Chirurgia (2025) 120: 566-574
No. 5, September - October

http://dx.doi.org/10.21614/chirurgia.3218

Comparative Analysis of Nutritional and Immune Status using the Conut Score in Patients Undergoing Billroth I and Billroth II / Roux-en-Y Reconstruction

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Abbreviations:
ASA: American Society of Anesthesiologists;
CD: Clavien–Dindo;
CONUT: Controlling Nutritional Status;
D1+/D2 – Extent of lymphadenectomy according to Japanese Gastric Cancer Association;
OR – Odds ratio;
RY – Roux-en-Y;
T0 – Preoperative timepoint;
T1 – Early postoperative timepoint (day 7 or discharge);
T2 – Three-month postoperative timepoint.

Received: 04.09.2025
Accepted: 20.10.2025

Rezumat

Analiza comparativă a statusului nutrițional și imun utilizând scorul CONUT la pacienții supuși reconstrucției Billroth I și Billroth II / Roux-en-Y

Introducere: Chirurgia cancerului gastric necesită nu doar radicalitate oncologică, ci şi o reconstrucție funcțională adecvată. Billroth I rămâne metoda cea mai fiziologică de restabilire a continuității digestive, în timp ce Billroth II şi Roux-en-Y sunt utilizate cel mai frecvent în chirurgia oncologică gastrică. Statusul nutrițional şi imun influențează semnificativ evoluția postoperatorie, iar scorul Controlling Nutritional Status (CONUT), bazat pe albumină serică, numărul de limfocite şi colesterolul total, a fost validat ca biomarker imuno-nutrițional pentru preîntampinarea posibilelor complicații în chirurgia oncologică.
Materiale şi Metodă: Am realizat un studiu observațional prospectiv, monocentric, incluzând 150 de pacienți oncologici cu gastrectomii distale între octombrie 2021 şi decembrie 2024. Reconstrucția a fost efectuată prin anastomoza Billroth I (n=72) sau Billroth II/Roux-en-Y (n=78). Scorul CONUT a fost evaluat preoperator (T0), postoperator precoce (T1) şi la trei luni (T2). Parametrii analizați au inclus evoluția scorului CONUT, complicațiile post-operatorii (Clavien–Dindo), durata spitalizării, rata de reinterare şi mortalitatea.
Rezultate: Ambele grupuri au prezentat o creştere semnificativă a scorului CONUT postoperator (mediana 2 [1–3] la T0 vs 3 [2–4] la T1, p<0,001), urmată de o recuperare parțială la trei luni. Nu s-au observat diferențe între Billroth I şi Billroth II/Roux-en-Y la niciun moment de evaluare. Valori mai mari ale scorului CONUT la T0, T1 şi T2 au prezis independent apariția complicațiilor totale şi majore (OR 1,15–1,25, p<0,05). Morbiditatea, mortalitatea (3,3%) şi durata spitalizării au fost similare între grupuri.
Concluzii: Scorul CONUT reprezintă un predictor independent al morbidității perioperatorii la pacienții cu cancer gastric, în timp ce metoda de reconstrucție nu modifică semnificativ traiectoria imunonutrițională. Monitorizarea serială a scorului CONUT poate optimiza stratificarea riscului perioperator.

