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Evaluation of preoperative and postoperative nutritional status using the CONUT score in patients undergoing sleeve gastrectomy and Roux-en-Y gastric bypass

Can Akgun[1], Mehmet Alperen Avci[1], Ahmet Can Sari[2], Omer Faruk Buk[3], Sonmez Ocak[3], Bulent Koca[4]

[1]Samsun University, Faculty of Medicine, Department of General Surgery, Samsun, Türkiye
[2]Samsun Gazi State Hospital, Department of General Surgery, Samsun, Türkiye
[3]Private Samsun Medicana Hospital, Department of General Surgery, Samsun, Türkiye
[4]Gaziosmanpaşa University, Faculty of Medicine, Department of General Surgery, Tokat, Türkiye

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Abstract

Bariatric procedures are often followed by various degrees of nutritional imbalance, which can adversely affect postoperative recovery. The Controlling Nutritional Status (CONUT) score provides an objective laboratory-based measure of nutritional risk by integrating serum albumin, total cholesterol and peripheral lymphocyte count. The purpose of this study was to compare nutritional status before and one year after surgery using the CONUT index in individuals undergoing Sleeve Gastrectomy (SG) or Roux-en-Y Gastric Bypass (RYGB), and to determine whether the preoperative CONUT value is predictive of subsequent nutritional decline. This retrospective study comprised 393 individuals who received either SG or Roux-en-Y Gastric Bypass between January 2021 and January 2024 at a single tertiary institution. Demographic, clinical, and laboratory data (albumin, lymphocyte count, cholesterol) were recorded preoperatively and one year postoperatively. CONUT and post-minus preoperative CONUT (ΔCONUT) scores were calculated. Independent predictors of postoperative malnutrition were determined through logistic regression analysis. Of 393 patients, 235 (59.8%) underwent SG and 158 (40.2%) RYGB. Baseline demographic and laboratory parameters were comparable. At one-year, postoperative CONUT and ΔCONUT did not differ between groups ($p > 0.05$). In multivariable analysis, the preoperative CONUT value emerged as the sole independent predictor of postoperative nutritional decline (OR 1.41, 95% CI 1.18–1.66, $p<0.001$). Other factors, including surgical type and baseline body mass index (BMI), were not associated with ΔCONUT. Patients with elevated preoperative CONUT values tended to exhibit more pronounced postoperative deterioration in nutritional status following bariatric surgery. The CONUT index could function as a practical indicator for recognising individuals who are vulnerable to postoperative nutritional impairment, highlighting the need for targeted preoperative nutritional optimisation to support favourable postoperative results.

Keywords: Bariatric surgery, sleeve gastrectomy, roux-en-y gastric bypass, controlling nutritional status score, malnutrition, predictive factors

Introduction

Obesity is a long-standing, complex condition that continues to rise globally, contributing substantially to metabolic and cardiovascular morbidity [1]. Surgical treatment remains the most reliable and durable intervention for severe obesity, achieving marked and lasting weight reduction together with improvements in obesity-associated comorbid conditions. [2,3].

Among current bariatric procedures, Sleeve Gastrectomy (SG) and gastric bypass operations including Roux-en-Y Gastric Bypass (RYGB) and Mini Gastric Bypass (MGB) are the most commonly performed globally [4]. Despite their proven efficacy, these operations may lead to postoperative nutritional deficiencies, especially after malabsorptive procedures [4,5].

Careful assessment of nutritional status is a critical component of both preoperative planning and postoperative follow-up in bariatric patients [3,5]. The Controlling Nutritional Status (CONUT) score, originally proposed by De Ulibarri and colleagues, provides an objective estimate of nutritional risk by integrating serum albumin, total cholesterol and peripheral lymphocyte count [6]. The CONUT index has been confirmed as

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Corresponding Author: Can Akgun, Samsun University, Faculty of Medicine, Department of General Surgery, Samsun, Türkiye
Email: canakgun@outlook.com.tr

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a dependable marker for anticipating postoperative outcomes and complication risk across multiple surgical specialties, including gastrointestinal and hepatobiliary surgery [7,8].

Recent studies investigating nutritional outcomes after bariatric surgery have mainly focused on the comparison between RYGB and MGB techniques [4]. However, studies evaluating changes in CONUT score following Sleeve Gastrectomy and comparing it with Bypass procedures remain scarce.

