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Effects of Laparoscopic Sleeve Gastrectomy on Hypertensive Morbidly Obese Patients

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ABSTRACT

Background: bariatric surgery is the standard way for obtaining a sustainable weight reduction in morbidly obese patients and it is a beneficial in lowering hypertension (both on the short and long terms)and improving other metabolic parameters. LSG is a relatively safe, simple and effective procedure which gained more popularity and became the most commonly performed bariatric operation.

Aim: this prospective, randomized study designed to evaluate the outcomes of laparoscopic sleeve gastrectomy (LSG) on hypertensive morbidly obese patients.

Patients and Methods: this prospective, randomized study was performed between January 2015 and December 2018 on 50 morbidly obese patients for whom a laparoscopic sleeve gastrectomy for treating morbid obesity was done in the department of general surgery, Al-Azhar University Hospital, Damietta.

Results: the comorbidities among the 50 patients included hypertension (40), dyslipidemia (20), sleep apnea (18) and diabetes mellitus (15). These preoperative comorbidities significantly improved within 6 months after LSG and at the end of follow-up period which was one year after operation, nearly all comorbidities were resolved or improved.There was also a significant short-term effect on obesity and hypertension following surgical treatment and the decrease of blood pressure occured prior to significant reduction of weight.

Conclusions: laparoscopic sleeve gastrectomy can improve and resolve elevated blood pressure in morbidly obese patients not only on the long term but also on the short term. It is a relatively safe and effective method not only for reduction of excessive body weight but also for improving and resolving many other comorbidities of morbid obesity.

Keywords: bariatric surgery; hypertension; laparoscopic sleeve gastrectomy; weight loss; obesity.

INTRODUCTION

Obesity is a critical health problem that is increasing all over the world. It is defined as body mass index (BMI) ≥ 30 kg/m2 **(1).**

Morbid obesity is accompanied by increasing risks of cardiovascular disease, dyslipidemia, obstructive sleep apnea, stroke ,diabetes type 2, musculoskeletal disorders, some cancers (endometrial, breast, and colonic carcinoma),osteoarthritis and many other diseases**(2,3).** Bariatric surgery is the standard way for obtaining a sustainable weight reduction in morbidly obese patients improving their quality of life and reducing long term mortality by diminishing the risk to previously mentioned comorbidities**(4**). LSG becomes a relatively safe, simple effective procedure, and a widely popular bariatric surgery**(5)**.

Hypertension is one of obesity associated comorbidities which show improvement in its control and may be reduced or even cured after correction of obesity as reported by some studies and in the same way it is easy to measure and to make a comparison between pre and post operative results what led us to do this study**(6)**

Some articles suggested that hypertension in morbidly obese patients is related to sympathetic nervous system activation and enhancement of sodium reabsorption by stimulation of renin-angiotensin mechanism besides increased arterial stiffness on the long run **(7-10).** Some studies proposed that up to 70% of hypertension in adults may be directly linked with adiposity and can be corrected by treatment of obesity**(11).** LSG was firstly performed as the first phase of bariatric operation biliopancreatic diversion with duodenal switch which was done in two stages**(12).** By the year 2000, LSG operation started to gain popularity and become a stand-alone procedure**(13,14).** Such profound results with regards to weight loss were noted following the first portion of the procedure and both the patients and the surgeons preferred to forego the second stage and by the year 2012, LSG gained more popularity and become the most commonly performed bariatric operation**(15).**

LSG is a restrictive procedure which limit food intake mechanically. Furthermore, it suggested that LSG may decrease appetite stimulation by

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removing part of gastric fundus responsible for producing ghrelin [16].

AIM OF THE STUDY

The present study is conducted to evaluate the outcomes and the effects of laparoscopic sleeve gastrectomy on hypertensive morbidly obese patients.

PATIENTS AND METHODS

This prospective, randomized study was performed between January 2015 and December 2018 on 50 morbidly obese patients for whom a laparoscopic sleeve gastrectomy for treatment of morbid obesity was done in the Department of General Surgery, Al-Azhar University Hospital, Damietta. **The study was approved by the Ethics Board of Al-Azhar University.**

Inclusion criteria: included patients with BMI > 35 kg/m^2.

Exclusion criteria: comprised obese patients with secondary obesity and or secondary hypertension.

Hypertension was defined as systolic blood pressure ≥ 140 mm Hg / diastolic blood pressure ≥ 90 mm Hg[17]. The procedure and its risks were explained for every included patient and an informed and written consent was obtained.

Full history taking (including symptoms of obstructive sleep apnea, joints pain and amenorrhea), clinical examination, and routine laboratory tests were done for all patients. Blood cortisone level, fasting and post-prandial blood glucose levels, thyroid function tests, lipid profile, pulmonary function tests, chest x ray, electrocardiography, echocardiography, cardiac assessment, abdominal and pelvic ultrasound, upper gastrointestinal endoscopy and psychological assessment were also done. Blood pressure assessed before surgery, at two weeks, one month, 3 months, six months and one year after the operation.

