

Sleeve Gastrectomy as a Stand-alone Bariatric Operation for Severe, Morbid, and Super Obesity

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ABSTRACT

Background: The laparoscopic sleeve gastrectomy (LSG) is emerging as an effective bariatric operation and is especially attractive in high-risk populations. In this study we examine the efficacy of LSG as a stand-alone operation in the veteran population.

Methods: This is a retrospective review of consecutive patients who underwent LSG as a stand-alone procedure at the Palo Alto Veterans Affairs medical center with a minimum 12-month follow-up.

Results: Of 205 patients undergoing bariatric surgery, 71 patients had a sleeve gastrectomy, 40 of whom had the operation performed at least 12 months previously. Thirty-six (90%) were available for 1-year follow-up, with a mean follow-up duration of 22 months (range: 12–42), a mean body mass index of 48.3 kg/m², and an 83% male population. Mean percent excess weight loss was 61% at an average of 22 months, with no significant difference between severely obese, morbidly obese, and super obese cohorts. Diabetes remission was seen in 56% of patients, hypertension remission in 51.6%, and obstructive sleep apnea remission in 46.4%, and gastroesophageal reflux disease improved or did not change in 83%. Medication use significantly decreased after surgery.

Conclusion: LSG is safe and effective as a stand-alone bariatric operation in the high-risk veteran population. It is effective in severely obese, morbidly obese, and super obese patients. LSG induces remission or improvement in comorbidities of nearly all patients, translating to a decrease in medication use.

Key Words: Obesity, Sleeve gastrectomy, Bariatric surgery, Veterans, Diabetes, Hypertension, Obstructive sleep apnea, Gastroesophageal reflux.

INTRODUCTION

The problem of obesity in the United States has reached epidemic proportions. It has increased over the past few decades, and it is now estimated that >30% of American adults are obese, and nearly two-thirds are either overweight or obese.^{1,2} The prevalence of severe and morbid obesity (corresponding to a body mass index [BMI] >35 kg/m² and 40 kg/m², respectively) has increased as well. Bariatric surgery, meanwhile, has emerged as the only effective and durable treatment of morbid obesity. Bariatric surgery consistently induces durable weight loss and reliably causes improvement or remission of comorbid diseases, such as diabetes mellitus and hypertension (HTN).^{3–10} The prevalence of obesity is especially high in the veteran population, and veterans are an especially high-risk bariatric surgical group.^{11–13}

Laparoscopic sleeve gastrectomy (LSG), first described as a modification of the biliopancreatic diversion-duodenal switch (BPD-DS), is emerging as a popular operation for the treatment of morbid obesity, with acceptable morbidity and long-term weight loss compared with the laparoscopic Roux-en-Y gastric bypass (LRYGB) and adjustable gastric band (AGB).^{14–16} The advantages of this procedure include lack of an intestinal bypass, thus avoiding gastrointestinal anastomoses, metabolic derangements, and internal hernias, shorter operating times, and no implantation of a foreign body.¹⁷ LSG has a favorable complication profile,^{17–19} making it an especially attractive procedure for higher-risk patients. It has been shown that male gender, advanced age, higher BMI, and the presence of multiple comorbidities are associated with higher risk of morbidity and mortality after bariatric surgery.^{20,23} The bariatric patient presenting to our Veterans Medical Center is typically male, older, heavier, and has more comorbidities than the bariatric cohort in the general population, representing a higher-risk bariatric surgical group.¹² In this study, we examined the efficacy of LSG as a single stand-

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alone bariatric operation in the veteran population, and compared outcomes among severely obese, morbidly obese, and super obese patients.

METHODS

After obtaining institutional review board approval, we reviewed the medical records of consecutive patients who underwent bariatric surgery at the Palo Alto Veterans Affairs (VA) Health Care System. All patients were followed before and after surgery by a dedicated multidisciplinary bariatric team including a bariatrician, bariatric surgeon, dietitian, psychologist, and exercise physiologist. Data for patients who had an LSG and a minimum of 12 months of follow-up were collected. These included patient demographic characteristics, weight, height, and comorbid conditions. After surgery, patients were followed after 2 weeks, 2 months, 6 months, 12 months, and at least annually thereafter.

Surgical Procedure

All operations were performed laparoscopically under general anesthesia, with the patient in the supine position. We used a 5-port technique with the bed in the reverse-Trendelenburg position. The division of the vascular supply to the greater curvature of the stomach was begun 6 cm proximal to the pylorus and continued to the angle of His, using the LigaSure device (Covidien, Norwalk, CT). The gastrectomy was performed using an Echelon Flex stapler (Ethicon, Somerville, NJ). The sleeve volume was calibrated to an intraluminal 36-Fr endoscope. The green staple load (4.1/60 mm) was used for the first 3 staple firings, followed by gold staple loads (3.8/60 mm) to complete the sleeve. SeamGuard (W.L. Gore, Flagstaff, AZ) buttressing strips were used to reinforce the staple line. The proximal resection line was performed 1 cm to the left of the angle of His. An endoscopic air-leak test was routinely performed at the conclusion of the operation, and an upper gastrointestinal contrast study was performed on the first postoperative day before introduction of oral liquid nutrition. All patients were discharged on a standard liquid diet.

