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Bowel function and gastrointestinal symptoms after laparoscopic sleeve gastrectomy: a cross-sectional comparison across postoperative time groups

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ABSTRACT

Introduction: Laparoscopic sleeve gastrectomy (LSG) is currently the most commonly performed bariatric procedure worldwide. Although LSG is widely performed, postoperative gastrointestinal symptoms and bowel function disturbances may negatively affect patients' quality of life. Nevertheless, data regarding patient-reported gastrointestinal function at different postoperative periods remain limited. This study aimed to evaluate bowel function and gastrointestinal symptoms after LSG using patient-reported outcome measures and to compare symptom burden across independent postoperative time groups.

Materials and Methods: This cross-sectional observational study included 140 patients who had previously undergone LSG. Participants were stratified into four postoperative time groups according to the time elapsed since surgery (0–1 month, 1–3 months, 3–12 months, and >12 months). Gastrointestinal symptoms and bowel function were evaluated using the Patient-Reported Outcomes–Digestive Recovery After Gastrointestinal Surgery (PRO-diGI) questionnaire. Only the bowel function score was converted to a 0–100 scale, whereas the remaining domain scores were analyzed as raw summed scores. Comparisons among postoperative time groups were performed using appropriate nonparametric statistical tests.

Results: A total of 140 patients (48 males, 34.3%; 92 females, 65.7%) with a median age of 37 years (95% CI: 33.02–40.36; range, 18–62 years) were included. Demographic characteristics were comparable across the postoperative time groups ($p>0.05$). No statistically significant differences were observed among the groups in bowel function scores, upper gastrointestinal symptoms, lower gastrointestinal symptoms, eating behavior changes, or general well-being domains (all $p>0.05$).

Conclusions: In this cross-sectional comparison, patient-reported gastrointestinal symptoms and bowel function scores were similar across different postoperative periods following LSG. These findings suggest that patient-reported gastrointestinal symptom burden was similar across independent postoperative time groups. The PRO-diGI questionnaire may be considered a useful measurement instrument for evaluating patient-reported gastrointestinal function after bariatric surgery.

Keywords: Bowel Function, gastrointestinal symptoms, laparoscopic sleeve gastrectomy, obesity, PRO-diGI

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Introduction

Obesity has become one of the most significant public health problems worldwide, with its prevalence increasing rapidly in recent decades. According to the World Health Organization, obesity is defined as abnormal or excessive fat accumulation that poses a risk to health.[1] Severe obesity, characterized by a body mass index (BMI) of 40 kg/m² or higher, or 35 kg/m² or higher with obesity-related comorbidities, is associated with numerous health complications, including type 2 diabetes, cardiovascular disease, sleep apnea, and various malignancies.[2]

Bariatric surgery has emerged as the most effective treatment for morbid obesity, providing significant and sustained weight loss along with improvement or resolution of obesity-related comorbidities.[3,4] Among the various bariatric surgical procedures, laparoscopic sleeve gastrectomy (LSG) has become the most commonly performed operation worldwide due to its relative technical simplicity, favorable weight loss outcomes, and lower complication rates compared with more complex procedures such as Roux-en-Y gastric bypass.[5,6] LSG involves vertical resection of approximately 75–80% of the stomach along the greater curvature, resulting in a tubular gastric remnant with reduced capacity and altered hormonal profiles.

Although laparoscopic sleeve gastrectomy is considered a relatively safe bariatric procedure, postoperative gastrointestinal dysfunction may still occur. While postoperative adhesions are more frequently observed after open and major surgical procedures, their incidence has been substantially reduced with minimally invasive techniques.[7,8] Nevertheless, postoperative gastrointestinal dysfunction remains an important clinical issue.

