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Outcomes Of Laparoscopic Sleeve Gastrectomy with The Application of Antireflux Mechanisms in Patients with Obesity

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Abstract

Obesity is a rapidly escalating global health crisis, with prevalence rates rising across all income levels and geographical regions. According to the World Health Organization (WHO), Obesity has been estimated that 1 billion people globally will be living with obesity by 2030. Countries will not only miss the 2025 World Health Organization (WHO) target to halt the rise in obesity at 2010 levels, but the number of people with obesity is expected to double across the globe by 2035. However, optimal surgical technique, complication prevention, and individualized patient selection remain critical determinants of success. **Objective:** The present study aimed to evaluate the clinical efficacy of a patient-specific approach to laparoscopic sleeve gastrectomy (LSG), with a focus on mitigating intraoperative risks, enhancing surgical ergonomics, and improving postoperative weight-loss outcomes.. **Methods:** A prospective cohort study was conducted in 2024 at Tashkent State Medical University, enrolling 85 patients with a body mass index (BMI) ≥35 kg/m² undergoing LSG. A tailored perioperative protocol was implemented, incorporating comprehensive preoperative anthropometric profiling, software-assisted individualized trocar placement, intraoperative positioning optimized according to oxygen saturation parameters, and the utilization of a custom-engineered triple-balloon bariatric orogastric tube. Primary endpoints included operative

time, intraoperative blood loss, postoperative morbidity, and excess weight loss (EWL) at 6 and 12 months post-surgery. **Results:** Operative duration demonstrated a consistent reduction across obesity classes (Class II: 52 ± 6.1 min; Class III: 74 ± 10.7 min). Intraoperative blood loss remained minimal, not exceeding 100 ml in any case, with 94% of patients exhibiting blood loss ≤50 ml. At 6 months, mean EWL reached 61.7%, further increasing to 82.7% at 12 months. Significant metabolic improvements were observed, including normalization of fasting glucose levels. Early postoperative complications were infrequent and predominantly minor, including nausea and vomiting (12.3%) and a single case of conservatively managed bleeding. No instances of gastric stenosis, staple-line leakage, or mortality were reported. **Conclusion:** A personalized approach to LSG—integrating patient-specific anthropometric planning, precision-guided trocar placement, and triple-balloon calibration—was associated with improved operative performance, reduced complication rates, and superior weight-loss and metabolic outcomes. These findings underscore the importance of individualized surgical strategies in optimizing both the safety and effectiveness of bariatric interventions.

Keywords: Bariatric surgery, Laparoscopic sleeve gastrectomy, Obesity, Triple-balloon orogastric tube Trocar placement, Weight loss outcomes

Introduction

Obesity is a rapidly escalating global health crisis, with prevalence rates rising across all income levels and geographical regions. According to the World Health Organization (WHO), Obesity has been estimated that 1 billion people globally will be living with obesity by 2030. Countries will not only miss the 2025 World Health Organization (WHO) target to halt the rise in obesity at 2010 levels, but the number of people with obesity is expected to double across the globe by 2035. However, optimal surgical technique, complication prevention, and individualized patient selection remain critical determinants of success. Obesity has emerged as one of the most significant global health challenges of the 21st century,

representing a rapidly expanding epidemic with profound medical, social, and economic consequences

A high body mass index (BMI) has been consistently identified as an independent predictor of morbidity and mortality. Large-scale epidemiological studies demonstrate that each 5 kg/m² increase in BMI is associated with approximately a 30–31% rise in all-cause mortality risk. In addition, severe obesity (BMI ≥40 kg/m²) is linked to a reduction in life expectancy of approximately 8–10 years, primarily due to cardiovascular disease, type 2 diabetes mellitus, respiratory dysfunction, and obesity-related malignancies. Laparoscopic sleeve gastrectomy (LSG) has become one of the most frequently performed restrictive bariatric procedures owing to its technical feasibility, reproducibility, and favorable balance between efficacy and safety. Despite these advantages, the procedure remains technically demanding, particularly in patients with elevated body mass index (BMI). In such cases, precise trocar positioning, optimal intraoperative visualization, and maintenance of a uniform gastric sleeve diameter represent essential determinants influencing surgical efficiency and postoperative outcomes.

Within our clinical practice, an individualized LSG protocol was developed and implemented, integrating patient-specific anthropometric assessment, algorithm-based optimization of trocar placement, and the application of a specially engineered triple-balloon bariatric orogastric calibration tube. This tailored approach was designed to improve surgical accuracy, minimize intraoperative and postoperative complications, and facilitate enhanced postoperative recovery. The present study evaluates the safety and clinical effectiveness of this personalized surgical strategy in a cohort of 85 patients who underwent bariatric surgery in 2024.