Cuvinte cheie: cancer gastric, gastrectomie, scor CONUT, stratus nutrițional

Abstract

Background: Gastric cancer surgery requires not only oncological radicality but also functional reconstruction. Billroth I remains the most physiological method of restoring continuity, whereas Billroth II and Roux-en-Y are most frequently adopted in the oncological treatment. Nutritional and immune competence strongly influence post-operative outcomes, and the Controlling Nutritional Status (CONUT) score has emerged as a validated biomarker integrating albumin, lymphocyte count, and cholesterol in predicting complications in surgically treated patients.
Methods: We conducted a prospective observational single-center study including 150 patients undergoing curative distal gastrectomy between October 2021 and December 2024. Reconstruction was performed using Billroth I (n=72) or Billroth II/Roux-en-Y (n=78). The CONUT score was assessed preoperatively (T0), early postoperatively (T1), and at three months (T2). Outcomes included CONUT evolution, postoperative complications (Clavien–Dindo), length of stay, readmission, and mortality.
Results: Both reconstruction groups demonstrated a significant postoperative increase in CONUT score (median 2 [1-3] at T0 to 3 [2-4] at T1, $p<0.001$), followed by partial recovery at three months. No differences were observed between Billroth I and Billroth II/Roux-en-Y at any timepoint. Higher CONUT values at T0, T1, and T2 independently predicted overall and major complications (OR range 1.15–1.25, $p<0.05$). Postoperative morbidity, mortality (3.3%), and hospital stay were similar across groups.
Conclusions: The CONUT score is an independent predictor of perioperative morbidity in gastric cancer, while the choice of reconstruction method does not significantly alter immunonutritional trajectories. Serial CONUT monitoring may enhance perioperative risk stratification.

Keywords: gastric cancer, gastrectomy, CONUT score, nutritional status

Introduction

Gastric carcinoma continues to affect the world population at a high level, while screening methods and perioperative care, and multimodal treatments have not decreased its high rates of morbidity and mortality (1-4). On the plus side, many studies report a strong survival rate for patients undergoing proper neoadjuvant treatment (4-5). The only treatment that can lead to a cure for localized disease is radical surgical resection, which depends on both complete cancer removal and maintaining postoperative function (5). The treatment approach for gastric cancer surgery has evolved from basic tumor removal to a comprehensive method that combines cancer elimination with nutritional support and immune system preservation, and functional recovery (6-14).

The extent of resection, along with reconstruction techniques, determines post-gastrectomy complications because they affect the digestive tract function and nutrient absorption, and bile flow (15). The Billroth I procedure stands as the most natural surgical method because it reconnects the stomach to the duodenum. Unfortunately, it remains restricted by tumor position and anastomotic stress (16,17). The two reconstruction methods, Billroth II and Roux-en-Y, exist because of technical requirements, but they lead to decreased duodenogastric reflux while causing motility problems and nutritional deficiencies, and malabsorption (18-20). The current literature does not support a single best reconstructive technique because multiple large-scale comparative studies and contemporary meta-analyses need patient-specific outcome-based evaluations, while a small beneficial consensus exists for the Roux-en-Y reconstruction treatment (21-24).

The recovery process after surgery depends on two essential factors, represented by the nutritional status and immune system function, in that they determine complication rates and hospital stay duration, treatment tolerance, and survival outcomes (25). The use of conventional anthropometric and biochemical indices has become less effective because of their poor sensitivity and reproducibility, which has led to the development of composite immunonutritional tools. The CONUT score assesses protein reserves and immune defense and caloric depletion through serum albumin, peripheral lymphocyte count, and total cholesterol measurements (26-29). Research shows that patients with higher CONUT scores experience higher rates of postoperative complications and worse survival outcomes and treatment response when undergoing perioperative chemotherapy or immunotherapy for gastric cancer (30-36). Furthermore, postoperative outcomes associated with different reconstruction methods have shown considerable variability across studies (37-40).

In light of these considerations, the present investigation was designed to perform a comparative, perioperative analysis of the CONUT score in gastric cancer patients undergoing Billroth I versus Billroth II/Roux-en-Y reconstruction. The research assesses immunonutritional status through three distinct evaluation periods to determine how the reconstructive method impacts nutritional and immune system variations.

Material and Method

This was a prospective observational single-center study conducted in the General Surgery I Clinic of the Emergency County Hospital Târgu Mureş, Romania, between October 2021 and December 2024. The protocol was reviewed and approved by the institutional Ethics Committee (Decision No. 30104/07.10.2021), and all participants provided written informed consent before enrollment, in accordance with the principles of the Declaration of Helsinki.