Postoperative gastrointestinal symptoms such as nausea, vomiting, abdominal distension, intolerance to oral intake, and altered bowel habits are frequently reported after bariatric surgery. In addition to substantial weight loss and metabolic improvement, patients undergoing laparoscopic sleeve gastrectomy may experience symptoms including reflux, bloating, constipation, and food intolerance. These gastrointestinal complaints may influence postoperative quality of life, dietary adaptation, and long-term patient satisfaction. However, the distribution and persistence of these symptoms across different postoperative periods remain insufficiently characterized.[9–11]

In recent years, studies have increasingly recommended the use of patient-reported outcome measures (PROMs) to evaluate gastrointestinal recovery.[12] Disease-specific PROMs developed for surgical patients aim to assess postoperative gastrointestinal problems. These measures capture patients' subjective experiences in addition to objective clinical outcomes, thereby supporting more comprehensive patient care. Despite increasing interest in postoperative gastrointestinal recovery after bariatric surgery, systematic evaluations of bowel function across different postoperative time intervals using standardized patient-reported outcome measures remain limited.[4,6]

A recently developed PROM, the Patient-Reported Outcomes–Digestive Recovery After Gastrointestinal Surgery (PRO-diGI), is increasingly used to assess postoperative digestive symptoms, gastrointestinal quality of life, and recovery following both acute and elective surgeries.[13] PRO-diGI is a validated and reliable instrument designed to evaluate postoperative gastrointestinal symptoms and bowel function. The conceptual framework developed during the creation of PRO-diGI reflects the multidimensional nature of postoperative gastrointestinal recovery.

The aim of this study was to evaluate patient-reported gastrointestinal symptoms and bowel function after laparoscopic sleeve gastrectomy and to compare symptom burden across independent postoperative time groups using the PRO-diGI questionnaire.

Materials and Methods

Study Design

This single-center, cross-sectional observational study was conducted at the General Surgery Clinic of Elazığ Fethi Sekin City Hospital between September 2025 and January 2026 to evaluate bowel function scores and gastrointestinal symptoms in patients who had previously undergone LSG for morbid obesity. The specified period refers to patient evaluation and questionnaire administration, not to the date of surgery.

Patients who had previously undergone LSG were identified from hospital records and invited to complete the PRO-diGI questionnaire during the study period. Each patient was evaluated once during the study period, and no longitudinal follow-up was performed. To ensure balanced group sizes for comparison, consecutive eligible patients were included until each postoperative time group contained 35 participants.

Approval was obtained from the local ethics committee

(Date: 04/09/2025; Session No: 2025/14; Decision No: 35). Written informed consent was obtained from all participants. The study was conducted in accordance with the ethical standards of the institutional research committee and the 1964 Declaration of Helsinki and its later amendments.

Study Groups

Patients were stratified into four groups according to the time elapsed since surgery:

- Group 1: 0–1 month postoperatively (n=35)
- Group 2: 1–3 months postoperatively (n=35)
- Group 3: 3–12 months postoperatively (n=35)
- Group 4: >12 months postoperatively (n=35)

This stratification enabled comparison of bowel function and gastrointestinal symptoms across different postoperative time intervals.

Patient Selection

During the study period, 158 patients who had previously undergone laparoscopic sleeve gastrectomy were assessed for eligibility. Patients were consecutively recruited according to the order of outpatient presentation to minimize potential selection bias. Eighteen patients were excluded because they did not meet the inclusion criteria or declined participation. Consequently, 140 patients were included in the final analysis. The sample size was determined by the number of eligible patients presenting during the study period.

Inclusion Criteria

- Age ≥18 years
- Elective laparoscopic sleeve gastrectomy for severe obesity
- Ability to complete the questionnaire
- Availability of information regarding time since surgery
- Provision of written informed consent

Exclusion Criteria

- Age <18 years
- History of other bariatric surgical procedures
- Diagnosed psychiatric eating disorders
- Alcohol or substance abuse
- Chronic diseases significantly affecting gastrointestinal function (e.g., diabetes mellitus, inflammatory bowel disease, chronic heart failure, malignancy, or autoimmune diseases)
- Inability to complete the questionnaire

Patients with conditions or medications known to significantly affect gastrointestinal motility or bowel habits, such as chronic laxative use, opioid therapy, or previously diagnosed gastrointestinal motility disorders, were excluded to reduce potential confounding factors.

Data Collection

Data were collected using the Patient-Reported Outcomes–Digestive Recovery After Gastrointestinal Surgery (PRO-diGI) questionnaire.[13] The questionnaire was administered during outpatient evaluation and completed by patients based on self-report. It assesses postoperative gastrointestinal symptoms and their impact on daily functioning.