Statistical Analysis

Group comparisons were performed using multiple regression and linear regression analyses, using Stata 11.0 software (StataCorp, College Station, TX); portions of the means were compared using the χ^2 test.

RESULTS

Of the 205 patients who underwent bariatric surgery, 71 patients had an LSG, of whom 40 had the operation performed at least 12 months previously. Thirty-six (90%) were available for 1-year follow-up, with a mean follow-up duration of 22 months (range: 12–42). Thirty of the patients (83%) were male and had a mean age of 53 years at the time of surgery. Patients with type 2 diabetes represented 50% of the cohort, 84% had HTN, 78% had obstructive sleep apnea, and 67.5% carried a diagnosis of gastroesophageal reflux disease (GERD) (**Table 1**). Overall, patients had a mean of 5.2 preoperative comorbid conditions, a mean calculated age-modified, Charlson comorbidity index score of 3, and were taking an average of 6.2 medications.

The mean BMI was 48.3 kg/m²: 25% were severely obese (BMI 35–39 kg/m²), 31% were morbidly obese (BMI 40–49 kg/m²), and 44% were super obese (BMI >50 kg/m²).

Early postoperative complications included urinary tract infection (2.8%), urinary retention (8.4%), prolonged nausea (8.4%), and refractory HTN in 2.8%. There was 1 postoperative staple-line leak (2.8%) identified 8 months after surgery in the distal sleeve and treated with partial gastrectomy. One patient had intraoperative bleeding from a splenic capsular tear that required conversion to

Table 1.
Patient Characteristics

	Total	BMI 35–39 kg/m ²	BMI 40–49 kg/m ²	BMI 50+ kg/m ²
N	36	9 (25%)	11 (31%)	16 (44%)
M/F (%)	83/17	88/12	55/45	94/6
Age (y)	53	57	51	52
Preoperative BMI (kg/m ²)	48.3	38.0	43.7	56.3
No. comorbidities	5.2	5.0	5.7	5.0
DM (%)	18 (50)	5	6	7
HTN (%)	31 (84)	8	11	12
OSA (%)	28 (78)	6	11	14
GERD (%)	24 (67.5)	5	9	10

M = male; F = female; BMI = body mass index; DM = diabetes mellitus; HTN = hypertension; OSA = obstructive sleep apnea; GERD = gastroesophageal reflux disease.

open for control. All other operations were completed laparoscopically. There was no perioperative mortality.

The mean percent excess weight loss (%EWL) for the entire group was 61% at a mean follow-up of 22 months (**Table 2**). Although the mean %EWL was highest for the cohort with a BMI of 35 to 39 kg/m² (71%), this was not statistically significant (morbidly obese cohort 60% EWL, super obese cohort 56% EWL; *P*=.113).

Total medication usage decreased from a mean of 6.2 to 3.8 (*P*=.002). Reduction of medication usage postoperatively correlated strongly with a preoperative diagnosis of diabetes. In addition, a negative relationship between percentage of excess weight loss and a previous diagnosis of diabetes was identified. The presence of a previous diagnosis of diabetes was the strongest single negative predictor of %EWL. This finding is associated with a predicted 17.1-point reduction in the percentage of EWL for patients with a previous diagnosis of diabetes relative to patients without diabetes (95% CI=2.16–32.03%; *P*=.026).

Of the diabetic patients undergoing LSG, 56% had complete remission of diabetes (100% of patients had improvement or remission) (**Table 3**). The super obese cohort had the largest percentage of diabetes remission (71.4%). HTN resolved in 51.6% of the patients, whereas 46.4% of the patients with obstructive sleep apnea had complete resolution. Of the 24 patients with a diagnosis of

GERD, GERD symptoms worsened in 17% after LSG, improved in 25%, and did not change in the majority (58%).

DISCUSSION

LSG is increasing in popularity, and, despite limited long-term data, it is accepted as a safe and effective bariatric operation and is especially attractive for the higher-risk patient.²¹ The higher-risk patient is characterized by male gender, increased age, and the presence of comorbidities such as diabetes and HTN.^{22,23} We found the use of LSG as a stand-alone bariatric procedure to be highly effective in the US veteran population. This is especially significant because the prevalence of obesity among American veterans is especially high. Three in 4 male veterans are overweight or obese, and the prevalence of overweight and obesity among veterans who use VA outpatient facilities is higher than in the general population.³² This veteran population is often a challenging bariatric surgical group, representing a mostly male older cohort, with multiple comorbidities, compared with the general bariatric population.¹³ Older age and male gender—both characteristics of the veteran bariatric surgical patient—are associated with adverse outcomes after bariatric surgery.²³ In addition, the bariatric patients at the Palo Alto VA center described in this study were referred to our surgical center from great distances, averaging more than 300 miles, posing specific challenges for postoperative follow-up and treatment of late complications. Nonetheless, with a mean follow-up of 22 months in this study, we have shown %EWL that compares favorably with multiple published results in the nonveteran population undergoing LSG.^{16,17,24} Residing a large distance from the medical and surgical center is typical of VA patients but less common in the general population. For this reason, it is valuable to identify a durable and effective operation that has low early and late morbidity for veteran patients who may not be able to easily access their bariatric surgical team because of geographic limitations. This makes the LSF as a stand-alone operation especially attractive in this patient population.

