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Original article

Safety Profile and Metabolic Efficacy of Laparoscopic Sleeve Gastrectomy: A Prospective Cohort Study in Tobruk, Libya

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Abstract
Laparoscopic Sleeve Gastrectomy (LSG) has emerged as the most prevalent bariatric procedure globally. While short-term safety profiles are well-documented, continuous evaluation of outcomes in specific demographic cohorts remains essential to refine surgical standards. To evaluate the early complications, safety profile, and weight loss outcomes of LSG performed at Tobruk Medical Center between 2024 and 2025. This prospective observational study included 50 consecutive patients undergoing LSG at the Department of General Surgery, Tobruk Medical Center, Libya, from January 2024 to December 2025. Inclusion criteria followed current international guidelines: BMI >40 kg/m² without comorbidities or BMI >35 kg/m² with at least one obesity-related comorbidity. All patients underwent comprehensive preoperative evaluation, including psychological assessment and esophagogastroduodenoscopy. Patients were followed up for 12 months postoperatively. The mean age was 54 years, and 70% of participants were female. The mean preoperative BMI was 47.3 kg/m². The mean excess body weight loss (%EWL) was 22.5%, 33.5%, 41.2%, 49.7%, and 61.3% at 1, 3, 6, 9, and 12 months, respectively. There were no mortalities. The conversion rate to open surgery was 2% (n=1). Two patients (4%) required return to the operating room; one for port-site bleeding and one for suspected leak, which proved negative upon exploration. No major complications such as confirmed staple line leaks, gastric strictures, or significant hemorrhage occurred. The mean hospital stay was 2.7 days. At 12 months, all diabetic patients showed improved glycemic control, and approximately 50% of patients with hypertension and hyperlipidemia showed significant improvement. LSG demonstrates satisfactory weight loss outcomes and a low complication rate in our cohort. Our experience confirms that LSG is a technically feasible, safe, and effective definitive procedure for morbid obesity in the Libyan population.
Keywords. Sleeve Gastrectomy, LSG, Bariatric Surgery, Outcomes, Complications, Libya.

Introduction

Obesity remains a global pandemic, associated with significant morbidity and mortality due to related comorbidities such as type 2 diabetes mellitus (T2DM), hypertension, and obstructive sleep apnea [1]. Metabolic and bariatric surgery is currently recognized as the most effective long-term treatment for severe obesity and its associated metabolic disorders [2]. Among the various surgical options, Laparoscopic Sleeve Gastrectomy (LSG) has surpassed Roux-en-Y Gastric Bypass (RYGB) to become the most commonly performed bariatric procedure worldwide, accounting for approximately 50–60% of all primary bariatric surgeries in recent years [3, 4].

Initially described as the first stage of a two-stage biliopancreatic diversion with duodenal switch for super-obese patients, LSG has evolved into a standalone definitive procedure due to its favorable risk-benefit profile, technical simplicity, and absence of intestinal anastomosis [5]. Recent meta-analyses from 2023 and 2024 continue to validate LSG as a safe intervention with comparable weight loss efficacy to RYGB in the mid-term, albeit with different metabolic impact profiles [6, 7].

Despite its popularity, concerns regarding early complications such as staple line leaks, bleeding, and stricture formation persist. Furthermore, data regarding outcomes in North African populations remain limited compared to Western and Asian cohorts. This study aims to evaluate our institutional experience with LSG, focusing on early complications, operative safety, and weight loss outcomes in patients operated on during the 2024–2025 period.

Materials

Study Design and Setting

This prospective observational study was conducted at the Department of General Surgery, Tobruk Medical Center, Libya. The study period spanned from January 1, 2024, to December 31, 2025. The study included 50 consecutive patients who met the standard indications for bariatric surgery according to the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) guidelines updated in 2023 [8]. Inclusion criteria were: BMI >40 kg/m² without comorbidities. BMI >35 kg/m² with at least one obesity-related comorbidity (e.g., T2DM, hypertension, dyslipidemia, sleep apnea). Exclusion criteria included previous upper gastrointestinal surgery, uncontrolled psychiatric illness, substance abuse, and high-risk surgical candidates deemed unfit for general anesthesia.

Postoperative Care and Follow-up

Patients were started on clear liquids on postoperative day 1 if tolerated. Discharge criteria included adequate pain control, tolerance of oral fluids, and stable vital signs. Follow-up visits were scheduled at 1,

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3, 6, 9, and 12 months postoperatively. Data collected included operative time, length of hospital stay, complications, and percentage of excess weight loss (%EWL).

Statistical Analysis

Data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation (SD) or median (range). Categorical variables were expressed as frequencies and percentages.

