

Comparison of Clinical, Laboratory, and Inflammatory Parameters in Pediatric Upper and Lower Gastrointestinal Bleeding

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Abstract

Aim: Pediatric gastrointestinal (GI) bleeding is an important emergency ranging from mild, self-limiting conditions to severe blood loss. Although laboratory parameters and inflammatory indices have been investigated for predicting clinical course, pediatric data remain limited.

Materials and Methods: This retrospective study included 29 pediatric patients hospitalized for GI bleeding. Patients were classified as having upper or lower GI bleeding. Hematological and biochemical parameters, neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), systemic immune-inflammation index (SII) and systemic inflammation response index (SIRI), and urea/creatinine (Cr) ratio were evaluated. Groups were compared, and associations with hospital stay were assessed by Spearman correlation analysis.

Results: Upper GI bleeding was identified in 20 (69%) patients, and lower GI bleeding was identified in 9 (31%). Hemoglobin and hematocrit were lower, and aspartate aminotransferase was higher, in the upper GI group, but these differences were not statistically significant ($p=0.052$, $p=0.089$, and $p=0.054$, respectively). NLR, PLR, SII, and SIRI did not differ between groups. Hospital stay was negatively correlated with Cr, albumin, calcium, hemoglobin, and hematocrit, and positively correlated with white blood cell, neutrophil, and SIRI. No significant correlations were found with NLR, PLR, or SII.

Conclusion: Routine laboratory parameters and inflammatory indices alone appear insufficient to distinguish upper from lower GI bleeding. However, the association of SIRI with hospital stay represents a preliminary finding, suggesting its potential complementary role in evaluating the clinical course. Larger multicenter prospective studies are needed to validate this finding.

Keywords: Gastrointestinal hemorrhage, child, inflammation, biomarkers, length of stay

Introduction

Gastrointestinal (GI) bleeding is an important pediatric emergency, ranging from mild, self-limiting bleeding to severe conditions causing hemodynamic instability and hemorrhagic shock (1,2). Although approximately 80% of pediatric GI bleeding resolves spontaneously, early identification of patients at risk of severe bleeding is essential to reduce morbidity and complications (1). Assessment of hemodynamic status and bleeding severity, identification of the potential bleeding source, and early recognition of patients requiring advanced diagnostic or therapeutic interventions are fundamental to emergency department management (2,3).

GI bleeding is classified as upper or lower according to anatomical location. Upper GI bleeding commonly presents with hematemesis or melena, whereas hematochezia is more frequent in lower GI

bleeding (1,2). Etiology varies considerably with age, comorbidities, and bleeding location, complicating diagnosis in children (1,4). Particularly in upper GI bleeding, assessing severity and determining the need and appropriate timing for endoscopy are essential for clinical management (5,6). Endoscopy also enables therapeutic intervention when required (7,8).

Routine laboratory markers, including hemoglobin (HGB), hematocrit (HCT), platelet (PLT), urea, creatinine (Cr), albumin (ALB), C-reactive protein (CRP), and coagulation parameters, are used in the initial evaluation of GI bleeding (2,3,6). Hematological and composite inflammatory indices derived from routine blood counts have also been investigated in acute clinical conditions (9,10). Neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), systemic immune-inflammation index (SII) and systemic inflammation response index (SIRI) are inexpensive and



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Cite this article as: Nogay S, Melekoğlu NA. Comparison of clinical, laboratory, and inflammatory parameters in pediatric upper and lower gastrointestinal bleeding. Eurasian J Emerg Med. 2026;25: 474-80.



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Received: 13.09.2026

Accepted: 07.10.2026

Published: 20.10.2026

accessible markers reflecting systemic inflammatory and immune responses. In acute upper GI bleeding, inflammatory indices have been associated with in-hospital mortality (10). However, age-specific reference ranges for SII, NLR, and PLR in healthy children emphasize the importance of age in interpreting these markers (11). Evidence regarding their clinical significance and potential utility in pediatric GI bleeding nevertheless remains limited.