Surgical technique

Each patient was given a single dose of 2 g cefazolin for the surgical prophylaxis. The procedure was done under general anesthesia in the modified Lloyd Davies position (in which the thighs were parallel to the ground with a 30-degree reverse Trendelenburg position). After the insertion of one 15 mm, one 10 mm, and three 5 mm trocars, the left lobe of the liver retracted using a Nathanson liver retractor. The greater curvature was skeletonized by the usage of a Ligasure™ sealing device (USA, Covidien, Norwalk, CT).The skeletonization was initiated at 4–6 cm far from the pylorus and continued up to the left crus of diaphragm. After that, a trans oral 36 french bougie was put along the lesser curvature and a sleeve is created using linear staplers EndoGIA® (USA, Medtronic Norwalk, CT). Two successive 4.8/60 mm green loads were fired for stapling the antrum, followed by 2–4 successive 3.5/60 mm blue reloads for stapling the remaining corpus and fundus, or Tri-Staple™ (Autosuture Norwalk, CT, USA) was applied using purple and tan cartridges. The staple line reinforced with separate clips.

The resected stomach grasped at the antral end by a laparoscopic grasper trough the 15 mm trocar. The first 2-3 cm portion of the resected stomach was grasped into the 15 mm trocar and then the grasper was extracted out together with the trocar and the tip of the resected stomach.

After the extraction of the specimen, ryle tube put in the stomach was irrigated with 0.9% saline solution to detect any anastomotic leak after stapling to deal with it. The 10 mm and 15 mm trocar sites were closed with number 0 polypropylene sutures.

Patients start clear liquid Diet (phase 1) on the 2nd day postoperatively followed by full Liquid Diet (phase 2) from the 3rd day to the end of the 2nd week then semi solid diet (phase 3) through the 3rd and 4th weeks then adjusted regular diet (phase 4) from the 5th week after surgery.

Statistical analysis

Statistical analyses were performed by applying SPSS v20.0 (SPSS, Chicago, IL, USA) and means were assessed by the usage of student's t-test or two-way ANOVA with the corresponding post-test. A p value ≤0.05 was considered statistically significant.

RESULTS

From the total number of patients (which was 50) the hypertensive patients was 40 (15 males and 25 females) while the non-hypertensive patients was 10 (2 males and 8 females). The mean age was 40±7.6 years for hypertensive patients and 38 ±6.3 years for Non-Hypertensive patients **(Table 1).**

The comorbidities among the 50 patients were as follow: hypertension (40), dyslipidemia (20), sleep apnea (18) and diabetes mellitus (15). Hypertension was significantly improved within two weeks after LSG and by one year follow up period most of the patients were cured or improved **(Table 3)**. The other preoperative complications were significantly improved within 6 months after LSG and at the end of follow-up, nearly all comorbidities were resolved or improved **(Table 3).**

Table (1): Demographic data

Variable	Hypertensive (n=40)	Non-Hypertensive (n=10)	P value
Age (years)	40 ± 7.6	38 ± 6.3	Non-Significant
Sex: Males (n=17) Females (n=33)	 15 (88 %) 25 (76 %)	 2 (12 %) 8 (24 %)	 Significant Significant

Table (2**)**. Data of obesity and hypertension in patients before and after LSG

	Pre-operative	two weeks	One month	Three months	Six months	One year
Mean weight (kg)	118.2 ± 26.8	111.7±25.1*	102.3±28.6*	92.3±17.9*	85.4 ± 19.5*	78.6±14.2*
Mean BMI	43.2 ± 7.4	40.3 ± 7.1*	37.2± 6.8*	34.1± 5.8*	31.4 ± 4.9*	28.3± 3.7*
Systolic BP (mean± SD)	132.1 ± 14.6	125.7±12.3*	124.3±11.6*	123±13.5*	122.3±12.8*	119.1±12.4*
Diastolic BP (mean± SD)	81.9 ± 10.2	78.4± 8.4*	77.9±9.3*	77.1±9.6*	76.6±8.4*	75.2±8.6*
No. of anti-hypertensive used	30	30	25	18	10	4

*indicates $p < 0.05$ vs before operation.

Table (3). Effects of LSG on comorbidities in morbidly obese patients

Complication	Number of patients	At 6 month		At 12 month	
		Resolved (%)	Improved (%)	Resolved (%)	Improved (%)
Hypertension	40	30 (75 %)*	10(25 %)	36 (90 %)*	4 (10 %)
Type 2 Diabetes mellitus	15	12 (80 %)*	3 (20%)	12 (80 %)*	3 (20%)
Sleep apnea	18	14 (78%)*	2 (11%)	16 (89%)*	1(5%)
Dyslipidemia	20	15 (75 %)*	5 (25 %)	19 (95 %)*	1(0.05 %)

*indicates $p < 0.05$ vs before operation.