Materials and Methods

A prospective observational study was conducted at the multidisciplinary clinic of the Tashkent state Medcal University Department of General and Hospital Surgery, over a 12-month period from January to December 2024. During this interval, 85 patients underwent bariatric surgical treatment, with laparoscopic sleeve gastrectomy (LSG) constituting the predominant operative procedure.

Study eligibility included adult patients aged 20–65years presenting with a body mass index (BMI) ≥35 kg/m² who demonstrated insufficient weight reduction following structured conservative management, including dietary, behavioral, and medical interventions. Patients were excluded if they had active peptic ulcer disease, obesity attributable to endocrine pathology, coagulation disorders, or decompensated systemic comorbid conditions that increased perioperative risk. The study cohort consisted of 68women (80%) and 17 men (20%). Based on BMI, 36 patients (42.3%) as Class II obesity (BMI 35–40 kg/m²), and 49 patients (57.6%) as Class III obesity (BMI ≥40 kg/m²). Common comorbidities included cholelithiasis in 16patients (18.8%), abdominal wall hernias in 8 (9.4%), and musculoskeletal disorders in 40(47%). Hypertension was diagnosed in 66patients (77.6%), dyslipidemia in 71 (83.5%), impaired glucose tolerance in 38 (44.7%), and chronic lymphovenous insufficiency in 65 (76.4%). All patients underwent preoperative optimization of comorbid conditions under the supervision of endocrinologists, cardiologists and anesthesiologists.Standard laboratory tests were performed, with particular attention to biochemical markers. Upper gastrointestinal endoscopy was performed to exclude peptic ulcer disease and other contraindications.

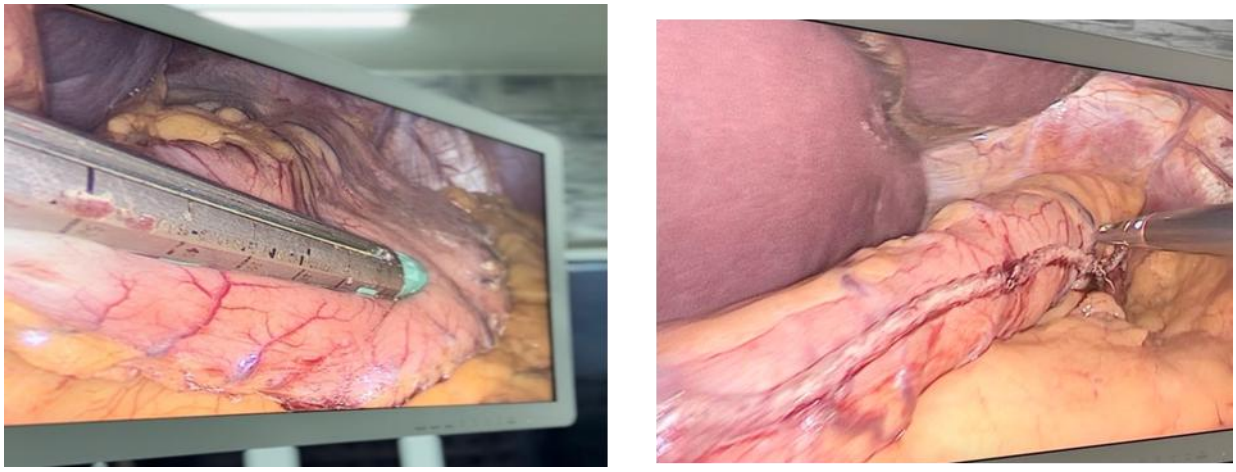

Figure 1. Placement of the stapling device during pyloric separation in LSG and the formation of the tubular stomach.

All laparoscopic sleeve gastrectomies were carried out under general anesthesia with endotracheal intubation. Pneumoperitoneum was

achieved using a Veress needle inserted 15 cm below the epigastrium and slightly left of the midline. Laparoscopic visualization was facilitated by a 10-mm optical trocar, and four additional working trocars were positioned following a clinic-specific protocol based on patients' anthropometric measurements.

Optimal patient positioning was determined using a proprietary algorithm to adjust the reverse Trendelenburg tilt, improving both surgical exposure and pulmonary function. The stomach's greater curvature was dissected with a LigaSure vessel-sealing device, extending from just above the pylorus to the fundus, including division of the gastrocolic and gastrosplenic ligaments.

A custom triple-balloon bariatric orogastric tube (36 Fr) was placed along the lesser curvature to guide sleeve sizing. Sequential 60-mm linear stapler firings were applied alongside the calibration tube, from 2–3 cm above the pylorus to the angle of His, forming a consistent tubular gastric lumen approximately 2–3 cm in diameter. The staple line was reinforced with continuous 2-0 Vicryl seromuscular sutures, followed by leak testing and removal of the excised stomach segment

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Figure 3. **Triple-balloon bariatric orogastric tube used in LSG.**

Our triple-balloon bariatric tube is made of silicone, with three independently inflated balloons for secure fixation, uniform sleeve

shaping, and prevention of postoperative stenosis and gastroesophageal reflux.