PRO-diGI Questionnaire

The PRO-diGI questionnaire is a validated and reliable patient-reported outcome measure developed to evaluate postoperative gastrointestinal recovery.[13] The instrument encompasses four principal domains: upper gastrointestinal symptoms, lower gastrointestinal symptoms, eating behavior changes, and general well-being. The domain structure of the PRO-diGI questionnaire is presented in Table 1. The original English version of the PRO-diGI questionnaire was translated into Turkish by the study investigators and administered to the participants.

Scoring System

Each item was rated on a five-point Likert scale (Never, Rarely, Sometimes, Most of the time, and Always). Responses were coded as follows: Never=4, Rarely=3, Sometimes=2, Most of the time=1, and Always=0.

The bowel function score was calculated by summing the corresponding item scores, dividing the total by the maximum possible score, and converting the result to a 0–100 scale, with higher scores indicating better bowel function. The remaining PRO-diGI domain scores were analyzed and presented as raw summed scores, consistent with the original scoring system.

The questionnaire evaluates four domains: upper gastrointestinal symptoms (questions 1–4), lower gastrointestinal

Table 1. Symptom items corresponding to the PRO-diGI questionnaire

Question	Symptom Item
1	Did you feel any discomfort in your stomach?
2	Did you vomit?
3	Did you feel discomfort after eating?
4	Did you vomit after eating?
5	Did you have diarrhea?
6	Did you have to change the types of foods you eat?
7	Did you have to restrict the foods you eat?
8	Did you notice that you eat more slowly than usual?
9	Did you have difficulty eating?
10	Did you have difficulty swallowing while eating?
11	Did you feel more tired than usual?
12	Did you feel weaker than usual?
13	Did you have difficulty performing activities that help you relax?
14	Did you have to rush to the toilet?
15	Did you have difficulty controlling your bowels?

symptoms (questions 5, 14, and 15), eating behavior changes (questions 6–10), and general well-being (questions 11–13).

Bowel Function Score

The primary outcome variable of this study was the bowel function score, derived from the lower gastrointestinal domain of the PRO-diGI questionnaire (questions 5, 14, and 15).

Scores from these items were summed, divided by the maximum possible score, and converted to a 0–100 scale according to the following formula:

Bowel Function Score=(Total Obtained Score/Maximum Possible Score)×100

Higher scores indicated better bowel function, whereas lower scores reflected worse bowel function.

The bowel function score was treated as a continuous variable ranging from 0 to 100 in all statistical analyses. There were no missing data in the questionnaire responses.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version 20.0 (IBM Corp., Armonk, NY, USA). A two-tailed p value <0.05 was considered statistically significant. All statistical tests were two-sided. The distribution of continuous variables was assessed using the Kolmogorov–Smirnov test before selecting appropriate parametric or nonparametric statistical methods.

Continuous variables were summarized as mean±standard deviation (SD) or median with 95% confidence interval (CI), as appropriate. Comparisons of bowel function scores across postoperative time groups were performed using the Kruskal–Wallis test. Post hoc pairwise comparisons with Bonferroni correction were planned when overall statistical significance was detected.

Categorical variables were summarized as counts (n) and percentages (%). Differences in categorical variables across postoperative time groups were evaluated using the chi-square test, Fisher's exact test, or likelihood ratio test, as appropriate.

Results

A total of 158 patients who had previously undergone laparoscopic sleeve gastrectomy were assessed for eligibility. Eighteen patients were excluded because they did not meet the inclusion criteria or declined participation. Consequently, 140 patients were included in the final analysis.

Of the 140 patients, 48 (34.3%) were male and 92 (65.7%) were female. The median age of all patients was 37 years (95% CI: 33.02–40.36; range, 18–62 years). No statistically significant differences were observed among the postoperative time groups with respect to age or sex distribution (p>0.05 for both variables) (Table 2).

The distribution of responses to individual PRO-diGI questionnaire items did not differ significantly among the postoperative time groups (all p>0.05) (Table 3).