The aim of this study was to compare demographic characteristics, routine laboratory parameters, and inflammatory indices, including NLR, PLR, SII, and SIRI, between pediatric patients with upper GI bleeding and those with lower GI bleeding, and to assess their associations with length of hospital stay.

Materials and Methods

Study Design and Setting

Following ethics approval by the Malatya Turgut Özal University Health Sciences Scientific Research Ethics Committee (approval date: 11.09.2026; approval no: E-30785963-020-421429), the data from pediatric patients who were admitted to the Malatya Training and Research Hospital emergency department between January and December 2025 and hospitalized with suspected GI bleeding were retrospectively reviewed.

Laboratory parameters potentially associated with clinical course and hospital stay were evaluated: complete blood count parameters [white blood cell (WBC), HGB, HCT, PLT, lymphocyte (LYM), monocyte (MONO), and neutrophil (NEU)]; biochemical parameters [CRP, urea, Cr, aspartate aminotransferase (AST), alanine aminotransferase (ALT), ALB, sodium (Na), potassium (K), and calcium (Ca)]; international normalized ratio (INR); derived ratios [NLR, PLR, and urea-to-creatinine ratio (urea/Cr)]; and inflammatory indices (SII and SIRI).

Composite hematological and inflammatory indices were calculated from admission laboratory values. NLR was calculated as NEU/LYM, and PLR was calculated as PLT/LYM. SII was calculated as $PLT \times NEU/LYM$ and SIRI was calculated as $NEU \times MONO/LYM$. The urea/Cr ratio was calculated by dividing urea by creatinine.

GI bleeding was anatomically classified as upper or lower. Bleeding proximal to the ligament of Treitz was considered upper GI bleeding, and distal bleeding as lower GI bleeding (1).

Selection of Participants

Using the Malatya Training and Research Hospital Information Management System, 38 patients who were recorded between January and December 2025 with ICD-10 codes K92.0 (hematemesis), K92.1 (melena), K92.2 (unspecified GI bleeding),

or K62.5 (hemorrhage of anus and rectum) were identified. Electronic medical records were reviewed for demographic information, admission laboratory results, endoscopic and colonoscopic findings, clinical diagnoses, and hospital stay. Nine patients who did not meet the inclusion criteria were excluded, and data from 29 eligible pediatric patients were retrospectively analyzed.

Inclusion Criteria

- Pediatric patients aged <18 years,
- Patients hospitalized from the emergency department with suspected GI bleeding,
- Patients with complete data available in the hospital information management system,
- Patients admitted between January and December 2025.

Exclusion Criteria

- Patients aged ≥ 18 years,
- Patients with incomplete data in the Hospital information management system,
- Patients transferred from the emergency department to other hospitals or who refused hospitalization and left the hospital.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 27.0 (IBM Corp., Armonk, NY, USA). Normality of continuous variables was assessed using the Shapiro-Wilk test, visual inspection of histograms and Q-Q plots, and evaluation of skewness and kurtosis. Normally distributed variables were expressed as mean $\pm$ standard deviation (SD), non-normally distributed variables as median and interquartile range [25th-75th percentile (IQR)], and categorical variables as number (n) and percentage (%).

Upper and lower GI bleeding groups were compared using the independent-samples t-test for normally distributed variables and the Mann-Whitney U test for non-normally distributed variables. Associations between laboratory parameters, inflammatory indices, and hospital stay were assessed using Spearman rank correlation analysis. Correlation coefficients were reported as Spearman's rho (ρ). All statistical tests were two-tailed, and $p < 0.05$ was considered statistically significant.

Results

A total of 29 pediatric patients were included. The median age was 14 years (IQR: 8-15; range: 1-17 years); 14 (48.3%) were female and 15 (51.7%) were male. Upper GI bleeding (esophagitis, gastritis,

gastric ulcer, bulbitis) occurred in 20 patients (69.0%), and lower GI bleeding (ileitis, colitis, hemorrhoids) occurred in 9 patients (31.0%). The median hospital stay was 1 day (IQR: 1-3; range: 1-8 days). Endoscopy alone was performed in 20 (69.0%) patients, while 9 (31.0%) underwent both endoscopy and colonoscopy. Admission laboratory parameters and inflammatory indices were evaluated.