Therefore, the present study seeks to assess nutritional status both before surgery and at one-year follow-up through the CONUT index among individuals undergoing SG or RYGB, and to investigate how the preoperative CONUT value relates to postoperative nutritional deterioration and the occurrence of surgical complications. Monitoring the change in CONUT score (ΔCONUT) rather than relying on a single time-point measurement may offer a clearer reflection of postoperative nutritional trajectories, allowing earlier identification of individuals at increased risk of nutritional deterioration.

Material and Methods

This investigation was structured as a retrospective observational study and included individuals who underwent bariatric surgery at a tertiary institution from January 2021 to January 2024. The period between January 2021 and January 2024 was selected to ensure adequate availability and completeness of clinical and laboratory data for both preoperative and postoperative evaluations. Patients operated after January 2024 were not included, as the one-year follow-up period had not yet been completed when data extraction was performed. Only those with a minimum of one year of postoperative follow-up were eligible for inclusion.

The study adhered to the ethical standards outlined in the Declaration of Helsinki, and approval was secured from the institutional review board.(Approval No: 2025/20/22, dated October 15, 2025)

Participants eligible for enrolment were adults aged 18 years or above who fulfilled recognised international criteria for bariatric surgery: a body mass index (BMI) ≥40 kg/m², or a BMI ≥35 kg/m² accompanied by least one obesity-associated comorbidity such as diabetes type 2 (DM), hypertension (HT), or dyslipidemia. All patients received routine postoperative supplementation, including a daily multivitamin, calcium–vitamin D combination, and vitamin B12 supplementation as required, in accordance with international bariatric guidelines. Patients with incomplete laboratory records, chronic inflammatory diseases, malignancy, pregnancy, or those who underwent revisional surgery within one year postoperatively were excluded. Based on the type of bariatric operation, patients were categorised into two groups:

- Sleeve Gastrectomy
- Roux-en-Y Bypass

Demographic, clinical and laboratory information was retrieved from the hospital's electronic medical record system. The following parameters were recorded for all patients:

- Demographic characteristics included age, sex and BMI.
- Comorbidities comprised DM, HT, coronary artery disease and pulmonary disorders.
- Laboratory parameters: albumin (g/dL), lymphocyte count ($\times 10^9$/L), and total cholesterol (mg/dL) measured preoperatively and at postoperative 1 year
- Clinical outcomes: postoperative complications (bleeding, leakage, infection) and mortality

The CONUT index was derived from three routinely obtained laboratory measures: serum albumin, total lymphocyte count, and total cholesterol (Table 1). Each variable was assigned a score, and the sum determined the overall nutritional status:

- 0–1: Normal nutrition
- 2–4: Mild malnutrition
- 5–8: Moderate malnutrition
- 9–12: Severe malnutrition

Both preoperative and postoperative (1-year) CONUT scores were calculated. The change in CONUT (ΔCONUT) was computed as: ΔCONUT=Postoperative CONUT − Preoperative CONUT

Table 1. CONUT score

Laboratory Parameter	Value	Score
Total lymphocyte count (mm³)	>1600	0
	1200–1599	1
	800–1199	2
	<800	3
Serum albumin concentration (g/dL)	≥3.5	0
	3.0–3.49	2
	2.5–2.99	4
	<2.5	6
Serum total cholesterol concentration (mg/dL)	≥180	0
	140–179	1
	100–139	2
	<100	3

0–1: normal; 2–4: mild malnutrition; 5–8: moderate malnutrition; 9–12: severe malnutrition

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Statistical analysis

All statistical procedures were performed using IBM SPSS Statistics software v25.0. Continuous variables were summarised as mean±standard deviation or as median with interquartile range, depending on normality evaluated by the Shapiro–Wilk test. Categorical variables were reported as counts and proportions. Between group comparisons used the t-test or Mann–Whitney U test for continuous variables, and the chi-square or Fisher's exact test for categorical variables. Paired comparisons of preoperative and postoperative values were analysed with the paired t-test or the Wilcoxon signed-rank test. Variables showing significance in univariate testing were subsequently entered into multivariable logistic regression. A p value below 0.05 was considered statistically significant.