Similarly, no statistically significant differences were observed among the four independent postoperative time groups with respect to bowel function scores or PRO-diGI domain scores, including upper gastrointestinal symptoms, lower gastrointestinal symptoms, eating behavior changes, and general well-being (all p>0.05) (Table 4 and Fig. 1). Median bowel function scores ranged from 68 to 71 across the four groups, indicating similar bowel function across the postoperative time groups.

Table 2. Demographic characteristics of patients according to postoperative time interval groups

	Group				Total	p
	0-1 Months	1-3 Months	3-12 Months	>12 Months		
Sex						
Male (n%)	11 (7.9%)	13 (9.3%)	14 (10%)	10 (7.1%)	48 (34.3%)	0.737
Female (n%)	24 (17.1%)	22 (15.7%)	21 (15%)	25 (17.9%)	92 (65.7%)	
Total (n%)	35 (25%)	35 (25%)	35 (25%)	35 (25%)	140 (100%)	
Age (years) (median, 95% CI)	37 (33.02–40.36)	33 (31.30–38.92)	33 (31.06–39.17)	41 (34.38–43.10)		0.561

*p<0.05; CI: Confidence Interval; n: Count

Table 3. Distribution of responses to individual PRO-diGI questionnaire items across postoperative time interval groups

	Group				p
	0-1 Months	1-3 Months	3-12 Months	>12 Months	
Q1: Did you feel any discomfort in your stomach?					
Always	1 (0.7%)	0 (0%)	1 (0.7%)	0 (0%)	0.633
Most of time	3 (2.1%)	2 (1.4%)	1 (0.7%)	5 (3.6%)	
Sometimes	7 (5%)	9 (6.4%)	9 (6.4%)	4 (2.9%)	
Rarely	16 (11.4%)	15 (10.7%)	16 (11.4%)	14 (10%)	
Never	8 (5.7%)	9 (6.4%)	8 (5.7%)	12 (8.6%)	
Q2: Did you vomit?					
Always	1 (0.7%)	0 (0%)	1 (0.7%)	0 (0%)	0.42
Most of time	2 (1.4%)	3 (2.1%)	1 (0.7%)	3 (2.1%)	
Sometimes	5 (3.6%)	3 (2.1%)	6 (4.3%)	9 (6.4%)	
Rarely	6 (4.3%)	12 (8.6%)	9 (6.4%)	11 (7.9%)	
Never	21 (15%)	17 (12.1%)	18 (12.9%)	12 (8.6%)	
Q3: Did you feel discomfort after eating?					
Always	1 (0.7%)	1 (0.7%)	1 (0.7%)	0 (0%)	0.667
Most of time	2 (1.4%)	3 (2.1%)	6 (4.3%)	8 (5.7%)	
Sometimes	9 (6.4%)	12 (8.6%)	10 (7.1%)	7 (5.0%)	
Rarely	14 (10%)	13 (9.3%)	13 (9.3%)	14 (10%)	
Never	9 (6.4%)	6 (4.3%)	5 (3.6%)	6 (4.3%)	
Q4: Did you vomit after eating?					
Always	1 (0.7%)	1 (0.7%)	1 (0.7%)	1 (0.7%)	0.795
Most of time	1 (0.7%)	1 (0.7%)	1 (0.7%)	3 (2.1%)	
Sometimes	6 (4.3%)	5 (3.6%)	4 (2.9%)	5 (3.6%)	
Rarely	4 (2.9%)	6 (4.3%)	8 (5.7%)	11 (7.9%)	
Never	23 (16.4%)	22 (15.7%)	21 (15.0%)	15 (10.7%)	