Demographic, laboratory, and inflammatory parameters are presented in Table 1 as mean $\pm$ SD for normally distributed variables and median (25th-75th percentile) for non-normally distributed variables.

Parametric laboratory data from patients with upper GI bleeding and from patients with lower GI bleeding were compared using

the independent-samples t-test. HGB and HCT levels were lower in the upper GI bleeding group, but the differences were not statistically significant ($p=0.052$ and $p=0.089$, respectively). AST levels were higher in the upper GI bleeding group, but the difference was not statistically significant ($p=0.054$). The urea/Cr ratio did not differ significantly between the upper and lower GI bleeding groups ($p=0.308$). No significant differences were found in other parametric laboratory variables (all $p>0.05$) (Table 2).

The Mann-Whitney U test was used to compare non-normally distributed variables between upper and lower GI bleeding groups. No statistically significant differences were observed for age, ALT, Na, CRP, NEU, LYM, MONO, NLR, PLR, SII, or SIRI (all $p>0.05$) (Table 3).

Associations between hospital stay, laboratory parameters, and inflammatory indices were assessed using Spearman correlation analysis. Hospital stay showed significant, moderate negative correlations with Cr ($\rho=-0.531$; $p=0.003$), ALB ($\rho=-0.616$; $p<0.001$), Ca ($\rho=-0.516$; $p=0.004$), HGB ($\rho=-0.449$; $p=0.015$), and HCT ($\rho=-0.562$; $p=0.002$). Significant moderate positive correlations were found with WBC ($\rho=0.408$; $p=0.028$), NEU ($\rho=0.511$; $p=0.005$), and SIRI ($\rho=0.450$; $p=0.014$). No significant correlations were observed with urea, AST, ALT, Na, K, CRP, PLT, LYM, MONO, INR, NLR, PLR, SII, or urea/Cr ratio (all $p>0.05$) (Table 4).

Discussion

Pediatric GI bleeding has a variable clinical course, making early risk stratification important. Evidence regarding readily available laboratory markers for predicting severity and clinical outcomes remains limited, particularly in children (3,12). We evaluated routine laboratory parameters and inflammatory indices, including NLR, PLR, SII, and SIRI, in pediatric patients with upper and lower GI bleeding. Although inflammatory indices did not differ significantly between groups, several parameters were associated with hospital stay. SIRI correlated positively with hospital stay, whereas HGB, HCT, ALB, Ca, and Cr correlated negatively. These findings suggest that laboratory parameters and inflammatory indices may provide complementary information regarding the clinical course.

HGB and HCT levels were lower in upper than in lower GI bleeding, although the differences were not statistically significant ($p=0.052$ and $p=0.089$, respectively). This may reflect greater blood loss in some upper GI bleeding cases. However, normal HGB values early after acute bleeding do not exclude significant blood loss, emphasizing serial measurements alongside clinical assessment (12). In 55 children with melena, HGB ≥ 3 g/dL below the age-adjusted lower limit was associated

Table 1. Descriptive statistics of study variables presented as mean $\pm$ SD or median (Q1-Q3)

Parameters	Mean $\pm$ SD	Median (Q1-Q3)
Cr (mg/dL)	0.59 $\pm$ 0.12	—
Urea (mg/dL)	23.82 $\pm$ 7.26	—
AST (U/L)	25.93 $\pm$ 11.49	—
ALB (g/dL)	4.45 $\pm$ 0.46	—
K (mmol/L)	4.32 $\pm$ 0.43	—
Ca (mg/dL)	9.58 $\pm$ 0.54	—
WBC ($\times 10^9$ /L)	8.98 $\pm$ 2.41	—
PLT ($\times 10^9$ /L)	308.83 $\pm$ 77.11	—
HGB (g/dL)	12.71 $\pm$ 2.22	—
HCT (%)	38.93 $\pm$ 6.07	—
INR	1.06 $\pm$ 0.08	—
Urea/Cr	41.96 $\pm$ 14.24	—
Age (years)	—	14 (8-15)
ALT (U/L)	—	15 (11-20)
Na (mmol/L)	—	138 (136-140)
CRP (mg/L)	—	1.00 (0.60-2.60)
NEU ($\times 10^9$ /L)	—	4.90 (3.82-6.46)
LYM ($\times 10^9$ /L)	—	2.55 (2.03-2.96)
MONO ($\times 10^9$ /L)	—	0.58 (0.51-0.70)
NLR	—	1.95 (1.22-2.98)
PLR	—	125.30 (85.05-160.20)
SII	—	559.20 (343.60-1071.45)
SIRI	—	1.22 (0.73-1.99)
Hospital stay (days)	—	1 (1-3)

