Short-term outcomes of laparoscopic sleeve gastrectomy for super-obese egyptian patients – a single-center experience

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Background
Owing to its simplicity, low morbidity and mortality, and efficacy in achieving sustained weight loss, laparoscopic sleeve gastrectomy (LSG) became increasingly popular as a primary procedure.

Aim
To report short-term outcomes of LSG in super-obese (SO) Egyptian patients with BMI more than 50–60, taking in consideration, the safety, feasibility, and efficacy of the technique.

Patients and methods
This was a prospective study performed on 50 SO patients in the Gastrointestinal Surgery Unit, Department of General Surgery, Tanta University Hospital, during the period from January 2017 to January 2019. The patients' characteristics, including preoperative weight, BMI, preoperative comorbidities, postoperative complications, the resolution of comorbidities, and percentage of excess weight loss, at different follow-up periods were prospectively analyzed.

Results
A total of 50 SO patients were subjected to LSG in our department during the study period. Mean patients' BMI was 53.42±2.95 kg/m^2 (range, 50–60 kg/m^2). Mean age was 34.58±9.93 years, with 12 males and 38 females. Mean operative time was 76.66±14.94 min. Mean percentage of excess weight loss achieved was 22.25 ±3.20, 35.07±5.67, 47.89±8.57, 57.80±7.65, 59.08±13.01, and 55.11±8.93 at 1, 3, 6, 12, 24, 48, and 36 months, respectively. There was no mortality, whereas total morbidity occurred in 15 patients.

Conclusion
In SO patients, LSG is a safe and feasible technique and is associated with acceptable and satisfactory weight loss results; moreover, there is improvement of obesity-related comorbidities on short-term follow-up.

Keywords:
laparoscopic sleeve, super obese, weight loss

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Introduction

In the past few decades, the prevalence of obesity has increased so exponentially that it is now considered a global epidemic. Surgery has proved to be the most effective long-term treatment for achieving successful weight loss and comorbidity improvement in patients who are morbidly obese [1,2]. Severely obese patients with high BMI (>50–60), life-threatening comorbidity, and extremely poor quality of life have the greatest potential to benefit directly from bariatric surgery; however, the degree of benefits they gain correlates with higher surgical risk owing to usual association of serious comorbidities in this category of obesity [3]. Initially, laparoscopic sleeve gastrectomy (LSG) was suggested as a bridging procedure for minimizing mortality and postoperative morbidity of more complicated bariatric procedures in higher risk patients [4]. Soon, many patients experienced sufficient weight loss following LSG, such that a second-stage operation became unnecessary [5]. The percentage of excess weight loss (EWL%) achieved after LSG is similar to that after laparoscopic Roux-en-Y gastric bypass but with shorter operative time [6]. Other advantages of LSG include maintenance of bowel continuity without any intestinal bypass and no risk for internal hernias [7]. LSG also has an acceptable morbidity rate, making it a preferred bariatric procedure for higher risk severely obese individuals [8,9].

Patients and methods

The data for a consecutive series of super-obese (SO) patients (BMI>50–60 kg/m^2) undergoing a LSG from January 2017 to January 2019 were collected and

analyzed prospectively. Inclusion criteria included patients with BMI more than 50–60 kg/m^2, with or without comorbidities. Exclusion criteria included patients with evident symptoms suggesting gastroesophageal reflux disease (GERD), previous procedure for weight loss, and individuals with drug or alcohol dependency. A written consent was obtained from each patient after discussion of benefits and possible complications of the procedure. Our study protocol was approved by the hospital ethical committee. The cost of LSG was at the patients' expense. Routine preoperative evaluation included cardiac, chest, psychiatric, and nutritionist consultation. Preoperative esophagogastroduodenoscopy and pelviabdominal ultrasonography were done for selected cases. Routine laboratory investigations were done for all of our patients. All procedures were done by the same surgical team (authors). This study discussed the demography of the patients, our preferred technique for LSG, postoperative convalescence, EWL results, postoperative complications, and resolution of comorbidities. Results were recorded intraoperatively, early postoperatively, and at 1, 3, 6, 12, 24, and 36-month intervals. Data were analyzed using IBM SPSS software package, version 18 (IBM Company, Chicago, Illinois, USA). Continuous variable data were reported as mean and SD, whereas categorical variables were reported using frequency distribution, and χ^2 test was used in cases of low expected frequencies ($P<0.05$ was considered significant).