Eligible patients were adults aged 18 years or older with histologically confirmed gastric adenocarcinoma who underwent elective curative-intent distal gastrectomy. Patients with metastatic disease on diagnosis, those undergoing palliative resections, individuals with prior gastrectomy or other procedures altering gastrointestinal continuity, as well as patients with severe hepatic or renal dysfunction or major psychiatric disorders impairing consent or follow-up were excluded. Patients lacking complete laboratory data for the calculation of the Controlling Nutritional Status (CONUT) score at the prespecified timepoints were also excluded.

All operations were performed by surgeons experienced in gastric cancer procedures, and D1+ or D2 lymphadenectomy was carried out according to international oncological standards. The type of reconstruction was selected intraoperatively based on tumor location, required resection margins, and the feasibility of a tension-free anastomosis. Patients were thus divided into two groups according to the reconstruction method: gastroduodenal anastomosis (Billroth I) and gastrojejunal anastomosis (Billroth II or Roux-en-Y). Neoadjuvant therapy was administered selectively according to international gastric cancer guidelines (NCCN, JGCA) for patients with locally advanced disease. Approximately one-third of patients (34.7%) received preoperative chemotherapy based on clinical staging and recommendations from a multidisciplinary tumor board. Perioperative management adhered to institutional protocols incorporating enhanced recovery principles.

For all included patients, blood samples were obtained at three predefined timepoints: preoperatively, within seven days before surgery (T0), early postoperatively on day 7 ± 2 or on hospital discharge, whichever occurred first (T1), and three months after surgery during routine follow-up (T2). At each timepoint, serum albumin (g/dL), total lymphocyte count (/mm^3), and total cholesterol (mg/dL) were measured in the accredited laboratory of the hospital using standardized methods. The CONUT score was calculated by assigning weighted points for each parameter – albumin, lymphocyte count, and cholesterol – according to established thresholds, yielding a total score ranging from 0 to 12. Patients were further categorized as having normal nutritional status (0-1), mild malnutrition (2-4), moderate malnutrition (5-8), or severe malnutrition (9-12).

The primary outcome of the study was the comparative evolution of the CONUT score between the Billroth I and Billroth II/Roux-en-Y groups across the three timepoints. Secondary outcomes included within-group longitudinal changes in CONUT score, as well as associations between CONUT and postoperative outcomes, such as the incidence and severity of complications (graded according to the Clavien–Dindo classification within 30 days), length of postoperative hospital stay, readmission within 30 days, and 30-day mortality. Baseline characteristics such as age, sex, tumor site, comorbidities (including hypertension, type 2 diabetes mellitus, coronary artery disease, and chronic obstructive pulmonary disease), and surgical details were also recorded.

Statistical Analyses

Statistical analyses were conducted using EasyMedStat (Paris, France). Data distribution was assessed with the Shapiro–Wilk test. Continuous variables were expressed as mean ± standard deviation for normally distributed data or as median with interquartile range for skewed distributions, while categorical variables were expressed as frequencies and percentages. Baseline differences between the two reconstruction groups were evaluated using the independent-samples t-test or the Mann-Whitney U test for continuous variables, and the χ^2 test or Fisher's exact test for categorical variables.

The longitudinal evolution of the CONUT score was examined using a two-way mixed ANOVA with Greenhouse-Geisser correction when sphericity was violated, with reconstruction type as the between-subjects factor and timepoint as the within-subjects factor. When distributional assumptions were not met, non-parametric alternatives were applied, including the Friedman test for within-group repeated measures and the Mann-Whitney U test for between-group comparisons at individual time-points, supplemented by ANCOVA on change scores (T1-T0 and T2-T0), adjusting for baseline values. Post-hoc pairwise analyses were corrected for multiple testing using the Bonferroni or Holm-Bonferroni method. Associations between CONUT score and categorical outcomes such as complications, readmission, and mortality were assessed with χ^2 tests and logistic regression models, while length of stay was evaluated with linear regression. All analyses were two-tailed, and statistical significance was set at $p < 0.05$.