Q1 and Q3 indicate the 25th and 75th percentiles, respectively
SD: Standard deviation, Cr: Creatinine, AST: Aspartate aminotransferase, ALB: Albumin, K: Potassium, Ca: Calcium, WBC: White blood cell, PLT: Platelet, HGB: Hemoglobin, HCT: Hematocrit, INR: International normalized ratio, ALT: Alanine aminotransferase, Na: Sodium, CRP: C-reactive protein, NEU: Neutrophil, LYM: Lymphocyte, MONO: Monocyte, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, SII: Systemic immune-inflammation index, SIRI: Systemic inflammation response index

Table 2. Comparison of parametric laboratory parameters between upper and lower gastrointestinal bleeding groups

Parameters	Upper GIB (n=20) Mean ± SD	Lower GIB (n=9) Mean ± SD	p-value*	Effect size (Hedges' g)
Cr (mg/dL)	0.58±0.12	0.60±0.09	0.687	0.159
Urea (mg/dL)	24.55±8.02	22.21±5.19	0.432	0.311
AST (U/L)	28.35±12.12	20.55±8.11	0.054	0.683
ALB (g/dL)	4.36±0.43	4.64±0.47	0.131	0.607
K (mmol/L)	4.35±0.39	4.23±0.51	0.528	0.249
Ca (mg/dL)	9.57±0.55	9.60±0.52	0.810	0.044
WBC (×10 ⁹ /L)	8.65±2.56	9.71±1.94	0.280	0.430
PLT (×10 ⁹ /L)	305.10±86.90	317.11±52.56	0.705	0.149
HGB (g/dL)	12.17±2.20	13.90±1.86	0.052	0.795
HCT (%)	37.64±6.18	41.79±4.98	0.089	0.689
INR	1.06±0.08	1.05±0.08	0.700	0.044
Urea/Cr	43.79±15.34	37.86±11.09	0.308	0.405

*: Independent samples t-test, Cr: Creatinine, GIB: Gastrointestinal bleeding, SD: Standard deviation, AST: Aspartate aminotransferase, ALB: Albumin, K: Potassium, Ca: Calcium, WBC: White blood cell, PLT: Platelet, HGB: Hemoglobin, HCT: Hematocrit, INR: International normalized ratio, Urea/Cr: Urea-to-creatinine ratio

Table 3. Comparison of non-parametric laboratory parameters and inflammatory indices between upper and lower gastrointestinal bleeding groups

Parameters	GIB	n	Median	IQR (25 th -75 th percentile)	p-value*	Effect size (r)**
Age (years)	Upper	20	15	7.75-15	0.519	0.120
	Lower	9	13	9-14		
ALT (U/L)	Upper	20	13	10.75-18	0.210	0.233
	Lower	9	17	13-22		
Na (mmol/L)	Upper	20	138	136.75-140.25	0.324	0.183
	Lower	9	138	136-138		
CRP (mg/L)	Upper	20	0.95	0.60-1.93	0.383	0.162
	Lower	9	1.00	0.70-5.20		
NEU (×10 ⁹ /L)	Upper	20	4.52	3.73-6.28	0.300	0.193
	Lower	9	5.58	4.31-6.45		
LYM (×10 ⁹ /L)	Upper	20	2.47	2.04-2.71	0.310	0.193
	Lower	9	2.93	2.38-3.15		
MONO (×10 ⁹ /L)	Upper	20	0.57	0.51-0.62	0.203	0.237
	Lower	9	0.65	0.57-0.93		
NLR	Upper	20	1.81	1.23-2.72	0.777	0.053
	Lower	9	2.16	1.23-3.08		
PLR	Upper	20	130.20	103.98-157.97	0.750	0.035
	Lower	9	119.45	83.49-146.21		
SII	Upper	20	529.55	344.01-871.98	0.509	0.123
	Lower	9	563.20	357.89-1078.67		
SIRI	Upper	20	1.09	0.73-1.66	0.437	0.144
	Lower	9	1.42	0.74-2.65		