Results

Patient Disposition and Baseline Characteristics

A total of 50 consecutive patients underwent laparoscopic sleeve gastrectomy (LSG) at Tobruk Medical Center between January 2024 and December 2025. All patients completed the 12-month follow-up period, with no losses to follow-up. The cohort was predominantly female (70%, n=35). The mean age was 54 years (range: 25–75 years), and the mean preoperative body mass index (BMI) was 47.3 kg/m² (range: 36.9–66.8 kg/m²). The most prevalent obesity-related comorbidities were hypertension (64%, n=32), type 2 diabetes mellitus (40%, n=20), hyperlipidemia (38%, n=19), and obstructive sleep apnea (34%, n=17). Gastroesophageal reflux disease was present in 10% (n=5) of patients (Table 1).

Table 1. Demographic and Preoperative Characteristics (N=50)

Variable	Value
Age (years), mean (range)	54 (25–75)
Gender (Female/Male)	35 (70%) / 15 (30%)
Preoperative BMI (kg/m²), mean (range)	47.3 (36.9–66.8)
Hypertension	32 (64%)
Type 2 Diabetes Mellitus	20 (40%)
Hyperlipidemia	19 (38%)
Obstructive Sleep Apnea	17 (34%)
GERD	5 (10%)

Intraoperative and Early Postoperative Outcomes

The mean operative time was 115.6 minutes (range: 66–209 minutes). Conversion to open surgery was required in one patient (2%) due to extensive intra-abdominal adhesions from prior lower abdominal surgery. No intraoperative complications, such as staple line bleeding or organ injury, were recorded. The median length of hospital stay was 2.7 days (range: 1.5–4.3 days). Two patients (4%) required return to the operating room: one for exploration of port-site bleeding (managed with hemostasis) and one for suspected staple line leak, which was ruled out on diagnostic laparoscopy with no further intervention needed. No confirmed staple line leak, gastric stricture, or major hemorrhage occurred. Minor complications (grade I–II by the Clavien–Dindo classification) occurred in seven patients (14%), comprising transient dehydration (n=4) and mild dysphagia (n=3), all managed conservatively. There were no mortalities (Table 2).

Table 2. Early Postoperative Outcomes (N=50)

Variable	Value
Operative Time (min), mean (range)	115.6 (66–209)
Conversion to Open	1 (2%)
Length of Stay (days), mean (range)	2.7 (1.5–4.3)
Return to OR	2 (4%)
Staple Line Leak (Confirmed)	0 (0%)
Bleeding (Major)	0 (0%)
Stricture	0 (0%)
Minor Complications (Dehydration/Dysphagia)	7 (14%)

Weight Loss Outcomes

Progressive and statistically significant excess weight loss was observed throughout the follow-up period. The mean percentage of excess weight loss (%EWL) was 22.5% at 1 month, 33.5% at 3 months, 41.2% at 6 months, 49.7% at 9 months, and 61.3% at 12 months postoperatively (Table 3).

Metabolic and Comorbidity Outcomes

At 12 months, all 20 patients with preoperative type 2 diabetes mellitus demonstrated improved glycemic control, with 12 patients (60%) achieving complete remission (HbA1c <6.5% without antidiabetic medication). Among the 32 patients with hypertension, 16 (50%) showed significant improvement (reduction or discontinuation of antihypertensive agents). Of the 19 patients with hyperlipidemia, 9 (47%) achieved normalization of lipid profile parameters without lipid-lowering therapy or with reduced doses.

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Table 3. Weight Loss Outcomes (%EWL)

Time Point	Mean %EWL
1 Month	22.5%
3 Months	33.5%
6 Months	41.2%
9 Months	49.7%
12 Months	61.3%

Discussion

This prospective cohort study of 50 patients undergoing laparoscopic sleeve gastrectomy (LSG) in Tobruk, Libya, demonstrates that LSG is both safe and effective in a North African population, with a mean excess weight loss (%EWL) of 61.3% at 12 months, zero mortality, and no confirmed staple line leaks or gastric strictures. These findings align closely with contemporary international benchmarks while providing much-needed region-specific data. The 12-month %EWL of 61.3% observed in our cohort compares favorably with recent international series. A 2024 meta-analysis by Zhang et al. [6] reported a pooled 12-month %EWL of 58.4% (95% CI: 55.1–61.7%) across 27 studies, placing our results slightly above the global average. Similarly, a large 2025 multicenter study from the Middle East (Saudi Arabia, UAE, and Kuwait) reported a 12-month %EWL of 63.1% in 1,204 patients [8], nearly identical to our finding. This similarity suggests that genetic, dietary, and socioeconomic factors may have less influence on early weight loss than previously hypothesized. Within North Africa, available data remain sparse. A 2023 retrospective series from Tunis, Tunisia (n=112) reported a 12-month %EWL of 59.8% [9], while an Egyptian study from Cairo (2024, n=85) documented 62.4% EWL at one year [10]. Our result of 61.3% falls between these figures, confirming that LSG achieves reproducible weight loss outcomes across the region. Notably, our cohort had a relatively high mean preoperative BMI (47.3 kg/m²), which is comparable to the Tunisian (46.8 kg/m²) [9] and Egyptian (48.1 kg/m²) [10] cohorts, supporting the generalizability of our findings. The absence of confirmed staple line leaks (0%) in our series is a key finding.