Results

A total of 150 patients were included in the analysis, of whom 72 underwent Billroth I reconstruction and 78 underwent Billroth II or Roux-en-Y reconstruction. The mean age of the study population was 61.5 ± 10.8 years, with no significant difference between the two groups (60.4 ± 10.6 vs 62.5 ± 11.0 years, p = 0.230). Men represented 60.7% of the cohort, with a similar distribution by reconstruction method. Tumor location was distal in 65.3% of patients, with no intergroup variation. Comorbidities were present in 81.3% of patients, most commonly hypertension, type 2 diabetes mellitus, and coronary artery disease, again without significant group differences. The distribution of ASA score and lymphadenectomy type (D1+ vs D2) was also comparable (*Table 1*).

Preoperative (T0) serum albumin, lymphocyte counts, and cholesterol values were comparable between groups. At early postoperative assessment (T1), both groups demonstrated a reduction in albumin, lymphocytes, and cholesterol, with

Table 1. Baseline characteristics of the study population

Variable	Billroth I (n=72)	Billroth II/RY (n=78)	Total (n=150)	p-value
Age (years)	60.4 ± 10.6	62.5 ± 11.0	61.5 ± 10.8	0.230 *
Sex, N (%)				0.693 **
Male	42 (58.3%)	49 (62.8%)	91 (60.7%)	
Female	30 (41.7%)	29 (37.2%)	59 (39.3%)	
Tumor site, N (%)				0.891 **
Distal	46 (63.9%)	52 (66.7%)	98 (65.3%)	
Body	19 (26.4%)	20 (25.6%)	39 (26.0%)	
Multicentric – Lower body / Distal region	7 (9.7%)	6 (7.7%)	13 (8.7%)	
Comorbidity, N (%)				0.980 **
Yes	58 (80.6%)	64 (82.1%)	122 (81.3%)	
No	14 (19.4%)	14 (17.9%)	28 (18.7%)	
ASA Score, N (%)				0.742 **
ASA II	34 (47.2%)	34 (43.6%)	68 (45.3%)	
ASA III	32 (44.4%)	37 (47.4%)	69 (46.0%)	
ASA IV	6 (8.3%)	7 (9.0%)	13 (8.7%)	
Lymphadenectomy (%)				0.615 **
D1+	27 (37.5%)	26 (33.3%)	53 (35.3%)	
D2	45 (62.5%)	52 (66.7%)	97 (64.7%)	
T stage	T1: 12 (16.7) T2: 24 (33.3) T3: 27 (37.5) T4: 9 (12.5)	T1: 11 (14.1) T2: 27 (34.6) T3: 28 (35.9) T4: 12 (15.4)	T1: 23 (15.3) T2: 51 (34.0) T3: 55 (36.7) T4:21 (14.0)	0.91**
Margin status	R0: 66 (91.7) R1: 6 (8.3)	R0: 70 (89.7) R1: 8 (10.3)	R0: 136 (90.7) R1: 14 (9.3)	0.69 **

*Mann–Whitney U test; ** χ^2 test

partial recovery by three months (T2). The mean albumin decreased from 3.95 ± 0.52 to 3.46 ± 0.49 g/dL in the Billroth I group and from 3.87 ± 0.56 to 3.39 ± 0.51 g/dL in the Billroth II/RY group, with no significant differences between reconstructions. A similar pattern was observed for lymphocyte counts (T0 median 1580 vs 1505/mm^3; T1 1310 vs 1260/mm^3) and cholesterol (T0 median 178 vs 176 mg/dL; T1 161 vs 159 mg/dL), followed by recovery toward baseline values at T2. The CONUT score reflected these dynamics, with an increase from a preoperative median of 2 [IQR 1-3] to 3 [IQR 2-4] postoperatively in both groups, followed by improvement at three months (median 2 [1-3]). No statistically significant differences were found between Billroth I and Billroth II/RY patients at any timepoint (all $p > 0.05$). Overall, the trajectory of nutritional and immune decline followed by partial recovery was consistent across reconstruction types (*Table 2*).

