight loss results. This showed that patients had lost 38.3% of the required weight by 3 months, 53.4% at 6 months, and 70.3% at 12 months, Table 2.

Table 2. showing the change in BMI and EWL of the patients.

Parameter	Follow-up time				P-value
	Day (0)	3 months	6 months	12 months	
BMI	49.2 (40.4-58.2)	41.3 (33.1-49.4)*	36.2 (30.4-44.1)*	29.3 (26.5-39.1)*	< 0.001
EWL (%)	-	38.3% (29.4-49.1%)	53.4% (40.5-70.2%)**	70.3% (57.5-89.1%)**	< 0.001

Data are presented as median (range), BMI: Body mass index, EWL: Excess weight loss. *Highly significant from day 0 measurement ($p < 0.001$). ** Highly significant from measurement at 3 months ($p < 0.001$).

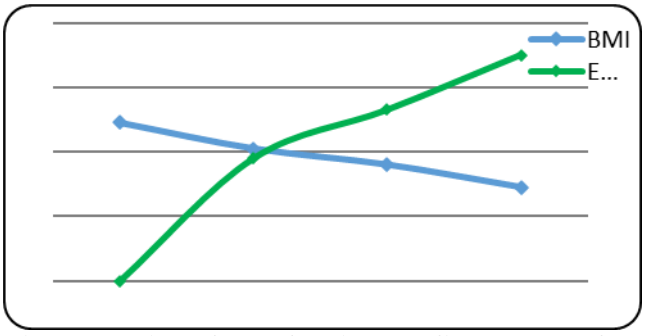

Figure 3. Line chart showing median BMI and EWL (%) change.

As for hypertension, 39 patients (78%) were using antihypertensive drugs in the preoperative period. After surgery, there was significant reduction of blood pressure values. At the end of the first year, the blood pressure values of 23 patient (59%) were self-regulated (resolved), there was improvement in 14 patients (35.9%) while there was no change in blood pressure values in 2 patients (5.1%), Figure 4.

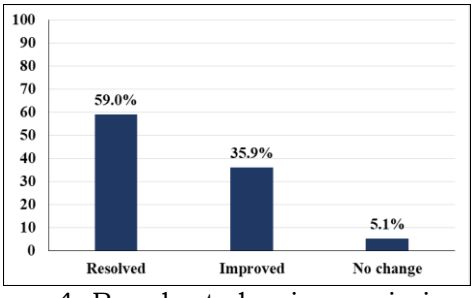

Figure 4. Bar chart showing remission rates of hypertensive patients.

Another component of MetS is dyslipidemia. The current study revealed a 9% reduction in the median total cholesterol level, which was 215 mg/dL at baseline and 196 mg/dL during the 12-month follow-up. The median LDL level was 21.8%

lower at the same follow-up point, down from 133 mg/dL to 104 mg/dL).

The median triglyceride level dropped significantly from 164 mg/dL to 127 mg/dL (a reduction of 22.6%). By the end of the follow-up, the level of high density lipoprotein (HDL) had grown significantly to 62 mg/dl, Table 3.

Table 3. Showing the change in total cholesterol, LDL, TG and HDL

Parameter	Follow-up time				P-value
	Day (0)	3 months	6 months	12 months	
Total cholesterol	215.0 (172.0-240.0)	191.0 (155.0-206.0)*	200.0 (160.0 - 215.0)*	196.0 (161.0 - 210.0)*	< 0.001
LDL	133.0 (106.0-164.0)	116.0 (101.0-141.0)*	114.0 (100.0 - 137.0)*	104.0 (93.0 - 123.0)*	< 0.001
TG	164.0 (121.0-202.0)	141.0 (105.0-172.0)*	135.0 (101.0-167.0)*	127.0 (95.0-159.0)*	< 0.001
HDL	53.0 (42.0 - 64.0)	45.0 (34.0-56.0)*	54.0 (44.0-65.0)**	62.0 (45.0-65.0)*	< 0.001

Data are presented as median (range), LDL: Low-density lipoproteins, TG: Triglycerides,

HDL: High-density lipoproteins. * Highly significant from day 0 measurement ($p < 0.001$).

** Significantly different from day 0 measurement ($p = 0.015$).

4. Discussion

The average duration of surgery in our study was 75 minutes. The transition to enteral feeding is expedited by reducing the duration of the procedure, minimizing the use of anesthetic, and promoting early postoperative recovery in patients. The primary and paramount advantage of LSG is the decrease in body weight. The median preoperative BMI was 49.2 kg/m2, ranging from 40.4 kg/m2 to 58.2 kg/m2. After three months of monitoring, the median BMI readings decreased to 41.3, with the minimum and maximum values falling within the 33.1-49.4 kg/m2 range. The median EWL percentage was 38.3% three months after undergoing LSG. Over the next 6 and 12 months, a consistent and favorable trend in achieving significant weight loss contributed to treating obesity. The median BMI decreased from 41.3 at the 3-month follow-up to 36.2 at the 6-month mark and decreased to 29.3 after one year of observation. The proportion of early weight loss (EWL) showed a progressive increase, rising from a median of 38.3% in the third month of follow-up to 53.4% in the sixth month and ultimately reaching 70.3% in the twelfth month following the operation.