Results

Due to the minimally invasive nature of laparoscopic surgery, most patients were mobilized within the first postoperative day despite the complexity of the procedures. Technical challenges in LSG were more pronounced among less experienced surgeons, particularly regarding optimal trocar placement, which must be tailored to each patient's body habitus. Our proprietary software for determining trocar placement and patient positioning significantly improved operative ergonomics.

The mean operative times varied according to obesity class: Class II – 52 ± 6.1 minutes, and Class III – 74 ± 10.7 minutes, representing a substantial reduction compared to standard approaches.

Table 2. Duration of LSG surgical procedures in patients

Obesity classes	Time, minutes, control group	Time, minutes, main group	t-student
Class II	72 ±11,3	58±8,1	1,007
Class III	94 ±12	74±10,7	1,431

Intraoperative blood loss did not exceed 100 ml in any case, with 94.1% of patients losing ≤50 ml.

Table 2. Comparative analysis of weight loss at 6 months and 1 year after surgery

Postoperative period	Average preoperative patient weight, kg	Average postoperative patient weight, kg	BMI Before	BMI after	Weight loss	
			kg/m^2	kg/m^2	kg	%EWL
6 month	130,4±17,6	92,6±6,6	47,2±4,6	34,8±2,2	37,8±6,2	61,7±3,4
1year	130,4±17,6	76,1±4,2	47,2±4,6	26,8±2,2	54,3±6,8	82,7±4,2

The average preoperative weight was 130.4 ± 17.6 kg. At six months, the mean weight loss was 37.8 ± 6.2 kg (61.7% excess weight loss), and at 12 months, 54.3 ± 6.8 kg (82.7% excess weight loss). Significant improvements were observed in metabolic parameters: fasting glucose decreased from 5.7 ± 0.3 mmol/L preoperatively to 4.5 ± 0.3 mmol/L at 12 months; glycated hemoglobin decreased from 5.4 ± 0.2% to 5.0 ± 0.2%. ALT and AST levels normalized within one year.

Table 3. Comparative analysis of EGD results in both patient groups.

RE Grade	Before Surgery	After Surgery
I	47% (n=40)	27% (n=23)
II	18.8% (n=16)	5.8% (n=5)
III	0	0
IV	0	0

In the main study group, where surgery was performed using refined techniques and a calibration tube, 85patients were treated. Before surgery, 40 patients (47%) had grade I RE and 16 patients (18.8%) had grade II RE. Following the intervention, these numbers significantly decreased to 23(27%) and 5 (5.8%), respectively, demonstrating the effectiveness of the individualized approach in reducing postoperative esophageal reflux.

Postoperative complications were minimal: nausea and vomiting occurred in 10.3% of patients, predominantly in the first three days and resolved with conservative therapy. One patient (1.1%) experienced postoperative bleeding managed non-operatively. No cases of anastomotic leak, stenosis, wound infection, pulmonary embolism, pneumonia, or mortality were recorded.

Discussion

This study demonstrates that individualized laparoscopic sleeve gastrectomy, incorporating patient-specific anthropometric data, optimized trocar placement, and the use of a triple-balloon calibration tube, results in improved surgical ergonomics, reduced operative time, and minimized blood loss. Our findings align with previous literature

highlighting the importance of precise gastric tube formation in preventing postoperative stenosis and reflux.

The use of the triple-balloon bariatric orogastric tube proved beneficial in maintaining uniform sleeve diameter and reducing the incidence of postoperative functional disorders. Furthermore, the integration of preoperative software algorithms for trocar positioning and reverse Trendelenburg angle adjustment enhanced visualization and access in patients with high BMI, addressing one of the main technical challenges in bariatric surgery.

Compared to standard LSG techniques reported in other studies, our approach yielded lower rates of early postoperative complications, particularly regarding gastrointestinal symptoms, and no recorded stenosis cases. The sustained weight loss and improvement in metabolic parameters observed at one year are consistent with the expected benefits of LSG and confirm the effectiveness of the individualized modifications applied in our practice.

Conclusion

1. Optimizing patient positioning and trocar placement according to individual anthropometric parameters improves visualization and reduces these risks.
2. The use of the triple-balloon bariatric orogastric tube decreased the incidence of postoperative reflux esophagitis from 65.7% to 33% and completely prevented stenosis. Average excess weight loss at one year reached 83%.
3. Preoperative individualized planning, including positioning and trocar placement, limited intraoperative blood loss to ≤100 ml in all patients and reduced the incidence of blood loss between 50–100 ml to 6.9%. No cases required trocar repositioning.

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