*: Mann-Whitney U test, **: Effect size: $r = |Z|/\sqrt{N}$, GIB: Gastrointestinal bleeding, ALT: Alanine aminotransferase, Na: Sodium, CRP: C-reactive protein, NEU: Neutrophil, LYM: Lymphocyte, MONO: Monocyte, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, SII: Systemic immune-inflammation index, SIRI: Systemic inflammation response index

Table 4. Significant correlations between length of hospital stay and laboratory parameters and inflammatory indices

Parameters	n	Spearman's rho (ρ)	p-value
Cr	29	-0.531*	0.003
ALB	29	-0.616*	<0.001
Ca	29	-0.516*	0.004
WBC	29	0.408*	0.028
HGB	29	-0.449*	0.015
HCT	29	-0.562*	0.002
NEU	29	0.511*	0.005
SIRI	29	0.450*	0.014

*: Correlation is significant at the 0.05 level (two-tailed), Cr: Creatinine, ALB: Albumin, Ca: Calcium, WBC: White blood cell, HGB: Hemoglobin, HCT: Hematocrit, NEU: Neutrophil, SIRI: Systemic inflammation response index

with identification of a bleeding source on upper GI endoscopy (13). Similarly, a multicenter study of 180 pediatric upper GI bleeding cases associated HGB <8 g/dL with significant lesions requiring endoscopic treatment (14). Nevertheless, substantial anemia may also occur in lower GI bleeding; a large pediatric cohort demonstrated lower HGB levels, particularly in bleeding associated with Meckel diverticulum (15). Thus, our nonsignificant findings suggest that anatomical bleeding location alone may not determine hematological loss; however, the limited sample size precludes definitive conclusions regarding differences between groups.

AST levels were also higher in the upper GI bleeding group, although the difference remained borderline ($p=0.054$). Portal hypertension and chronic liver disease may represent important etiologies of pediatric upper GI bleeding (16). However, our data did not allow linking AST elevation to a specific etiology. Therefore, this borderline finding should be interpreted cautiously. Overall, HGB, HCT, and AST alone may be insufficient to distinguish bleeding location in pediatric GI bleeding.

Biochemical parameters (ALT, Na, and CRP) and inflammatory markers (NEU, LYM, MONO, NLR, PLR, SII, and SIRI) did not differ significantly between upper and lower GI bleeding groups. The considerable etiological heterogeneity of pediatric GI bleeding may produce varying inflammatory responses regardless of anatomical location. In our lower GI bleeding group, etiologies were distributed as follows: colitis in 6 patients (66.7%), hemorrhoids in 2 patients (22.2%), and ileitis in 1 patient (11.1%). This etiological heterogeneity, encompassing conditions with potentially different degrees of inflammatory activity, may have contributed to the absence of significant differences in inflammatory indices between the upper- and lower-GI

bleeding groups. Recent pediatric lower GI bleeding series have demonstrated diverse etiologies, ranging from inflammatory bowel disease to anal fissures and polyps (17). Similarly, pediatric upper GI bleeding encompasses gastric and duodenal lesions, infectious causes, and other etiologies (18). NLR, PLR, SII, and SIRI reflect different cellular components of systemic inflammation and may increase to varying degrees in pediatric inflammatory diseases (19,20). Accordingly, the lack of discriminatory value of these indices between bleeding groups may indicate that they reflect the inflammatory burden and clinical severity of the underlying disease rather than the anatomical location of bleeding.