Unlike the patients described in this study, large series of LSG as a stand-alone procedure in the literature typically describe a population that is mostly female and younger with a lower BMI than the average veteran bariatric population.³³ To our knowledge, this is the first study to describe LSG as a stand-alone operation in veterans. Our reported mean EWL compares favorably with published results but is slightly less than the %EWL documented in the general population. This may be a result of the demographic characteristics of the veteran patients, as described previously.

Table 2.

Percent Excess Weight Loss for Each Weight Classification

	Total	BMI 35–39 kg/m ²	BMI 40–49 kg/m ²	BMI 50+ kg/m ²	<i>P</i> Value
%EWL	61%	71%	60%	56%	.113

%EWL = percent excess weight loss.

Table 3.

Postoperative Remission of Comorbidities

	Remission (%)	Improvement or Remission (%)
DM	56.0	100
HTN	51.6	87
OSA	46.4	100

DM = diabetes mellitus; HTN = hypertension; OSA = obstructive sleep apnea.

We found that the preoperative obesity classification, patient gender, patient age, and presence of other preoperative comorbidities, other than diabetes, had no statistically significant effect on %EWL. The efficacy of LSG as a stand-alone weight loss operation in the veteran population was seen in all BMI ranges. In comparing the results in patients with severe obesity, morbid obesity, and super obesity, we found that LSG as a stand-alone procedure was most effective in the cohort with a BMI of 35 to 39 kg/m², but this was not statistically significant. However, we did note that more patients in this group were able to achieve a normal BMI after LSG than patients in other groups. This suggests that in addition to the morbidly and super obese groups, the LSG is a very effective stand-alone operation for the severely obese population. All but one of the patients with BMI >50 kg/m² were satisfied with total weight loss after a minimum of 1 year. Despite a high satisfaction rate overall, it appears that it may be difficult for the super obese population to reach a BMI <30 kg/m² with LSG alone. Chopra et al²⁵ found similar results 24 months after surgery, with a greater %EWL in the cohort of patients with a BMI <50 kg/m² compared with those with BMI >50 kg/m², although their results were not statistically significant. In this study, we also showed that there is no significant difference between the morbidly obese and the severely obese.

We found that LSG alone also resulted in significant improvement in obesity-related comorbid conditions, in a manner similar to that seen with the general population undergoing LSG, and compares favorably with patients undergoing LRYGB.²⁶ Nearly all patients with diabetes, HTN, or obstructive sleep apnea saw improvement in their comorbidities, and a large proportion had complete remission. This was seen in all weight categories. Casella et al²⁷ demonstrated that duration of diabetes for >10 years before surgery predicts lower rates of complete remission postoperatively. It is possible that we saw this effect in our study population because only 56% had complete remission of type 2 diabetes. Interestingly, 50% of the diabetic patients in this study were taking injectable insulin preoperatively, but in this relatively small cohort it did not correlate with lack of remission postoperatively.

There is disagreement in the literature with respect to the effect of LSG on GERD symptoms.^{25,28,29} In the present study, we found that a minority of patients had exacerbation of GERD symptoms, whereas most of the patients had no change in GERD symptoms.

Overall improvement in comorbidities translated to a significant decrease in total medication requirements after

surgery in all weight groups. LSG has previously been shown to decrease diabetes and HTN medication requirements after surgery.³⁰ In this study, we demonstrated a decrease in all medications, although we excluded vitamin supplements.

There were no mortalities, and there was a favorable complication profile. We had a single leak in the postoperative period, also comparing favorably with published results.²⁴ Interestingly, our leak presented several months after surgery and was identified in the distal portion of the gastric sleeve. This is in contrast to most reported leaks that are identified in the proximal stomach and often take a long time to heal.³¹ Because of the location in this specific case, we treated the leak by partial gastrectomy and drainage. Other complications appeared in the immediate postoperative period and were easily treated with nonoperative measures.

CONCLUSION

LSG is safe and effective as a stand-alone bariatric treatment in members of the high-risk veteran population group who are severely, morbidly, and super obese. In addition, LSG induces remission or improvement in comorbidities of nearly all patients and in all obesity categories, translating to a decrease in medication use.

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