Table 3. Continued

	Group				p
	0-1 Months	1-3 Months	3-12 Months	>12 Months	
Q5: Did you have diarrhea?					
Always	0 (0%)	1 (0.7%)	1(0.7%)	0 (0%)	0.168
Most of time	4 (2.9%)	4 (2.9%)	7 (5%)	11 (7.9%)	
Sometimes	11 (7.9%)	11 (7.9%)	4 (2.9%)	5 (3.6%)	
Rarely	9 (6.4%)	6 (4.3%)	5 (3.6%)	6 (4.3%)	
Never	11 (7.9%)	13 (9.3%)	18 (12.9%)	13 (9.3%)	
Q6: Did you have to change the types of foods you eat?					
Always	5 (3.6%)	11 (7.9%)	7 (5%)	6 (4.3%)	0.282
Most of time	11 (7.9%)	8 (5.7%)	6 (4.3%)	14 (10%)	
Sometimes	8 (5.7%)	6 (4.3%)	8 (5.7%)	4 (2.9%)	
Rarely	3 (2.1%)	5 (3.6%)	10 (7.1%)	6 (4.3%)	
Never	8 (5.7%)	5 (3.6%)	4 (2.9%)	5 (3.6%)	
Q7: Did you have to restrict the foods you eat?					
Always	16 (11.4%)	14 (10%)	11 (7.9%)	12 (8.6%)	0.285
Most of time	11 (7.9%)	11 (7.9%)	9 (6.4%)	10 (7.1%)	
Sometimes	3 (2.1%)	3 (2.1%)	8 (5.7%)	7 (5%)	
Rarely	0 (0%)	5 (3.6%)	4 (2.9%)	3 (2.1%)	
Never	5 (3.6%)	3 (2.1%)	2 (1.4%)	3 (2.1%)	
Q8: Did you notice that you eat more slowly than usual?					
Always	2 (1.4%)	4 (2.9%)	2 (1.4%)	0 (0%)	0.263
Most of time	9 (6.4%)	10 (7.1%)	7 (5%)	4 (2.9%)	
Sometimes	10 (7.1%)	10 (7.1%)	9 (6.4%)	11 (7.9%)	
Rarely	5 (3.6%)	7 (5%)	6 (4.3%)	10 (7.1%)	
Never	9 (6.4%)	4 (2.9%)	11 (7.9%)	10 (7.1%)	
Q9: Did you have difficulty eating?					
Always	1 (0.7%)	0 (0%)	0 (0%)	0 (0%)	0.765
Most of time	2 (1.4%)	3 (2.1%)	1 (0.7%)	1 (0.7%)	
Sometimes	2 (1.4%)	4 (2.9%)	3 (2.1%)	3 (2.1%)	
Rarely	11 (7.9%)	7 (5%)	6 (4.3%)	10 (7.1%)	
Never	19 (13.6%)	21 (15%)	25 (17.9%)	21 (15%)	
Q10: Did you have difficulty swallowing while eating?					
Always	2 (1.4%)	1 (0.7%)	4 (2.9%)	1 (0.7%)	0.541
Most of time	6 (4.3%)	6 (4.3%)	5 (3.6%)	6 (4.3%)	
Sometimes	9 (6.4%)	15 (10.7%)	8 (5.7%)	11 (7.9%)	
Rarely	10 (7.1%)	9 (6.4%)	6 (4.3%)	8 (5.7%)	
Never	8 (5.7%)	4 (2.9%)	12 (8.6%)	9 (6.4%)	
Q11: Did you feel more tired than usual?					
Always	3 (2.1%)	2 (1.4%)	5 (3.6%)	1 (0.7%)	0.514
Most of time	4 (2.9%)	3 (2.1%)	7 (5%)	4 (2.9%)	
Sometimes	11 (7.9%)	18 (12.9%)	9 (6.4%)	14 (10%)	
Rarely	6 (4.3%)	6 (4.3%)	7 (5%)	9 (6.4%)	
Never	11 (7.9%)	6 (4.3%)	7 (5%)	7 (5%)	