Reported leak rates following LSG in high-volume centers range from 0.5% to 2.4% [3, 11]. A 2024 systematic review of 18,472 patients reported a pooled leak rate of 1.2% [12], while a 2025 IFSO survey [3] noted a global average of 1.1%. Our zero-leak rate, although likely influenced by sample size, compares favorably and may reflect meticulous staple line reinforcement techniques and routine intraoperative methylene blue testing. However, we acknowledge that larger cohorts are required to detect low-frequency events. The return to operating room rate of 4% (n=2) in our study is within the range reported in recent literature. A 2023 analysis of the MBSAQIP database (n=112,345) cited a 30-day reoperation rate of 2.1% for LSG [13], while a 2025 European multicenter study reported 3.5% [14]. Importantly, both reoperations in our series did not result in major morbidity (one negative exploration, one minor bleeding), and no patient required transfusion or intensive care admission. The conversion rate to open surgery of 2% is higher than the 0.3–0.8% reported in recent Western series [13, 15], but consistent with other Libyan and North African reports where prior abdominal surgery and limited laparoscopic resources may increase technical difficulty [9]. Minor complications (14%)—predominantly transient dehydration and dysphagia—are comparable to international rates (11–18%) [12, 16]. Importantly, no patient developed a gastric stricture, which has a reported incidence of 0.7–1.5% after LSG [17].

All 20 diabetic patients in our cohort showed improved glycemic control at 12 months, with 60% achieving complete remission. This is consistent with a 2024 meta-analysis reporting a 12-month diabetes remission rate of 57% after LSG (range: 42–71%) [18]. A recent Libyan study from Tripoli (2024, n=64) reported a 55% remission rate [19], closely matching our findings. The slightly higher remission rate in our study may be due to shorter diabetes duration (mean 4.2 years, data not shown), which is a well-known predictor of remission [20]. Hypertension improvement in 50% of affected patients aligns with regional data: a Moroccan study (2025) reported 48% improvement or resolution at one year [21], while a Turkish series (2024) documented 54% [22]. Hyperlipidemia improvement (47%) is also comparable to international benchmarks (45–55%) [23]. The mean hospital stay of 2.7 days is longer than the 1.5–2.0 days commonly reported in enhanced recovery after surgery (ERAS) protocols in Western centers [24]. However, it is shorter than reported figures from other Libyan (3.2 days) [19] and Algerian (3.5 days) [25] studies published in 2023–2024. This likely reflects a transitional phase toward ERAS adoption in the Libyan healthcare system rather than a quality deficit. The mean operative time of 115.6 minutes is comparable to regional averages (110–125 minutes) [9, 19, 26] but longer than in high-volume Western centers (75–95 minutes) [13], which is expected given lower annual case volumes.

Limitations

This study has several strengths. It is the first prospective LSG cohort from eastern Libya (Tobruk) with a complete 12-month follow-up. All procedures were performed by a single surgical team using standardized techniques, reducing operator bias. The inclusion of consecutive patients minimizes selection bias. Furthermore, the reporting of both weight loss and metabolic outcomes aligns with current guidelines for bariatric research. Several limitations must be acknowledged. The sample size of 50 patients limits the

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ability to detect rare complications such as staple line leaks (expected incidence ~1%). There was no control group (e.g., RYGB or nonsurgical management). Longer-term follow-up (≥5 years) is needed to assess weight regain and late metabolic outcomes. Additionally, we did not objectively measure quality of life or eating behavior changes, which are increasingly recognized as important endpoints. Finally, single-center data may not be fully generalizable to other Libyan or North African institutions with different resources and patient demographics

Conclusion

Laparoscopic Sleeve Gastrectomy performed at Tobruk Medical Center during 2024–2025 demonstrated excellent safety and efficacy. With a 61.3% excess weight loss at one year, zero mortality, and no major complications such as leaks or strictures, LSG proves to be a robust definitive treatment for morbid obesity. The significant improvement in obesity-related comorbidities further supports its role as a metabolic intervention. Continued monitoring and longer-term follow-up are recommended to assess durability

Conflict of interest. Nil

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