The overall postoperative complication rate was 36.0%, with no significant difference between Billroth I (31.9%) and Billroth II/RY (39.7%, p = 0.321). Major complications (Clavien–Dindo grade ≥ III) occurred in 16.7% of patients, again without intergroup variation. Anastomotic leakage was observed in 7.3% of patients (4 in Billroth I vs 7 in Billroth II/RY, p = 0.533), while other complications included surgical site infection (11.3%), postoperative ileus (10.7%), and pulmonary complications (14.0%), with no statistically significant group differences. The mean length of stay was 11.2 ± 4.6 days for Billroth I and 11.8 ± 5.0 days for Billroth II/RY (p = 0.447). Readmission within 30 days occurred in 7.3% of patients, and 30-day mortality was 3.3% (2 cases in Billroth I, 3 in Billroth II/RY). Thus, short-term morbidity and mortality were comparable between groups (*Table 3*).

Logistic regression demonstrated that a higher baseline CONUT score (T0) was independently associated with increased risk of both overall complications (OR 1.18, 95% CI 1.01–1.41, p = 0.042) and major complications (OR 1.25, 95% CI 1.05–1.61, p = 0.031). Reconstruction type, age, sex, and comorbidity were not significant predictors (*Table 4*).

When postoperative CONUT values were considered, both T1 and T2 scores showed predic-

Table 2. Nutritional and immune status of the study population

Variable	Billroth I (n=72)	Billroth II/RY (n=78)	Total (n=150)	p-value
Albumin T0 (G/DL)	3.95 ± 0.52	3.87 ± 0.56	3.91 ± 0.54	0.412 *
Albumin T1 (G/DL)	3.46 ± 0.49	3.39 ± 0.51	3.42 ± 0.50	0.376 *
Albumin T2 (G/DL)	3.72 ± 0.47	3.68 ± 0.50	3.70 ± 0.49	0.553 *
Lymphocytes T0 ($/MM^3$)	1580 [1210–1990]	1505 [1165–1920]	1545 [1180–1950]	0.478 **
Lymphocytes T1 ($/MM^3$)	1310 [970–1610]	1260 [940–1570]	1280 [950–1590]	0.511 **
Lymphocytes T2 ($/MM^3$)	1420 [1080–1760]	1390 [1050–1720]	1400 [1060–1740]	0.622 **
Cholesterol T0 (MG/DL)	178 [152–210]	176 [149–205]	177 [150–208]	0.593 **
Cholesterol T1 (MG/DL)	161 [135–186]	159 [132–183]	160 [134–184]	0.482 **
Cholesterol T2 (MG/DL)	169 [143–194]	167 [141–192]	168 [142–193]	0.551 **
CONUT T0	2 [1–3]	2 [1–3]	2 [1–3]	0.607 **
CONUT T1	3 [2–4]	3 [2–4]	3 [2–4]	0.442 **
CONUT T2	2 [1–3]	2 [1–3]	2 [1–3]	0.563 **

*Welch t-test; ** Mann–Whitney U test

Table 3. Postoperative outcomes and complications

Variable	Billroth I (n=72)	Billroth II/RY (n=78)	Total (n=150)	p-value
Any Complication	23 (31.9%)	31 (39.7%)	54 (36.0%)	0.321 **
Major Complication (CD ≥ III)	11 (15.3%)	14 (17.9%)	25 (16.7%)	0.680 **
Anastomotic Leak	4 (5.6%)	7 (9.0%)	11 (7.3%)	0.533 **
Surgical Site Infection	7 (9.7%)	10 (12.8%)	17 (11.3%)	0.596 **
Postoperative Ileus				
Pulmonary Complications	9 (12.5%)	12 (15.4%)	21 (14.0%)	0.645 **
Length of Stay (days)	11.2 ± 4.6	11.8 ± 5.0	11.5 ± 4.8	0.447 *
30-day Readmission	5 (6.9%)	6 (7.7%)	11 (7.3%)	0.864 **
30-day Mortality	2 (2.8%)	3 (3.8%)	5 (3.3%)	1.000 **