Table 3. Continued

	Group				p
	0-1 Months	1-3 Months	3-12 Months	>12 Months	
Q12: Did you feel weaker than usual?					
Always	0 (0%)	1 (0.7%)	1 (0.7%)	3 (2.1%)	0.196
Most of time	3 (2.1%)	0 (0%)	3 (2.1%)	1 (0.7%)	
Sometimes	10(7.1%)	14 (10%)	9 (6.4%)	6 (4.3%)	
Rarely	7 (5%)	8 (5.7%)	7 (5%)	5 (3.6%)	
Never	15 (10.7%)	12 (8.6%)	15 (10.7%)	20 (14.3%)	
Q13: Did you have difficulty performing activities that help you relax?					
Always	0 (0%)	0 (0%)	2 (1.4%)	2 (1.4%)	0.662
Most of time	1 (0.7%)	2 (1.4%)	2 (1.4%)	2 (1.4%)	
Sometimes	9 (6.4%)	8 (5.7%)	6 (4.3%)	6 (4.3%)	
Rarely	8 (5.7%)	4 (2.9%)	6 (4.3%)	4 (2.9%)	
Never	17 (12.1%)	21 (15%)	19 (13.6%)	21 (15%)	
Q14: Did you have to rush to the toilet?					
Always	0 (0%)	0 (0%)	1 (0.7%)	0 (0%)	0.911
Most of time	3 (2.1%)	3 (2.1%)	2 (1.4%)	3 (2.1%)	
Sometimes	11 (7.9%)	8 (5.7%)	8 (5.7%)	8 (5.7%)	
Rarely	8 (5.7%)	12 (8.6%)	9 (6.4%)	13 (9.3%)	
Never	13 (9.3%)	12 (8.6%)	15 (10.7%)	11 (7.9%)	
Q15: Did you have difficulty controlling your bowels?					
Always	0 (0%)	2 (1.4%)	2 (1.4%)	1 (0.7%)	0.217
Most of time	2 (1.4%)	1 (0.7%)	1 (0.7%)	4 (2.9%)	
Sometimes	9 (6.4%)	5 (3.6%)	5 (3.6%)	3 (2.1%)	
Rarely	5 (3.6%)	9 (6.4%)	13 (9.3%)	6 (4.3%)	
Never	19 (13.6%)	18 (12.9%)	14 (10%)	21 (15%)	

Table 4. PRO-diGI domain scores and bowel function scores according to postoperative time interval groups

	Group				p
	Months (Median, 95% CI)	1-3 Months (Median, 95% CI)	3-12 Months (Median, 95% CI)	>12 Months (Median, 95% CI)	
Eating behavior changes (Q6-10)	11 (9.63–12.43)	9 (8.90–11.56)	12 (10.69–13.03)	12 (10.30–13.13)	0.148
General well-being (Q11-13)	9 (7.80–9.52)	8 (7.63–9.23)	8 (7.09–9.14)	9 (7.75–9.68)	0.781
Upper GI symptoms (Q1-4)	13 (10.97–13.37)	13 (10.91–13.15)	12 (10.68–12.92)	12 (10.10–12.70)	0.744
Lower GI symptoms (Q5, Q14-15)	9 (8.13–9.52)	9 (8.07–9.59)	10 (7.96–9.92)	9 (7.78–9.65)	0.839
Bowel Function Score	68 (62.42–73.20)	68 (60.61–71.10)	71 (62.04–73.68)	70 (61.40–73.74)	0.827

*p<0.05 ; CI: Confidence Interval

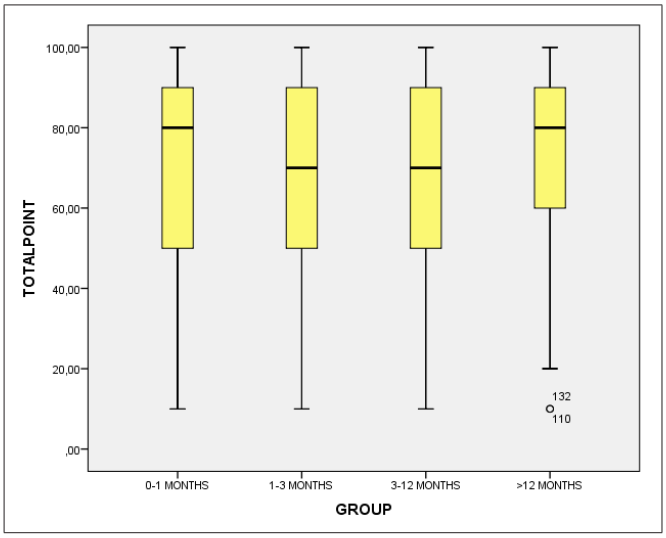

Figure 1. Distribution of bowel function scores across postoperative time interval groups.