Preoperative considerations

All included patients in our study were advised to get a balanced high-protein diet for at least 1 week preoperatively. The aim of this low-calorie diet was to help in shrinkage of the large fatty liver and thus minimizing need for insertion of liver retractor port during the operation. All patients received enoxaparin (Clexane) 40 IU night of the procedure. Sequential compression stocking was placed for DVT prophylaxis.

Surgical technique

The patients were placed in French position (supine position with splitted legs) and anti-Trendelenburg. The main surgeon stood in-between the splitted legs and the camera man stood on the patient's right, whereas the assistant stood on the patient's left. Four to five trocars were used. The first 12-mm ENDOPATH XCEL port was inserted midline at the supraumbilical border for the 30° optical system, and the second 12-mm trocar is inserted 5–7 cm below the left costal margin on the midclavicular line (surgeon right hand); two 5-mm trocars were used: one 5-mm trocar was inserted at lateral border of the right rectus nearly at same level of the left 12 mm port (surgeon left hand), and one 5-mm trocar on left anterior axillary line 2–3 cm below left costal margin (assistant) (Fig. 1). If necessary, liver retractor 5 mm port was inserted in midline just below xiphisternum. The greater omentum was divided using Harmonic scalpel (Ethicon Endo-Surgery, Cincinnati, Ohio, USA) from 5 cm above pyloric ring and dissection was continued cephalic up to gastroesophageal junction, where left hand of surgeon elevated the gastric wall in a vertical manner allowing complete mobilization of the gastric fundus from the left crus of diaphragm without the need for liver retractor. A 36-Fr orogastric tube was passed down transorally up to the pylorus to calibrate the gastric sleeve. The gastric sleeve was fashioned using successive firings of articulating linear stapler (Echelon Flex Endopath; Ethicon Endo-Surgery Inc., Johnson and Johnson, Cincinnati, Ohio, USA). No reinforcement of the staple line was implemented. All patients underwent routine intraoperative leak test using methylene blue. Any bleeding sites on the staple line were controlled by application of clips. Extraction of the excised gastric specimen was achieved through the left 12-mm port and a tube drain was applied routinely intraabdominally in subsplenic area through the site of left 5-mm port (Fig. 2). Early postoperative ambulation was strongly encouraged with patients getting out of bed the evening of the surgery.

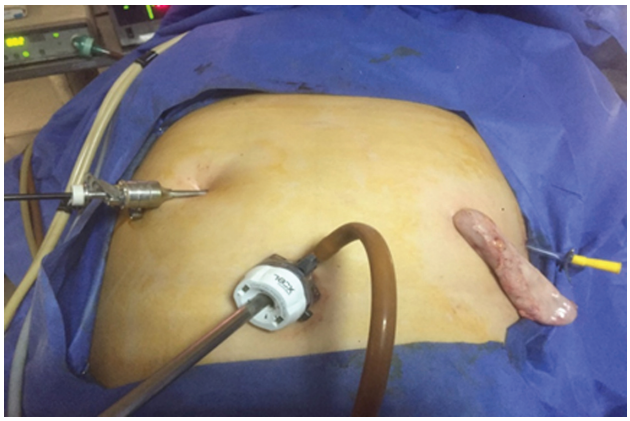
Figure 1

Sites of trocar placement.