DISCUSSION

With the improvement of safety and accumulation of clinical data, physicians and patients become more convinced about bariatric surgery benefits in lowering hypertension and improving other metabolic parameters [(18)].

The current study demonstrates that LSG is an effective method to decrease rates and degrees of hypertension and its complications in the morbidly obese patients either on the short and long terms.

This study shows that BMI (and subsequently body weight as the length of patients is a fixed value) was significantly reduced within a month after LSG and the hypertension were significantly improved within two weeks, which is similar to previous works [(19)]. At one year after operation, there was a reduction in mean systolic and diastolic pressures which decreased by 13 mm Hg and 6.7 mm Hg, respectively. These results suggest that there is a significant short-term effect on obesity and hypertension following surgical treatment and the decrease of blood pressure occurs prior to significant reduction of weight. Also there was greater reduction in systolic than diastolic blood pressure.

For a long time, weight loss was considered as an effective treatment for hypertension and bariatric surgery has become the most effective method [(20)].

There were many studies supporting this result, the study containing the largest proportion of patients was that of ***Nocca et al.***[(21)] in the year 2016, which included a total of 1050 patients for whom LSG was done between January 2005 and June 2013 at a

single center in France. They conducted a retrospective research of the prospectively recorded database. The number of pre-existing hypertensive patients in the original study was three hundred and nine out of the 1050, which accounted for 33% of patients. At the 5-year record, only 144 patients (which represent 46.6% of hypertensive patients) were available and eligible for follow-up who were at least 5-year post-LSG. Of the 144 followed up patients who represent 46.6% of pre-existing hypertensive patients, there was a 19.2% resolution of hypertension, while 76.9% of the patients showed improvement of hypertension**.**

A prospective study was performed by ***Ruiz-Tovar et al.*** [(22)] in Spain .This study was performed between October 2007 and February2010, on 54 patients. The number of pre-existing hypertensive patients was 15 (30%). The follow-up rate was 94% from whom 10 patients showed resolution of hypertension which was defined as blood pressure< 135/85 mmHg on no antihypertensive medications, while another two patients showed improvement of hypertension. This study did not report number of antihypertensive medications no blood pressure values.

Many other studies have shown improvement or resolution of hypertension following LSG. ***Hutter et al.*** performed a prospective study on 944 patients and reported 68% improvement or resolution of hypertension at one-year follow up [(23)]. ***Basso et al.*** found that 62 out of 100 high-risk super obese patients with a mean BMI of 54.4 kg/m2 reported complete resolution of hypertension[(24)]. A multi-center study done by Sanchez and his colleagues (2009) showed that hypertension improved in 63% of LSG patients [(25)]. A long-term study done by **D'Hondt *et al.*** reported that 90.9% patients had improvement or resolution of hypertension 5 years after LSG [(26)]. A systematic review by Sarkhosh and his colleagues (2012) found that out of 3997 patients, 75% had improvement or resolution of their hypertension and 58% had complete resolution of hypertension after sleeve gastrectomy [(27)].

As regards to the short-term effects of LSG on hypertensive patients, many articles reported significant encouraging results. Samson et al 2018 concluded that LSG significantly reduced body weight, systolic blood pressure, and diastolic blood pressure as early as one month after the procedure in hypertensive morbidly obese patients. After one month, systolic blood pressure, and diastolic blood pressure did not decline further; they remained significantly lower than baseline levels despite a major reduction in anti-hypertensive therapy. In contrast to BP, body weight continued to decline, reaching a nadir at 6 months after LSG. At twelve months after LSG, patients had significant reduction in BP and body weight than at baseline [(28)].

Samson et al. also observed that patients continued to lose weight for 5 months without obtaining further decline in BP. Thus, the body weight loss and reduction of blood pressure may not be directly related after LSG [(28)].

Xiaoqiang and his colleagues observed that body weight and BMI were significantly reduced within a month after LSG and the symptoms of hypertension were significantly improved within 10 days. A plateau of reduced blood pressure appeared at 1 month after the operation. At one year after operation, the systolic and diastolic pressures had decreased by 13 mm Hg and 8 mm Hg, respectively, although the reduction was small after the first month. These results suggest that there is a significant short-term outcome on obese and hypertensive patients after surgical treatment and the decrease of blood pressure occurs before obtaining a significant loss of weight [(29)].

Many mechanisms have been suggested to be responsible for the early BP decline after LSG. Sharp hemodynamic changes after LSG may result from intravascular fluid loss due to poor fluid and low nutrient/ sodium intake in the days following surgery. Enhanced obligation to diet and medical regimen is also a frequent byproduct of any surgical procedure. Decreased level of circulating leptin and activity of sympathetic nervous system may also mediate the anti-hypertensive action of LSG [(29)].

CONCLUSION

LSG can improve and resolve blood pressure in morbidly obese patients not only on the long term but also on the short term. It is a relatively safe and effective method not only for reduction of excessive body weight but also for improving and resolving many other comorbidities of morbid obesity.

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