Gluck et al. [5] The results of their study were consistent with ours, demonstrating average excess weight loss (EWL) percentages of 49.9%, 64.2%, and 67.9% after three, six, and twelve months, respectively, following laparoscopic sleeve gastrectomy (LSG).

Our findings are consistent with the research carried out by Boza et al.[6] Among a cohort of 1000 patients who underwent laparoscopic sleeve gastrectomy (LSG), the average excess weight loss (EWL) seen after one year was 86.6%.

Out of the 50 patients in our study, 39 (78%) developed hypertension and were taking antihypertensive medication before the surgery. After the surgery, there was a significant decrease in blood pressure levels at three, six, and twelve months. By the conclusion of the initial year, 23 patients (59%) achieved a state of HT remission, as evidenced by their ability to self-regulate their blood pressure values. Additionally, improvement was observed in 14 patients (35.9%), while two patients (5.1%) saw no change in their blood pressure values.

Golomb et al.[7] The study revealed that the initial year HT remission rate was 46.3%, while the rate was 55.4% in the conducted study by Noel et al. .[8]

The findings we obtained align with the research carried out by Boza et al. [6] The study demonstrated a 62.5% rate of remission of hypertension one year after laparoscopic sleeve gastrectomy, which significantly differed from the outcomes of previous studies. A study conducted by Srinivasa et al.[9] The study revealed that 83% of the individuals achieved a 29% reduction in symptoms and a 48% enhancement in hypertension after one year after receiving LSG (laparoscopic sleeve gastrectomy) and D'Hondt et al.[10] An individual reported a 95% resolution or improvement in their hypertension status one year after undergoing laparoscopic sleeve gastrectomy (LSG).

Throughout 1 to 12 months of monitoring, the median fasting glucose serum level progressively declined. By the end of the follow-up period, the mean glucose concentration had decreased by 11 mg/dl. 44.4% of patients achieved full remission of diabetes. 14.8% of patients had partial remission, 37.1% exhibited improvement, and 3.7% had no change in their diabetes status. The literature revealed a first-year remission rate of 50.7% by Golomb et al. 7 and 43.4% by Noel et al. [8]

Our study found a substantial decrease in HbA1C levels three, six, and twelve months after the surgery. The median HbA1C values at three, six, and twelve months were 6.3, 5.9, and 5.6, respectively, compared to a median preoperative value 6.7. A study conducted by Schauer et al. [11]

showed a comparable decrease in glycosylated hemoglobin levels. An individual demonstrated significant progress in glycosylated hemoglobin levels, decreasing from 7.5 to 7.1 at three months and further to 6.7 at six months following LSG.

Dyslipidemia is another constituent of Metabolic Syndrome (MetS). The study revealed a reduction of almost 9% in the median total cholesterol level, from 215 mg/dL at the beginning to 196 mg/dL after 12 months of follow-up, which is near the previously indicated value by Zetu et al.[12] According to the findings, the average total cholesterol level reduced from 217.8 mg/dl to 193.8 mg/dl after 12 months of follow-up, resulting in an 11% reduction. In contrast, Zhang et al.[13] observed that the total cholesterol level one year after the operation was not significantly different from the previous measurement. After twelve months of follow-up, the median LDL level in the current trial has decreased from 133 mg/dL to 104 mg/dL, representing a reduction of 21.8%. This reduction is more than what was previously concluded by Zetu et al.[12] The individual who provided the report stated that there was a reduction of around 15% in LDL levels at the same follow-up point. Specifically, the LDL level decreased from 141.3 mg/dL to 119.9 mg/dL.

Our study found that one year following the treatment, there was a notable drop in the median triglyceride levels of the patients, decreasing from 164 mg/dL to 127 mg/dL (a fall of 22.6%), which is similar to the previously observed levels by Zhang et al. 13 (The individual stated that there was a reduction in triglyceride levels from 141.7 to 109.3 mg/dl and documented this information by Turgut et al. [14] (The individual who reported the data stated that the average triglyceride level reduced from 134.8 mg/dL to 104.1 mg/dL after 12 months. The present study exhibited a substantial rise in HDL levels, increasing from 53 mg/dL to 62 mg/dL, and a noteworthy decrease in triglyceride levels. This aligns with the findings reached by Turgut et al.[14], Zetu et al. [12], and Feng et al. .[15]

4. Conclusion

The overall conclusion is that, according to the guidelines of evidence-based medicine and sound clinical practice, LSG is one of the bariatric surgeries that ought to be suggested as the primary and initial step of a complex treatment approach for instances of morbid obesity and metabolic syndrome.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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