*Mann–Whitney U test; ** χ^2 test or Fisher's exact test, as appropriate

Table 4. Logistic regression analysis of risk factors for complications

Outcome / Variable	OR	95% CI	p-value
Any Complication			
CONUT Score (T0)	1.18	1.01–1.41	0.042
Reconstruction (Billroth II/RY vs I)	1.27	0.66–2.43	0.478
Age (years)	1.01	0.98–1.04	0.412
Male Sex	1.09	0.56–2.13	0.802
Comorbidity Present	1.32	0.58–3.02	0.493
Major Complication (CD ≥ III)			
CONUT Score (T0)	1.25	1.05–1.61	0.031
Reconstruction (Billroth II/RY vs I)	1.21	0.53–2.83	0.647
Age (years)	1.02	0.98–1.06	0.376
Male Sex	0.92	0.40–2.19	0.845
Comorbidity Present	1.18	0.47–3.14	0.702

Binary logistic regression
(maximum likelihood estimation). Wald χ^2 test for p-values

tive significance for complications. At T1, higher CONUT scores correlated with increased risk of overall complications (OR 1.15, 95% CI 1.02-1.39, p=0.038) and major complications (OR 1.21, 95% CI 1.04-1.55, p=0.033). At T2, the CONUT score remained predictive for both outcomes (overall complications OR 1.17, 95% CI 1.03-1.46, p=0.029; major complications OR 1.24, 95% CI 1.07-1.62, p=0.026). Reconstruction type did not emerge as an independent risk factor at either postoperative timepoint (*Table 5*).

Mixed-effects modeling confirmed a strong effect of time on CONUT scores (χ^2 = 261.98, p < 0.001), reflecting the deterioration after surgery and sub-sequent partial recovery. There was no significant main effect of reconstruction type (χ^2 = 0.22, p = 0.636), nor a significant interaction between time and group (χ^2 = 2.13, p = 0.345), indicating that both techniques followed similar immunonutritional trajectories (*Table 6*).

Post-hoc within-group comparisons revealed that both Billroth I and Billroth II/RY patients experienced a significant increase in CONUT scores from T0 to T1 (all p < 0.001). By three months, CONUT scores improved significantly compared to T1, though they remained higher than baseline, indicating only partial recovery (all p < 0.001). These trends were consistent across both reconstruction groups (*Table 7, Fig.1*).

Table 5. Logistic regression analysis of CONUT score at T1 and T2 for postoperative complications

Outcome / Variable	OR	95% CI	p-value
Any Complication – T1			
CONUT Score (T1)	1.15	1.02–1.39	0.038
Reconstruction (Billroth II/RY vs I)	1.21	0.64–2.31	0.543
Age (years)	1.01	0.98–1.04	0.426
Male Sex	1.12	0.58–2.19	0.755
Comorbidity Present	1.29	0.55–3.00	0.564
Any Complication – T2			
CONUT Score (T2)	1.17	1.03–1.46	0.029
Reconstruction (Billroth II/RY vs I)	1.18	0.61–2.26	0.615
Age (years)	1.01	0.98–1.04	0.391
Male Sex	1.07	0.54–2.16	0.842
Comorbidity Present	1.24	0.51–2.96	0.632
Major Complication (CD ≥ III) – T1			
CONUT Score (T1)	1.21	1.04–1.55	0.033
Reconstruction (Billroth II/RY vs I)	1.16	0.51–2.74	0.708
Age (years)	1.02	0.98–1.06	0.374
Male Sex	0.95	0.41–2.21	0.901
Comorbidity Present	1.22	0.47–3.28	0.693
Major Complication (CD ≥ III) – T2			
CONUT Score (T2)	1.24	1.07–1.62	0.026
Reconstruction (Billroth II/RY vs I)	1.14	0.49–2.66	0.774
Age (years)	1.02	0.98–1.06	0.387
Male Sex	0.89	0.38–2.15	0.812
Comorbidity Present	1.19	0.44–3.19	0.711

