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*Clinical Study*

# Laparoscopic Sleeve Gastrectomy for Mildly Obese Patients (Body Mass Index of 30 <35 kg/m$^2$): Operative Outcome and Short-Term Results

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*Background*. Data concerning laparoscopic sleeve gastrectomy (LSG) in mild obesity are under investigation. *Aim/Objective*. May 2010 to May 2012, 122 consecutive patients with preoperative body mass index (BMI) of 33 ± 2.5 kg/m$^2$ (range 30–34.9) undergoing LSG were studied. Mean age was 33 ± 10 years (range 15–60), and 105 (86%) were women. Mean preoperative weight was 91 ± 9.7 kg (range 66–121), and preoperative excess weight was 30 ± 6.7 kg (range 19–43). Comorbidities were detected in 44 (36%) patients. *Results*. Mean operative time was 58 ± 15 min (range 40–95), and postoperative stay was 1.8 ± 0.19 days (range 1.5–3). There were no admissions to intensive care unit and no deaths within 30 days of surgery. The rates of leaks and strictures were 0%, and of hemorrhage 1.6%. At 12 months, BMI decreased to 24.7 ± 2, and the percentage of excess weight loss (% EWL) reached 76.5%. None of the patients had a BMI below 20 kg/m$^2$. Comorbidities resolved in 70.5% or improved in 29.5%. Patient satisfaction scoring (1–5) at least 1 year after was 4.6 ± 0.8 for body image and 4.4 ± 0.6 for food tolerance. *Conclusion*. LSG for mildly obese patients has proved to be technically relatively easy, safe, and benefic in the short term.

## 1. Introduction

Laparoscopic sleeve gastrectomy (LSG) is now established as a stand-alone bariatric procedure for the morbidly obese population and is adopted worldwide [1–4]. LSG yielded excellent outcomes particularly when applied to the lower BMI population according to the current guidelines for bariatric surgery [5, 6].

However, the expanding obesity epidemic consists mostly of relatively less obese patients (BMI 30 < 35 kg/m$^2$) who are not (yet) eligible for bariatric surgery [6, 7]. Hence, less invasive procedures and devices based upon gastric restriction and upon small intestinal exclusion, mimicking bariatric surgery, are rapidly being developed [7]. Even though short-term results of some of these techniques are promising, there is insufficient scientific data to support their clinical implementation today [8].

The use of bariatric surgery for the mildly obese population (BMI of 30 < 35 kg/m$^2$) is currently under investigation, and preliminary studies have demonstrated beneficial and safe outcomes [9–11]. The aim of the present study is to investigate the operative outcome and short-term results of LSG for this population.

## 2. Patients and Methods

The data for a consecutive series of mildly obese patients (BMI 30 < 35 kg/m$^2$) undergoing a LSG from May 2010 to May 2012 were collected prospectively. Our eligibility criteria

included patients with class I obesity (BMI of $30 < 35\,kg/m^2$) resistant to medical treatment and lasting for ≥five years with or without comorbidities. Patients with a history of a prior bariatric procedure were excluded. The risks, benefits, and long-term consequences of LSG were discussed in detail during the initial encounter with the surgeon and the dietician. Written informed consent was obtained from all patients undergoing LSG. The cost of LSG was at the patients' expense. The study was approved by the hospital Ethics Committee.

Preoperative work-up included blood tests, chest radiography, electrocardiogram, abdominal ultrasounds, psychiatric, and endocrinologic evaluations. Preoperative gastroscopy was selective rather than routine.

Data collected included demographics, perioperative outcome including intraoperative and postoperative data. Followup data included weight loss parameters, change in comorbidity status, and patients satisfaction scoring (body image and food tolerance). Ideal body weight was determined according to Metropolitan Life Insurance height/weight tables [12]. All patients received preoperative low molecular weight heparin and antibiotic prophylaxis.

All data analysis was carried out using the SPSS version 15.0 for Windows statistical package (SPSS Inc., Chicago, IL). Results are reported as mean ± SD or as percentages when appropriate. Statistical analysis was conducted using Student's $t$ test for continuous data and $\chi^2$ test for population proportions, with a $P$ value of .05 considered to be significant.