Postoperative considerations

All patients received oral clear fluid small snips 8 h postoperatively, and very soft solid food such as yoghurt 16 h postoperatively. Drain removal and discharge of noncomplicated cases were done in the second

Figure 2



Specimen extraction through left 12-mm port, and tube drain through left 5-mm port.

postoperative day. Low-molecular-weight heparin, prophylactic dose was given every 24 h up to 2 weeks postoperatively. Gastric protection with proton pump inhibitors was done for the first 2 months postoperatively. Detailed dietary instructions were provided. Patients were advised to take daily multivitamins as well. The patients were usually discharged within 24–48 h after surgery and were advised to follow-up at 1 week, 1 month, 3 months, 6 months, and yearly thereafter. They were started on pureed and soft diet within 2 weeks, progressing to normal diet by 4–6 weeks.

Results

Data from 50 SO patients included in the study were analyzed. Patients' demographics are shown in Table 1. Of these patients, 38 (76%) were females, and 12 (24%) were males. Overall, the mean age was 34.58±9.93 years (range, 19–60 years). The mean preoperative weight was 145.42±19.02 kg (range, 120–205 kg). The mean of excess weight was 77.82±13.50 kg (range, 60–119 kg). The mean preoperative height was 164.64±7.72 cm (range, 154–185 cm). The mean preoperative BMI was 53.42±2.95 kg/m^2 (range, 50–60 kg/m^2). Regarding follow-up period, 100% (50 patients) of our patients completed 1, 3, 6, and 12 months of follow-up, whereas 86% (43 patients) completed 24 months and only 28% (14 patients) completed 3 years of follow-up.

Obesity-associated comorbidities

The main obesity-related comorbidities included type 2 diabetes mellitus in 14 (28%) of the patients, hypertension in 10 (20%) patients, hyperlipidemia in 21 (42%) patients, chronic joint pain in 18 (36%) patients, and obstructive sleep apnea (OSA) in three (6%).

Table 1 Patients' characteristics at the time of operation

Variables	Mean±SD (range)
Age	34.58±9.93 (19–60)
Sex (female/male)	38/12
Preoperative weight (kg)	145.42±19.02 (120–205)
Preoperative height (cm)	164.64±7.72 (154–185)
Preoperative BMI (kg/m^2)	53.42±2.9 (50–60)
Preoperative excess weight (kg)	77.82±13.49 (60–119)

Operative records and hospital stay

The same surgeons had done all of the operations. All patients were operated through four-port technique, except eight patients, who required placement of an additional port. Intraoperative mishaps included superficial liver laceration in six patients, who were managed laparoscopically by electro-cautery. The mean operative time was 76.66±14.94 min (range, 40–120 min). The mean length of hospital stay was 1.84±2.98 day (range, 1–22 day). Concomitant procedures during LSG were done for seven (14%) patients and included laparoscopic cholecystectomy in five patients, and umbilical hernia repair in two patients.

Postoperative morbidity and mortality

No mortality was observed in this series. Early postoperative complications (within the first month postoperative) were recorded in 14% (7/50 patients). Late complications developed in 16% (8/50 patients). The type and severity of complications are listed in Table 2. A leakage in the staple line was detected in one (2%) female patient, on the third postoperative day. Upper gastrographic contrast study confirmed leakage just distal to gastroesophageal junction. This patient required a self-expandable metal stent applied for 5 weeks and was then removed, and the patient improved. Two (6%) patients had early major postoperative bleeding that required blood transfusion. Laparoscopic re-exploration revealed staple line bleeding that was managed by suture oversewing of the stable line at bleeding points. Minor complications were recorded in four (8%) patients and included left lung atelectasis in one patient, superficial wound infection in two patients, and intolerance to early oral intake associated with repeated vomiting and dehydration in one patient. This patient required intravenous fluid administration for 24–48 h, and the symptoms gradually resolved without further intervention. We did not record deep venous thrombosis or pulmonary embolism in our patients. With respect to late complications, one (2%) patient developed a gastric stricture 6 months postoperatively in the upper part of the gastric sleeve (Fig. 3). Trials for endoscopic dilatation were done but failed, so the