Binary logistic regression
(maximum likelihood estimation). Wald χ^2 test for p-values

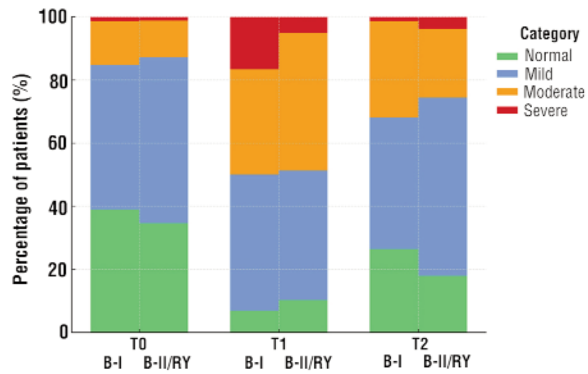

Figure 1. CONUT severity categories

Table 6. Mixed-effects model analysis of CONUT score by reconstruction type and time

Effect	χ^2 (DF)	p-value	Interpretation
Group (Billroth II/RY vs I)	0.22 (1)	0.636	No difference between reconstruction groups
Time (T0 vs T1 vs T2)	261.98 (2)	<0.001	Significant change in CONUT over time
Group x Time Interaction	2.13 (2)	0.345	No difference in CONUT trajectories between groups

Table 7. Post-hoc within-group comparisons of CONUT score (Wilcoxon signed-rank with Holm–Bonferroni correction)

Group	Comparison	Adjusted p-value	Interpretation
Billroth I	T1 vs T0	<0.001	Significant increase early after surgery
	T2 vs T0	<0.001	Partial recovery, still higher than baseline
	T2 vs T1	<0.001	Significant improvement at 3 months
Billroth II/RY	T1 vs T0	<0.001	Significant increase early after surgery
	T2 vs T0	<0.001	Partial recovery, still higher than baseline
	T2 vs T1	<0.001	Significant improvement at 3 months

Discussions

The prospective observational study showed that patients who underwent distal gastrectomy for gastric cancer demonstrated a particular pattern of CONUT score decrease at postoperative time before showing some improvement at the three-month follow-up. The CONUT scores of patients who received Billroth I reconstruction showed no major differences from patients who received Billroth II/Roux-en-Y reconstruction, yet the CONUT score independently predicted both post-operative complications and major surgical issues.

The CONUT score demonstrates its validity as a prognostic tool for gastric cancer through various validation research studies. The study confirmed existing research, which showed that patients with elevated preoperative CONUT scores tend to experience more postoperative complications. The Turkish research by Tırnova et al. showed that pre-operative CONUT scores can predict postoperative complications in stage I–III gastric cancer patients (16). The study by Qian et al. (26) found that patients with higher preoperative CONUT scores experienced negative short-term results after undergoing laparoscopic radical gastrectomy. The predictive value of the model receives additional support from the results of Takagi et al. in their meta-analysis. The authors analyzed results from various studies to determine that high CONUT values always lead to negative surgical results (19). Liu et al. demonstrated its prognostic value for short-term and long-term patient results through a combined analysis of 9,764 patients (20). Our research supports existing studies that validate CONUT as a dependable immunonutritional bio-marker.