*2.1. Surgical Technique.* The technique used for LSG is based on a 5-port approach: one 15 mm trocar inserted midline at the supraumbilical border; one 12 mm trocar inserted 5–7 cm below the left costal margin on the midclavicular line; and three 5 mm trocars; one 5–7 cm below the right costal margin on the midclavicular line, one subxiphoid to retract the liver, and one at the lateral border of the left rectus. Using the Ligasure (Covidien) vessel sealing device, the vessels of the gastric greater curvature are ligated starting from 6 cm proximal to the pylorus and proceeding to the angle of His where all the attachments of the fundus to the left crus are released. Once this maneuver is completed, a 36-French (F) bougie is introduced by the anesthesiologist and passed down the esophagus, along the lesser curvature through the antrum, to calibrate the diameter of the gastric tube. The LSG is created by applying sequential firings of 60 mm endoGIA staplers (Covidien) tightly abutting the bougie and extending from 6 cm orad to the pylorus to the angle of His. Green (4.8 mm) and blue (3.5 mm) cartridges were used depending on the thickness of the stomach. Intraoperative methylene blue test is performed in all patients to exclude a leak in the staple line. The specimen is retrieved via the 15 mm port, and the fascial defect is closed. No nasogastric tube or abdominal drainage is left in place.

Early postoperative ambulation was strongly encouraged with patients getting out of bed the evening of the surgery. At discharge, detailed dietary instructions were provided. Patients were advised to take daily multivitamins as well as proton pomp inhibitor (PPI) prophylaxis for 1 month. Followup appointments with the surgeon and the dietician were scheduled at 1, 3, 6, and 12 months postoperatively, then twice a year.

Table 1: Patient demographics.

| Variable | Mean ± sd (range) |
|---|---|
| Age | 33 ± 10 (15–60) |
| Gender (F : M) | 105/17 |
| Mean preoperative BMI ($kg/m^2$) | 33 ± 2.5 (30–34.9) |
| Mean preoperative weight (kg) | 91 ± 9.7 (66–121) |
| Mean preoperative excess weight (kg) | 30 ± 6.7 (19–43) |

Table 2: Postoperative data.

| Variables | Number (%) |
|---|---|
| Leakage, abscess, and stricture | 0 |
| Bleeding | 2 (1.6%) |
| Splenic infarction | 1 (0.8%) |
| Pneumonia | 1 (0.8%) |
| 30-day morbidity | 4 (3.2%) |
| Reoperation | 0 |
| Readmission | 1 (0.8%) |
| 30-day mortality | 0 |

## 3. Results

A total of 122 consecutive mildly obese patients were enrolled in the study. Data were analysed prospectively. Patients demographics are shown in Table 1. Eighty-six percent of patients were young women, and 41 (33.6%) of them underwent a previous cosmetic surgery including abdominoplasty in 28 and breast reduction surgery in 13. Comorbidities were detected in 44 (36%) patients.

*3.1. Operative Outcome.* Intraoperative data: all cases were completed laparoscopically with an average operative time (skin to skin) of 58 ± 15 min (range 40–95). No iatrogenic injuries or major intraoperative bleeding occurred. No leaks were identified intraoperatively using the methylene blue test. The mean number of sequential firings of 60 mm endoGIA staplers cartridges was 5 ± 0.45 cartridges (range 4–6). All the patients were monitored in the recovery room and were then transferred to the wards. None were transferred to the intensive care unit.

Postoperative data are shown in Table 2: intra-abdominal bleeding requiring a blood transfusion occurred in 2 patients. One patient reported on postoperative day 2 acute pain originating from the left upper quadrant and radiating to the left shoulder. An abdominal CT scan ruled out a leakage but revealed a 4 cm splenic infarct located at the upper pole of the spleen (Figure 1). Spontaneous resolution of symptoms occurred within 5 days in that case. Another patient presented on postoperative day 7 with fever and left shoulder pain. An abdominal CT scan excluded an intra-abdominal etiology, and a thoracic CT scan revealed a left

Table 3: The mean weight, mean BMI, and mean percentage of weight loss and of excess weight loss at each followup point.