Table 2 Operative time, hospital stay, and postoperative complication

Operative time (min) [mean (range)]	76.66 (40–120)
Length of stay (day) [mean (range)]	1.84 (1–22)
Total 30-day complications [*n* (%)]	7 (14)
Mortality	0
Pulmonary embolism	0
Deep vein thrombosis	0
Staple line leak	1 (2)
Staple line hemorrhage	2 (4)
Postoperative vomiting and dehydration	1 (2)
Pulmonary atelectasis	1 (2)
Wound Infection	2 (4)
Late complications [*n* (%)]	8 (16)
Gastroesophageal reflux	3 (6)
Gastric sleeve stricture	1 (2)
Trocar site hernia	1 (2)
Gall stones	3 (6)
Overall complications [*n* (%)]	15 (30)

patient was subjected to revision to laparoscopic Roux-en-Y gastric bypass with gradual improvement. Three (6%) patients reported symptoms that suggested gastroesophageal reflux requiring daily low-dose proton pump inhibitors. One (2%) patient developed a port-site hernia and was subjected to open repair with prolene mesh. During the follow-up, three (6%) patients underwent cholecystectomy owing to symptomatic gallstones.

Weight loss results

Mean EWL% was 22.25±3.20, 35.07±5.67, 47.89 ±8.57, 57.80±7.65, 59.08±13.01, and 55.11±8.93% at 1, 3, 6, 12, 24, 48, and 36 months, respectively. All patients lost weight during the first year; however, three (6%) patients lost weight but not efficiently (EWL% <50% at 1 year). LSG revision as a result of weight regain was important in two of those patients after 2 years, with EWL% less than 30%. Both were subjected to one anastomosis gastric bypass. The third patient was satisfied and refused any revision. The results of mean BMI and EWL % at different follow-up periods are illustrated in Table 3. The overall success rate, defined when EWL% is more than 50%, was 96.1% of the patients after 1 year, 88.3% after 2 years, and 66.6% after 3 years.

Resolution of comorbidities

After the first postoperative year, most of the comorbidities were improved or resolved. Resolution/improvement of comorbidities were 78.5% for diabetes mellitus, 60% for hypertension, 76.2% for hyperlipidemia, 66.5% for chronic joint pain, and 100% for OSA (Table 4).

Figure 3

Stenosis at upper third gastric tube.

Discussion

LSG is increasingly being performed as a potentially stand-alone bariatric operation. In 2009, the American Society of Metabolic and Bariatric Surgery (ASMBS) approved LSG as a primary bariatric procedure [10]. Operating in SO patients has been found to be difficult owing to the large size of the liver and reduced workspace. In these patients, LSG is easier to perform than laparoscopic Roux-en-Y gastric bypass [11]. Several studies have verified the effectiveness of LSG in inducing EWL and improving the comorbidities associated with obesity [12]. In our study, we recorded a mean EWL% of 57.80% at 12 months postoperatively. The weight loss achieved by patients in this study was similar to that reported by Eisenberg *et al.* [13], who reported a mean 1-year EWL% of 56% in 16 SO patients subjected to LSG, with a mean BMI equal to 56.3 kg/m^2. Recently, Singla *et al.* [14] published their study comparing the efficacy of LSG and minigastric bypass on SO patients. They reported a mean 1-year EWL% of 56.20 in 50 SO patients subjected to LSG having a mean BMI equal to 54.18 kg/m^2. Another comparative study was carried out by Plamper *et al.* [15] on SO patients and revealed a mean 1-year EWL % of 66.2 and 57.3% after MGB and LSG, respectively. On the contrary, our result regarding EWL% were superior than those published by Madhok *et al.* [16], who reported a 1-year EWL% of 45%, though their patients were super SO with a mean BMI of 65 kg/m^2. Our result were inferior than those published by Kular *et al.* [17] who

Table 3 The results of mean BMI and percentage of excess weight loss at different follow-up periods

	0	1	3	6	12	24	36
BMI	53.424±2.95	47.012±2.60	43.52±2.75	39.68±3.23	36.49±2.86	31.6535±4.10	37.93±3.50
EWL%	0	22.25±3.20	35.72±5.67	45.8±19.4	57.80±7.65	59.08±13.01	56.95±7.72

EWL, excess weight loss.