Esashi et al. show that CONUT maintains its predictive value for postoperative complications at both T1 and T2 because it evaluates both the initial nutritional status and the subsequent changes in nutritional and immune system health (23). The study by Aoyama et al. showed that patients with higher CONUT scores following curative gastrectomy experienced worse survival outcomes. CONUT scores maintained their effect on patient outcomes from the start of curative treatment until the end of the follow-up period. Also, findings revealed that patients with elevated CONUT scores at T1 and T2 developed more complications, which suggests that continuous monitoring enables doctors to detect patients who require advanced nutritional and immunological support (24).

A non-negligible proportion of patients (8.7%) presented multicentric tumors located in the distal and lower body regions. For these cases, subtotal gastrectomy was performed, and all surgical margins were histopathologically confirmed as tumor-free (R0 resection). The choice of subtotal rather than total gastrectomy was based on intra-operative assessment of adequate resection margins and the absence of proximal involvement. The TNM staging of these patients did not differ significantly from the rest of the cohort. Although total gastrectomy remains the standard approach for extensive or multifocal disease, our findings support that in selected multicentric cases with clear margins, subtotal resection ensures oncologic safety while preserving postoperative nutritional function.

With regard to reconstruction, our study found no differences in CONUT evolution between Billroth I and Billroth II/Roux-en-Y patients. The CONUT score demonstrates that reconstruction techniques do not produce different results regarding nutritional and immune system recovery. The results match previous research studies that compared reconstruction methods because they found no significant variations in long-term nutritional results. The study of 15 research papers by Zong et al. revealed Billroth I, II, and Roux-en-Y did not show any better results in terms of overall functional outcomes (31). Xiong similarly concluded that Roux-en-Y does not significantly outperform Billroth I in terms of nutritional recovery (32), while He et al. confirmed the lack of a definitive preferred surgical reconstruction method is not feasible (33). Lombardo et al. have conducted research in this field more recently. The authors performed a network meta-analysis of randomized trials with results unable to identify any reconstructive technique that would preserve optimal nutritional status (34). Taken together, our findings suggest that immunonutritional impairment after gastrectomy is more strongly related to the physiological stress of surgery than to the specific method of alimentary tract reconstruction.

Our clinical findings demonstrate that perioperative care requires the implementation of CONUT-based nutritional monitoring systems. As highlighted by Sun et al. (18) and Jin et al. (27), patients with elevated CONUT may benefit from targeted nutritional interventions and close postoperative monitoring to reduce morbidity. The study by Chen et al. suggests that CONUT scores can help determine the most suitable adjuvant treatments because they measure both protein reserves and immune system strength, integrating a prognostic role in patients receiving immunotherapy (22).

The present study contains multiple restrictions. The study took place at a single research site, which can restrict the ability to apply its findings to other settings. The study had enough participants to identify CONUT-related differences, but the power to analyze Billroth II and Roux-en-Y separately was limited. The research had a short follow-up duration of three months, which prevented researchers from monitoring nutritional patterns and survival rates throughout the entire study period. The research did not assess how additional treatments (chemotherapy/radiotherapy) affected nutritional health at various points during the follow-up period.

The study results show that serial CONUT assessments should be used in gastric cancer surgery because they provide useful clinical information. Our research confirms that preoperative and early postoperative and three-month CONUT values serve as prognostic indicators that enable better risk assessment and personalized nutritional support and postoperative treatment plans with opportunities for risk stratification, nutritional optimization, and tailored postoperative care.

Conclusion

This prospective study demonstrated that the CONUT score is a robust predictor of postoperative morbidity in gastric cancer patients, both at baseline and during postoperative follow-up. While Billroth I and Billroth II/Roux-en-Y reconstructions showed comparable nutritional and immune trajectories, elevated CONUT values consistently identified patients at increased risk of complications. Serial CONUT assessment should be integrated into perioperative care to optimize risk stratification and guide targeted nutritional and immunological support.

Conflict of Interest

The authors declare no conflicts of interest.

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