| Month | 0 | 1 | 3 | 6 | 12 | 18 | 24 |
|---|---|---|---|---|---|---|---|
| Weight (kg) | 90.6 ± 9 | 81.3 ± 8.6 | 74.9 ± 8.1 | 70.8 ± 7.1 | 68 ± 7.3 | 68.8 ± 4.3 | 69 ± 5 |
| BMI (kg/m$^2$) | 33.2 ± 2.5 | 30 ± 1.7 | 28 ± 1.9 | 26 ± 1.9 | 24.7 ± 2 | 25.2 ± 2.6 | 25.4 ± 1.9 |
| % weight loss | 0 | 10.3 ± 2.4 | 17.3 ± 2.2 | 21 ± 4.8 | 25.3 ± 5 | 24 ± 5.9 | 23.9 ± 6.4 |
| EWL* | 0 | 31.9 ± 6.3 | 54.6 ± 8.9 | 68 ± 14.5 | 76.5 ± 17 | 75.9 ± 16 | 75.8 ± 18 |

*Calculated using Metropolitan tables.

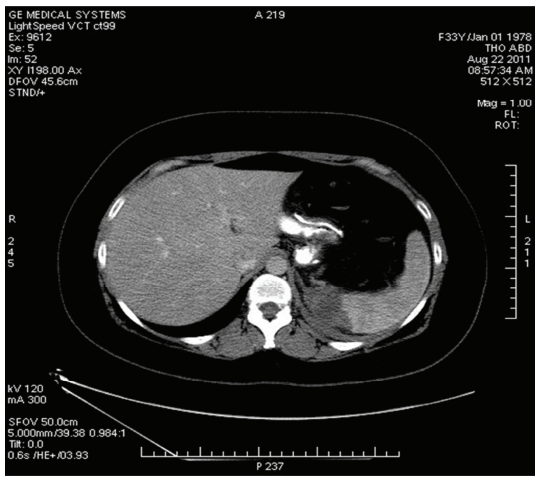


Figure 1: Oral and intravenous contrast abdominal multidetector CT scan showing infarction of the upper-medial part of the spleen and the adjacent gastric sleeve.

pneumonia requiring a readmission to the hospital and intravenous antibiotic therapy. No deaths occurred within 30 days of surgery, and the overall surgical morbidity was 2.4%. There were no leaks, abscesses, or strictures during the postoperative follow-up, and the rate of hemorrhage was 1.6%. The mean length of hospital stay was 43 ± 4.5 hours (range 36–72).

*3.2. Follow-Up.* All patients had a routine multidisciplinary follow-up. The median followup period was 14 months (2–26). Ninety percent of weight loss occurred at 6 months and then stabilized after postoperative month 12 at an EWL value of 76%. The mean preoperative BMI decreased from 33.2 ± 2 to 24.7 ± 2 at 12 months. At that time the mean percentage of weight loss was 25.3% of the initial weight. Followup parameters of weight loss are reported in Table 3. Substantial weight loss occurred in most patients with 96.8% achieving the 50% EWL at 1 year. None of the patients had a BMI drop below 20 kg/m$^2$ or a serum albumin level below the normal range. LSG had a significant effect on resolution (70.5%) or improvement (29.5%) of comorbidities of patients who had achieved at least 6 months follow-up as shown in Table 4. On a satisfaction scale of 1 (very poor) to 5 (excellent), the patient satisfaction scoring for 62 patients achieving at least one year of follow-up was 4.4 ± 0.8 for body image and 4.2 ± 0.6 for food tolerance. Two (3.2%) patients expressed a degree of dissatisfaction with the weight loss results. The

Table 4: Evolution of comorbidities after 6 months of LSG for mildly obese patients.

| Comorbidity | Number of patients (%) | Resolved/improved |
|---|---|---|
| Chronic joint pain | 36 (29.5%) | 25/11 |
| Depression | 35 (28.5%) | 15/20 |
| Irregular menstrual cycle | 22 (18%) | 18/4 |
| Chronic headache | 16 (13%) | 11/5 |
| Stress incontinence | 3 (2.5%) | 2/1 |
| Hyperlipidemia | 15 (12%) | 10/5 |
| Diabetes | 14 (11.5%) | 12/2 |
| Hypertension | 12 (10%) | 10/2 |

procedure was well tolerated clinically, and the patients only encountered episodic emesis or mild reflux, occurring after eating fast or overeating.