Result

Demographic and Clinical Characteristics

A total of 393 individuals who underwent bariatric procedures were enrolled in the study. Of these, 158 (40.2%) received RYGB and 235 (59.8%) underwent SG. The mean age was notably greater in the RYGB group than in the SG group (40.5±11.3 vs. 36.3±10.8 years, p=0.001). The proportion of females to males did not differ significantly between the two groups (p=0.147). Hospital stay duration showed a tendency to be greater in the RYGB cohort (5.0±1.8 vs. 4.5±3.4 days), although this difference did not reach statistical significance (p=0.079) (Table 2).

The RYGB group exhibited a considerably greater prevalence of diabetes mellitus (p=0.001) and hypertension (p=0.008) than the SG group. Sleep apnea occurred more frequently in the RYGB cohort (22.3% vs. 13.5%; p=0.037). There were no significant group differences in coronary artery disease (p=0.789), asthma (p=0.596) or postoperative events including bleeding (p=0.557) or leakage (p=0.056), although leakage showed a tendency to be more common in the SG group (Table 2).

Preoperative Nutritional Status and Laboratory Findings

Preoperative laboratory findings, including cholesterol, albumin, and lymphocyte counts, did not differ significantly between the groups (all p>0.05). The mean preoperative CONUT score was higher in the SG group (0.86±1.5) than in the RYGB group (0.48±0.9), though this difference was not statistically significant (p=0.221). The distribution of nutritional status categories was similar in groups and neither group had any cases of severe malnutrition (Table 3).

Table 2. Comparison of clinical and demographic features between RYGB and sleeve gastrectomy groups

Variable	RYGB (n)	SG (n)	p-value
Age (Mean, SD) years	40.5 ± 11.3	36.3 ± 10.8	0.001*
Sex			
Female	127 (80.4%)	203 (86.4%)	0.147
Male	31 (19.6%)	32 (13.6%)	
Length of hospital stay (days)	5.0 ± 1.8	4.5 ± 3.4	0.079
Weight (kg)	128.9 ± 19.4	126.8 ± 15.1	0.246
Height (cm)	165.4 ± 8.3	164.2 ± 7.5	0.138
BMI (Mean, SD)	47.0 ± 5.4	47.1 ± 5.2	0.958
Diabetes Mellitus	67 (42.4%)	46 (19.6%)	0.001*
Hypertension	49 (31.0%)	45 (19.1%)	0.008
Coronary Disease	5 (3.2%)	9 (3.8%)	0.789
Sleep Apnea	33 (22.3%)	30 (13.5%)	0.037*
Asthma	10 (8.0%)	12 (5.9%)	0.596
Complication			
Leakege	1 (0.6%)	10 (4.3%)	0.056
Bleeding	6 (3.8%)	6 (2.6%)	0.557

*: Statistically significant at p<0.05

Table 3. Preoperative laboratory parameters and malnutrition status by surgical type

Variable	RYGB	Sleeve	p-value
Cholesterol (mg/dL)	210.2 ± 31.2	208.2 ± 36.2	0.806
Albumin (g/dL)	4.3 ± 0.8	3.9 ± 0.8	0.067
Lymphocyte (mm³)	2507 ± 615	2881 ± 1451	0.192
CONUT score	0.48 ± 0.9	0.86 ± 1.5	0.221
Malnutrition Status			
Mild	3 (10%)	7 (14.6%)	0.442
Moderate	2 (6.7%)	4 (8.3%)	0.761
Severe	0 (0%)	0 (0%)	-

Malnutrition classification based on CONUT: 0–1: Normal; 2–4: Mild; 5–8: Moderate; 9–12: Severe

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Postoperative (1-Year) Nutritional Status and CONUT Changes

At the 1-year follow-up, the differences in cholesterol, albumin, lymphocyte count, and CONUT score between the RYGB and SG groups did not show statistically significant differences ($p>0.05$ for all). The ΔCONUT score, representing the difference between postoperative and preoperative values, was also comparable between the groups (4.86±2.23 for RYGB vs. 4.60±2.18 for SG, $p=0.252$). The distribution of postoperative malnutrition status (mild, moderate, severe) was similar across surgical types ($p>0.05$ for all comparisons) (Table 4).

Predictors of Nutritional Deterioration

Among the variables tested at multinomial logistic regression model, only the preoperative CONUT value emerged as an independent predictor. Each one-unit rise in the preoperative CONUT score corresponded to a 41% elevation in the likelihood of postoperative nutritional decline (odds ratio (OR) 1.41; 95% confidence interval (CI) 1.18–1.66; $p<0.001$). Other factors such as surgical type, preoperative BMI, comorbidities, age, and sex were not significantly associated with ΔCONUT (Table 5).