Discussion

The principal finding of this study is that patient-reported gastrointestinal symptoms and bowel function scores were similar across independent postoperative time groups after laparoscopic sleeve gastrectomy. Our findings demonstrated that patient-reported gastrointestinal symptom burden was comparable across different postoperative time groups. To our knowledge, this is among the first studies to systematically assess early- and mid-term gastrointestinal recovery after LSG using patient-reported outcome measures and to evaluate the applicability of the PRO-diGI instrument in a bariatric surgery population.

Enhanced Recovery After Surgery (ERAS) protocols are evidence-based perioperative care pathways designed to accelerate postoperative recovery and reduce complications. These protocols include strategies such as early mobilization, early oral feeding, and multimodal analgesia, which facilitate faster recovery of gastrointestinal function. ERAS guidelines specifically developed for bariatric surgery also emphasize optimized nutritional and digestive management in the postoperative period.[14,15]

Nutritional and digestive problems are frequently observed in the postoperative period among patients undergoing bariatric surgery.[16] Postoperative nutritional insufficiencies, vitamin and mineral deficiencies, and digestive symptoms significantly affect quality of life in this population. Nutritional problems following bariatric surgery require long-term follow-up and management, and nutritional management is critical in postoperative care.[17–19] Maintenance of weight loss and appropriate nutritional management are essential for long-term success after bariatric surgery. Furthermore, nutritional and digestive problems are important causes of hospital readmission after bariatric surgery.[20]

Postoperative complications such as ileus, which are associated with abnormal gastrointestinal motility, are reduced with laparoscopic surgery.[7] Additionally, postoperative nausea and vomiting rates may vary depending on the type of surgical procedure, including cholecystectomy and other laparoscopic procedures.[9] Our findings suggest that patient-reported gastrointestinal symptom burden was similar across postoperative time groups following LSG. These findings indicate that postoperative gastrointestinal symptom burden, as reported by patients, remained comparable across independent postoperative time groups after LSG.

Comprehensive studies evaluating the relationship between postoperative digestive symptoms and bowel function remain limited. In particular, there is insufficient evidence regarding how this relationship evolves across postoperative time points and which symptoms have the greatest impact on bowel function. Bowel function is a key determinant of postoperative quality of life, as functional impairment may restrict daily activities and prolong recovery.[21,22] Postoperative gastrointestinal symptoms substantially affect patients' quality of life, and understanding the association between symptom severity and bowel function is essential for optimizing postoperative care strategies.

In this cross-sectional comparison, gastrointestinal symptom scores and bowel function measures did not differ significantly among the predefined postoperative time groups. This finding suggests that patient-reported postoperative gastrointestinal symptom burden was similar across independent postoperative time groups after LSG. Although our design does not allow longitudinal evaluation of individual symptom trajectories, cross-sectional comparisons across postoperative time groups provide valuable information regarding the distribution of symptom burden across different postoperative periods in real-world clinical populations.

One possible underlying mechanism is reduced acid secretion resulting from tubular gastric remodeling, leading to decreased food and fluid intake.[23] A substantial proportion of patients undergoing laparoscopic sleeve gastrectomy continue to report upper and lower gastrointestinal

complaints, such as constipation, bloating, and reflux, in the long term. These symptoms may persist despite significant weight loss and metabolic improvement and may negatively influence quality of life as well as eating behavior.[24–26] Persistent digestive symptoms may therefore represent an underrecognized component of postoperative adaptation following sleeve gastrectomy.

In the literature, symptom burden and its temporal evolution after sleeve gastrectomy have been evaluated in several cohort studies. Hu et al. [24] used the BODY-Q instrument in 491 patients and reported that constipation (56%), bloating (54%), and reflux were the most common symptoms and that these complaints persisted with similar frequency beyond the 12th postoperative month, although partial improvement over time was observed in constipation, abdominal pain, and nausea. Similarly, Kyang et al., [27] in a 2-year prospective cohort, found a mild overall improvement in total symptom scores, while constipation scores remained largely unchanged, and reflux and other symptoms fluctuated depending on procedure type and follow-up duration. Longer-term follow-up studies in both adults and adolescents have demonstrated that the prevalence of reflux, bloating, and constipation may increase compared with the preoperative period, even though overall quality-of-life measures remain improved.[28,29] These findings are consistent with our observation that gastrointestinal symptom scores were comparable among postoperative time groups in this cross-sectional analysis.