Moderate negative correlations between hospital stay and HGB, HCT, ALB, Ca, and Cr, and positive correlations between hospital stay and WBC, NEU, and SIRI suggest that hematological, nutritional, and inflammatory status may be associated with the clinical course of pediatric GI bleeding. In particular, the association between lower HGB and HCT and longer hospitalization may indicate that greater blood loss warrants closer monitoring and treatment. Previous evidence showing associations of indices combining HGB and ALB with hospital stay and clinical outcomes in pediatric GI surgery supports these findings (21). The negative correlation between ALB and hospital stay may reflect its relationship with nutritional and inflammatory status. The inverse association with creatinine warrants caution because pediatric creatinine levels are strongly influenced by age and muscle mass, and may not reflect disease severity.

Positive associations of WBC and NEU with hospital stay suggest that systemic inflammation may accompany a prolonged clinical course. SIRI, which integrates NEU, MONO, and LYM, was also positively correlated with length of hospital stay. Pediatric studies support its association with inflammatory burden: higher SIRI was associated with complicated disease and longer hospitalization in necrotizing pneumonia (22), while children with pneumonia showed higher WBC, NEU, and SIRI than healthy controls (23). Elevated SIRI and SII were also associated with fulminant pediatric myocarditis (24). In adults with GI bleeding, SIRI was independently associated with in-hospital mortality, suggesting potential prognostic value (25). However, the performance of inflammatory indices may vary across pediatric populations (26). In our cohort, NLR, PLR, and SII were not significantly associated with hospital stay, whereas SIRI was significantly associated with hospital stay. This preliminary finding may suggest that SIRI captures a distinct aspect of systemic inflammation through its incorporation of the MONO component and that it warrants validation in larger cohorts.

Study Limitations

This study has several limitations. First, its retrospective, single-center design limits the generalizability of the findings to other pediatric populations. The relatively small sample size, particularly in the lower GI bleeding group, may have reduced statistical power to detect between-group differences, increasing the risk of a Type II error; therefore, non-significant findings should not be interpreted as definitive evidence of no difference between groups. Etiological heterogeneity may also have influenced laboratory and inflammatory parameters. Additionally, evaluating only admission laboratory values prevented the assessment of dynamic changes during the clinical course. The limited sample size precluded multivariable regression analysis to adjust for potential confounders, including age, bleeding location, underlying etiology, and treatment requirements or endoscopic interventions, particularly because pediatric parameters are age-dependent. Therefore, the observed associations require validation in larger pediatric cohorts.

Conclusion

This study evaluated associations of routine laboratory parameters and inflammatory indices with bleeding location and length of hospital stay in pediatric patients with GI bleeding. Most parameters, including NLR, PLR, SII, and SIRI, did not differ significantly between the upper and lower GI bleeding groups. However, given the limited sample size and the risk of Type II error, these findings should not be interpreted as definitive evidence of no difference. Hospital stay was negatively correlated with HGB, HCT, ALB, Ca, and Cr, and positively correlated with WBC, NEU, and SIRI. Notably, SIRI was significantly associated with length of hospital stay, whereas NLR, PLR, and SII were not, suggesting its potential complementary role in reflecting the systemic inflammatory burden. However, SIRI and other laboratory parameters should not be considered standalone prognostic markers and should be interpreted alongside clinical findings, hemodynamic status, bleeding severity, and endoscopic evaluation. These preliminary associations require validation in larger, multicenter prospective pediatric studies before their prognostic significance and clinical utility can be established.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the Malatya Turgut Özal University Health Sciences Scientific Research Ethics Committee (approval date: 11.09.2026; approval no: E-30785963-020-421429).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from the patients.

Generative AI Usage Statement: The authors used artificial intelligence-based language editing tools solely to improve grammar and linguistic clarity during manuscript preparation.

Footnotes

Authorship Contributions

Concept: S.N., N.A.M., Design: S.N., Data Collection or Processing: S.N., Analysis or Interpretation: S.N., N.A.M., Literature Search: S.N., Writing: S.N., N.A.M.

Conflict of Interest: The authors declare that they have no conflicts of interest.

Financial Disclosure: The authors declared that this study received no financial support.

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