Table 4. Postoperative 1st year laboratory parameters, malnutrition status and CONUT score changes by surgical type

Variable	RYGB	Sleeve	p-value
Cholesterol (mg/dL)	201.5 ± 30.1	198.3 ± 29.8	0.442
Albumin (g/dL)	3.8 ± 0.7	3.4 ± 0.9	0.058
Lymphocyte (mm³)	2120 ± 530	1890 ± 740	0.078
CONUT score	1.8 ± 1.2	2.3 ± 1.6	0.117
Malnutrition			
Mild	10 (33.3%)	22 (32.4%)	0.924
Moderate	9 (30%)	22 (32.4%)	0.817
Severe	3 (10%)	8 (11.8%)	0.782
ΔCONUT score	4.86 ± 2.23	4.60 ± 2.18	0.252

Malnutrition classification based on CONUT: 0–1: Normal; 2–4: Mild; 5–8: Moderate; 9–12: Severe; ΔCONUT score: the difference between postoperative and preoperative CONUT scores

Table 5. Multinomial logistic regression analysis of factors associated with change in CONUT score

Variable	Category	Odds Ratio (95% CI)	p-value
Operation Type	RYGB vs Sleeve	1.62 (0.46–5.72)	0.455
Preoperative CONUT Score	Per unit increase	1.41 (1.18–1.66)	<0.001
Preoperative BMI	Per unit increase	0.87 (0.63–1.20)	0.261
Diabetes Mellitus	Yes vs No	1.21 (0.72–2.03)	0.400
Hypertension	Yes vs No	1.39 (0.96–2.00)	0.082
Pulmonary Disease	Yes vs No	1.35 (0.78–2.33)	0.270
Coronary Artery Disease	Yes vs No	1.19 (0.74–1.91)	0.460
Age	Per year increase	1.05 (0.99–1.12)	0.081
Gender	Male vs Female	1.13 (0.78–1.64)	0.490

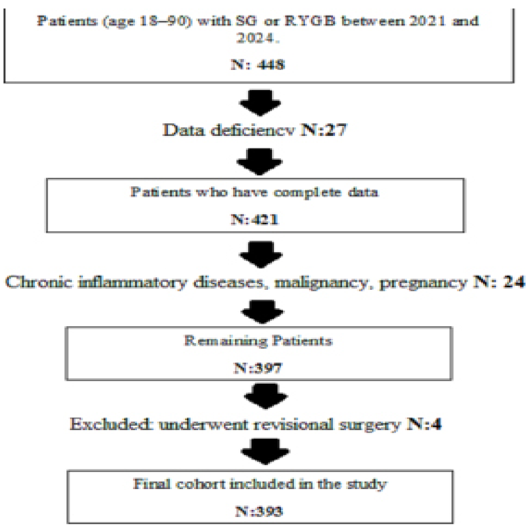

Figure 1. Flow chart of included and excluded patients

Discussion

We found that the preoperative CONUT value was linked to postoperative alterations in nutritional status among individuals undergoing bariatric surgery. Our findings revealed that patients with elevated preoperative CONUT scores showed a greater postoperative rise in this index, reflecting a more marked decline in nutritional condition following surgery. This suggests that individuals with pre-existing malnutrition are more likely to experience a further decline in nutritional status following bariatric procedures, highlighting the impact of preoperative malnutrition on postoperative nutritional decline. Given its independent association with postoperative nutritional decline, the preoperative CONUT score may help identify patients who require closer nutritional surveillance and targeted preoperative optimisation. To our knowledge, no previous investigation has directly examined the prognostic relevance of the preoperative CONUT score or its relationship to postoperative nutritional

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deterioration in the bariatric population. Most available studies have centred on comparisons between RYGB and one-anastomosis gastric bypass (OAGB), yet none has assessed these outcomes in conjunction with sleeve gastrectomy (SG) [4,9]. Therefore, our study provides novel insight by comparing SG and RYGB procedure within the same cohort.