Table 4 Resolution/improvement of comorbidities

Comorbidity	Preoperative [*n* (%)]	Resolved/improved [*n* (%)]
Chronic joint pain	18 (36)	11 (61.1)
Hyperlipidemia	21 (42)	16 (76.2)
Diabetes	14 (28)	12 (85.7)
Hypertension	10 (20)	5 (50)
Obstructive sleep apnea	3 (6)	3 (100)

reported a 1-year EWL% of 69%, though their study were on morbid obese with a mean BMI of 42 kg/m^2. Four (10%) patients experienced progressive weight regain at 2 years (>10 kg from nadir weight). Weight regain in our study was more than that reported by Liu *et al.* [18] (1%) at 2 years and less than 19.2% reported by Bohdjalian *et al.* [19]. Several mechanisms have been proposed to explain weight regain following LSG, of them, the primary gastric tube size, gastric tube dilatation, elevated serum ghrelin hormone levels, and maladaptive lifestyle are the most important [20]. In our studies, most of the comorbidities improved or resolved after the first 12 months postoperatively. Ratio of resolution and/or improvements of comorbidities were 85.7% for diabetes mellitus [total resolution in 10 (71.4%) patients and improvement in two patients), 50% for hypertension (total resolution in two patients and improvement in three patients), 61% for degenerated joint disease, 76% for hyperlipidemia, and 100% for OSA. The best rate of remission was for diabetes (71.4%); similar results were published by Eisenberg *et al.* [13], who reported diabetes remission, hypertension resolution, and OSA resolution in 71.4, .51.6, and 46.4%, respectively, of their SO patients. The improvement of type 2 diabetes mellitus after LSG is attributed mainly to reduction of fat mass. It has been suggested that complete gastric fundal resection with resultant drop in the ghrelin hormone level may help to explain the rapid weight-independent glycemic effects of LSG [20–22]. Regarding major complications, we recorded leakage of the staple line in one (2%) patient and bleeding in two (4%) patients. The leakage was detected in the third day postoperatively when the patient developed pain in the left hypochondrium referred to left shoulder associated with dyspnea. Examination revealed tachycardia, tachypnea, epigastric, and left hypochondrial tenderness. Upper gastrointestinal gastrographic study was done and revealed the site of leakage next to the fundal staple line in addition to relative gastric tube narrowing at level of incisura angularis, which suggest mechanical cause of leakage. Ece *et al.* [23] reported similar result of leak (1.9%) and bleeding (1.9%) in their SO patients after LSG. Plamper *et al.* [15]. reported leak and bleeding in 5.1 and 0.8%, respectively, in SO patients undergoing LSG. (5.1%). Madhok *et al.* [16] did not record any leakage or bleeding in their super SO patients. The reported incidence of gastric tube stenosis after sleeve gastrectomy ranges from 0.1 to 3.9% [24–26]. In the present study, we reported gastric stricture incidence of 2%, which is similar to that published by several authors. Gastric tube twisting may be a possible cause for gastric stenosis [27]. New-onset GERD after LSG in our study was found in 6% of patients and seen mostly after 1 year. Plamper and colleagues reported new-onset GERD just in 2.5% of their SO after LSG, and all of them required revision. Alexandrou *et al.* [28] reported higher incidence of de novo GERD (16%) in their study on SO.

Conclusion

We found that LSG as a stand-alone bariatric operation was feasible, safe, and efficient in the SO population with appropriate EWL%, lower complication rate, and resolution/improvement of most of the obesity-associated comorbidities. In spite of a high overall satisfaction rate, it appears that achieving a BMI of less than 30 kg/m^2 with LSG alone can be difficult for the SO population.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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