## 4. Discussion

LSG is now considered a definitive procedure for the treatment of morbid obesity and type 2 diabetes. LSG is increasingly performed worldwide and represents the bariatric procedure of choice in many countries [1–5]. The third international summit on the current status of sleeve gastrectomy that was held in December 2010 demonstrated that sleeve gastrectomy is successfully performed by laparoscopy in 99.7%, with high leaks rate of 1.3%, low leaks rate of 0.5%, and a mortality rate of 0.1% [13]. More recently, LSG has been shown to be particularly safe and effective for the lower BMI (35–43 kg/m$^2$) population according to the current guidelines for bariatric surgery [6].

However, the current era also demands effective therapies for the relatively moderate obese population. This population was shown to be also at increased risk from obesity-related conditions [11, 12, 14]. This encouraged the introduction of less invasive procedures mimicking the effects of conventional bariatric surgery on weight and comorbidities. Hence, procedures influencing gastric function (intragastric balloons, gastric plication, gastric pacing, and transoral gastric stapling) and procedures bypassing a part of the small intestine (endoluminal duodenojejunal sleeve and gastroduodenojejunal sleeve) were developed. Even though short-term results of some of these techniques are promising, there is insufficient scientific data to support their clinical implementation today [7].

The use of bariatric surgery in patients with BMI of 30 <35 kg/m$^2$ is currently under investigation. Apart from some scarce data concerning LSG in these patients, the current study of LSG in mildly obese patients is one of the few published series [11, 13, 15]. Preliminary studies have demonstrated the benefits and safety of laparoscopic gastric banding (LAGB) in this subgroup [9, 10, 16, 17]. Recently, an FDA panel supported the use of LAGB in the mildly obese population [16]. They consider LAGB as the least invasive and safest bariatric procedure.

However, LSG is safer than LAGB in regards to long-term complications and more effective in term of quality of life and weight loss [18]. LAGB introduces a foreign body and may lead to long-term complications including band erosion or prolapse, requiring band replacement or removal. A recent study comparing quality of life after each procedure has shown that LSG had the highest scores as far as food tolerance and gastrointestinal quality of life [19]. Moreover, LAGB does not decrease plasma ghrelin levels and may result in intolerance for restriction, excessive consumption of sweets, and insufficient weight loss or weight regain [20].

In the current series with low BMI, LSG was straightforward and technically nonchallenging. This was reflected by the short operative time and minimal intraoperative blood loss that compare favorably with other series in the literature [4, 21–23]. This positive correlation between BMI, operative time, and intraoperative blood loss has been previously demonstrated [16]. In addition, the complication rate was low, and recovery was fast as demonstrated by the short length of hospital stay. While intraoperative splenic upper pole discoloration is frequently observed during LSG, symptomatic splenic infarction occurring after LSG has been reported only once in a recent large series [4]. In the present case, the splenic infarct spontaneously resolved. Finally, there were no long-term complications related to LSG.

Several studies have shown that LSG allows a reduction of the preoperative BMI by nearly from 7 to 10 points [4, 23, 24]. This finding is in concordance with our results showing that the mean preoperative BMI was reduced by 8.5 points and therefore dropped to the optimal BMI category of (20.0–24.9 kg/m$^2$). This BMI category has been shown to have the lowest all cause mortality risk and is rarely obtained when surgery is performed on patients with a preoperative higher BMI [25]. In contrast with other studies, none of the patients suffered from excessive weight loss or denutrition [24]. Elevated EWL values could be explained by the low preoperative BMI values in our series.

The comorbidities in the current study were characterized by a low incidence of metabolic syndrome when compared with series based on a higher preoperative BMI. The bulk of comorbidities in our case included chronic joint pain, depression, menstrual irregularities, and chronic headaches. These comorbidities substantially resolved or improved after LSG. The young age, the low incidence of metabolic syndrome, and the relative technical ease of the surgery contributed to the low morbidity in the studied population.

Coupled to weight loss, improved psychosocial status and body image are paramount. Body image had been significantly altered in our patients given the high rate of prior cosmetic surgery performed and depression. Body image dissatisfaction played a major role in the decision for LSG and improved dramatically after surgery, as the majority of patients were satisfied with the final outcome.

Our pilot study showed that LSG performed for mildly obese patients has proved to be technically relatively easy, safe and brought up benefits in term of weight loss, comorbidities, and body image. However, it would be premature on the basis of this study to draw conclusions regarding long-terms benefits and harms of LSG for adults who are not yet morbidly obese.

## Conflict of Interests

All contributing authors declare that they have no conflict of interests.

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