Voglino et al. [9] compared RYGB and OAGB over a three-year follow-up period and found no meaningful variation in malnutrition rates was found between the two groups. In their series, mild malnutrition was observed in approximately 37–38% of patients, with comparable protein and albumin levels across procedures. Similarly, Gentileschi et al. [4] reported that although both procedures were associated with a significant postoperative increase in CONUT scores, no difference was detected between groups. These results suggest that postoperative nutritional deterioration may depend not only on surgical technique but also on patients' baseline nutritional condition. The present study supports this interpretation, as an elevated preoperative CONUT score showed a significant association with a larger ΔCONUT change, highlighting the impact of preoperative malnutrition on postoperative nutritional decline.

The influence of preoperative nutritional status on predicting unfavourable nutritional outcomes after bariatric surgery has gained increasing recognition in recent years. Berardi et al. [10] demonstrated that approximately 80% of candidates for bariatric surgery presented with at least one micronutrient deficiency, with vitamin D deficiency being the most common.(66.7%). Similarly, Simancas-Racines et al. [11] and Sherf-Dagan et al. [12] emphasized that micronutrient and macronutrient deficiencies present before surgery are major determinants of postoperative complications and delayed recovery, underscoring the necessity of multidisciplinary preoperative nutritional optimization. These findings align with our results, supporting the notion that an elevated preoperative CONUT scores are linked to an increased likelihood of postoperative nutritional impairment.

Postoperative malnutrition is particularly common after procedures with a significant malabsorptive component. Campanelli et al. [13] reported mild malnutrition (CONUT > 2) in 40% of patients undergoing banded OAGB, emphasizing the need for long-term nutritional monitoring despite the short-term safety of the procedure. Gentileschi et al. [4] also found comparable malnutrition rates between OAGB and RYGB, although both groups exhibited significant postoperative increases in CONUT scores. These data indicate that postoperative nutritional decline is an inherent risk even in technically different procedures. In our cohort, there were no meaningful variations in either preoperative or postoperative CONUT measurements between SG and bypass groups, suggesting that postoperative nutritional outcomes are influenced not only by the surgical approach but also by patients' baseline nutritional condition.

In conclusion, the current literature demonstrates the high prevalence of preoperative nutritional deficiencies and their contribution to postoperative malnutrition risk. However, no previous study has evaluated the dynamic change in CONUT score (preoperative–postoperative difference) as a predictor of postoperative nutritional deterioration. Our findings indicate that the CONUT score may function not only as a tool for initial screening but also as an indicator of prognosis in bariatric surgery. Identifying and correcting preoperative malnutrition appear essential to prevent postoperative complications and nutritional deficiencies, thereby improving surgical outcomes and long-term recovery.

Strengths and Limitations

The key advantage of this study is its original approach and emphasis on an underexplored area of bariatric research. To our knowledge, this study is the first investigation to evaluate CONUT scores at both the preoperative and postoperative stages among individuals treated with SG or RYGB within a single cohort. Unlike previous research limited to RYGB and OAGB procedures, our analysis extends the understanding of nutritional dynamics by including restrictive and mixed techniques. Another major strength is the homogeneous, single-center cohort in which all patients were managed under standardized perioperative protocols, minimizing variability in operative methods and postoperative monitoring. Applying one standardized laboratory-derived nutritional index (the CONUT score) provides reproducibility and enables straightforward evaluation across different time intervals. Moreover, by analyzing ΔCONUT (pre-to-postoperative change), the study offers a longitudinal perspective on nutritional decline that has not been previously reported.

However, a number of limitations must be recognized. First, its retrospective nature may introduce selection-related bias, causality cannot be firmly established. Second, although the study included comprehensive biochemical evaluation, dietary intake and specific micronutrient measurements were not available for all patients, which might underestimate subclinical deficiencies. Third, the follow-up duration was restricted to a single year, precluding assessment of long-term nutritional trajectories and late complications. Finally, because the study was conducted at a single institution, its generalizability may be constrained, and the findings should be interpreted with caution until confirmed by multicenter prospective trials.

Conclusion

At conclusion, elevated preoperative CONUT values were linked to a more pronounced postoperative deterioration in nutritional status after bariatric surgery, individuals with compromised baseline nutritional profiles are more likely to experience worsening after surgery. Our results indicate that the CONUT score could function as a straightforward and clinically useful marker for detecting individuals with elevated risk of postoperative malnutrition. Preoperative nutritional optimization is therefore essential to improve surgical outcomes.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
This study was approved by the Clinical Research Ethics Committee of Samsun University Faculty of Medicine (Approval No: 2025/20/22, dated 15.10. 2025).

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