Sleeve gastrectomy is known to alter gastric motility and gastrointestinal hormone secretion, including ghrelin and GLP-1 signaling, which may influence gastric emptying and intestinal transit patterns. Formation of a tubular gastric pouch reduces gastric reservoir capacity and may increase the gastroesophageal pressure gradient, potentially contributing to reflux. Conversely, it may also increase the gastroduodenal pressure gradient, enhancing gastric emptying and thereby modulating reflux symptoms.[23] Minimizing postoperative opioid use, shortening anesthesia duration, optimizing anesthetic techniques, and reducing the risk of postoperative nausea and vomiting have been proposed to support gastrointestinal recovery.[30] Postoperative nausea and vomiting (PONV) remain among the most common postoperative complications, occurring in approximately 30% of patients, and may delay oral intake and prolong hospital stay.

PRO-diGI, a newly developed PROM, evaluates gastrointestinal recovery from a patient-centered perspective.[13] The use of PROMs such as PRO-diGI provides important insight into patient-perceived digestive recovery, which may not be fully captured by traditional clinical outcome measures. The purpose of the PRO-diGI system is to improve the assessment of postoperative gastrointestinal problems by incorporating patient-reported outcomes. Unlike traditional clinical metrics, it allows structured evaluation of digestive recovery. In the present study, despite the absence of direct manipulation of intestinal or colonic segments, structural modification of the stomach, restricted fluid intake, and decreased acid secretion due to both the loss of acid-producing cells and postoperative proton pump inhibitor therapy may contribute to the gastrointestinal dysfunction observed across different postoperative time intervals.

However, the absence of preoperative symptom assessment limits our ability to determine whether the observed postoperative gastrointestinal symptoms were present preoperatively or developed postoperatively. Future prospective studies incorporating preoperative baseline evaluation and longitudinal postoperative follow-up will be essential to clarify the temporal evolution of gastrointestinal function after sleeve gastrectomy.

In addition, although the PRO-diGI bowel function domain evaluates diarrhea, urgency, and fecal continence, it does not specifically assess constipation. Because constipation has been reported as one of the most common bowel complaints following laparoscopic sleeve gastrectomy, this limitation may have reduced the comprehensiveness of our evaluation of postoperative bowel function.[25,26]

Limitations

Several limitations should be acknowledged. First, the cross-sectional design precludes causal inference and does not allow assessment of individual symptom trajectories over time; prospective longitudinal follow-up would provide stronger evidence regarding temporal patterns. Second, reliance on self-reported data may introduce recall and social desirability biases, and the absence of objective physiological assessments (e.g., transit time studies or anorectal manometry) limits mechanistic interpretation. Third, the exclusion of patients with chronic systemic diseases may reduce generalizability to the broader bariatric population, in whom metabolic comorbidities are common. Fourth, some categories in Table 3 contained relatively small numbers of participants, which may have reduced the statistical power of categorical comparisons. Finally,

preoperative gastrointestinal symptoms were not evaluated, preventing direct comparison between preoperative and postoperative functional status.

Conclusion

In this cross-sectional comparison, patient-reported gastrointestinal symptoms and bowel function scores did not differ significantly across postoperative time intervals following laparoscopic sleeve gastrectomy. Patient-reported data indicated that upper and lower gastrointestinal complaints were similar across different postoperative time groups. The PRO-diGI instrument provides a structured, patient-centered approach to evaluating postoperative gastrointestinal recovery and enables systematic assessment of bowel function and symptom burden. Prospective longitudinal studies incorporating preoperative baseline evaluations and objective physiological measurements are warranted to better define the trajectory and mechanisms of gastrointestinal adaptation after bariatric surgery.

Disclosures

Ethics Committee Approval: This study was approved by the Elazığ Fethi Sekin City Hospital Ethics Committee (Date: 04/09/2025; Decision No: 35).

Informed Consent: Written informed consents were obtained from patients who participated in this study.

Conflict of Interest: The authors declare that there is no conflict of interest.

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