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Diagnostic utility of inflammatory ratios and nutritional scores in acute mesenteric ischemia: A retrospective single-center study

Ferdi Bolat[1], Muhammet Fatih Keyif[1], Mustafa Şit[1], Bahri Özer[1], Oğuz Çatal[1], Songül Peltek Özer[2]

[1]Department of General Surgery, Bolu Abant İzzet Baysal University Faculty of Medicine, Bolu, Türkiye
[2]Department of Pathology, Bolu Abant İzzet Baysal University Faculty of Medicine, Bolu, Türkiye

ABSTRACT

Objective: Acute mesenteric ischemia (AMI) is a rare but highly fatal vascular emergency. Due to its non-specific clinical presentation, early diagnosis remains a major challenge. This study aimed to evaluate the diagnostic utility of selected inflammatory ratios and nutritional scores in differentiating AMI from other causes of acute abdominal pain.

Material and Methods: This retrospective, single-center study included 40 patients diagnosed with AMI and 40 control patients who presented with non-specific abdominal pain and had no definitive diagnosis. Preoperative laboratory parameters obtained upon emergency admission were analyzed. Calculated indices included neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), systemic immune-inflammation index (SII), prognostic nutritional index (PNI), C-reactive protein (CRP)-to-albumin ratio (CAR), and CRP-to-LDH ratio (CLDR), among others. Group comparisons, Pearson correlation analyses, and receiver operating characteristic (ROC) curve analyses were performed.

Results: Compared to controls, AMI patients showed significantly elevated levels of NLR, PLR, SII, CAR, and CLDR, and significantly lower levels of PNI ($p<0.05$). ROC analysis revealed that SII [area under the curve (AUC) =0.89], NLR (AUC =0.86), and PNI (AUC =0.81) demonstrated the strongest diagnostic performance. Several indices were found to be strongly correlated, Including NLR with SII and CAR with CLDR. The observed mortality rate in the AMI group was 52.5%.

Conclusion: Inflammatory and nutritional markers, particularly SII, NLR, and PNI, appear to offer valuable diagnostic support in identifying AMI. These indices may help prioritize patients for advanced imaging and early intervention, especially in resource-limited emergency settings. Further prospective multicenter studies are needed to confirm their clinical utility.

Keywords: Acute mesenteric ischemia, systemic inflammation index, prognostic nutritional index, CRP to albumin ratio, diagnostic biomarker

INTRODUCTION

Acute mesenteric ischemia (AMI) is a life-threatening vascular emergency that occurs due to the sudden interruption of blood supply to the intestines. If not diagnosed and treated promptly, it can progress rapidly to transmural infarction, multi-organ failure and death (1). Although rare—accounting for approximately 0.09-0.2% of all acute abdominal presentations— AMI carries an alarmingly high mortality rate, often exceeding 50% in delayed cases (2,3). The disease is commonly caused by arterial embolism or thrombosis; mesenteric venous thrombosis; or non-occlusive mesenteric ischemia (NOMI) (4).

Despite its potentially devastating outcome, AMI frequently presents with vague and non-specific symptoms such as abdominal pain, nausea, vomiting, and diarrhea, which overlap significantly with more benign causes of abdominal pain (5). The classical triad of abdominal pain, fever, and leukocytosis is seen in only about one-third of patients, contributing to delayed diagnosis and intervention (6). As a result, many cases are identified at advanced stages when irreversible intestinal damage has already occurred (3,6).

Contrast-enhanced computed tomography angiography (CTA) remains the gold standard for AMI diagnosis, offering high sensitivity and specificity in detecting mesenteric occlusion and ischemia (7,8). However, delays in image acquisition or interpretation, limited access to scanners, and contraindications to contrast in certain patients may hinder its timely use. These limitations have prompted investigations

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Corresponding Author
Ferdi Bolat

E-mail: drferdibolat@gmail.com
ORCID ID: orcid.org/0000-0002-3012-2362

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into alternative, easily obtainable and non-invasive diagnostic strategies (9,10).

Recent research has focused on inflammatory and nutritional biomarkers as adjunctive tools for early recognition of AMI. Markers, such as the neutrophil to lymphocyte ratio (NLR), the platelet to lymphocyte ratio (PLR), and scores like the prognostic nutritional index (PNI), have shown promise in identifying systemic inflammatory response and nutritional depletion associated with bowel ischemia (11,12).

This study aims to assess and compare the diagnostic utility of selected inflammatory ratios and nutritional scores in distinguishing patients with AMI from those presenting with other causes of acute abdominal pain. By elucidating the potential role of these non-invasive laboratory markers, we aim to enhance early diagnostic accuracy and contribute to improved clinical decision-making and patient outcomes. Although these parameters alone may not provide a definitive diagnosis, they may offer valuable supportive evidence and help prioritize patients for advanced imaging studies such as CTA, thus contributing to more timely diagnosis and treatment.

MATERIAL and METHODS

Research Design, Setting and Study Period

This retrospective study was conducted at Bolu Abant İzzet Baysal University İzzet Baysal Training and Research Hospital. The study included adult patients (≥18 years), diagnosed with AMI between January 2014 and January 2024. The study received ethical approval from the Bolu Abant İzzet Baysal University Faculty of Medicine Hospital Ethics Committee (approval number: 2024/298, date: 19/11/2024).

Patient Selection and Data Collection

Among 172 patients initially diagnosed with mesenteric ischemia, 40 patients who met the diagnostic criteria for AMI and were treated with medical therapy, endovascular intervention, or surgery were included in the study group. Patients with chronic mesenteric ischemia, NOMI or veno-occlusive mesenteric ischemia were excluded. The control group consisted of 40 patients who presented with non-specific abdominal pain and were discharged without a definitive diagnosis after clinical evaluation.

Demographic characteristics, comorbidities, imaging findings, treatment methods, and laboratory values were retrospectively obtained through the hospital's electronic medical records system (KARMED®). Only preoperative laboratory data -obtained at the time of emergency department admission and prior to any intervention- were included in the analysis. Postoperative values were intentionally excluded to preserve the diagnostic relevance of the findings.

Laboratory Parameters and Calculated Indices

All laboratory tests were performed in the central laboratory of our institution using standardized procedures. Hematological parameters including platelets (PLT), lymphocytes (LYM), monocytes (MONO), neutrophils (NEU), platelet distribution width (PDW), and mean platelet volume (MPV) were measured using an automated hematology analyzer (Mindray BC-6800, Shenzhen, China). Biochemical parameters such as albumin (ALB), C-reactive protein (CRP), urea, sodium (Na), potassium (K), calcium (Ca), and lactate dehydrogenase (LDH) were analyzed using a Beckman Coulter AU5800 chemistry analyzer (Brea, CA, USA). Prothrombin time (PT) was measured using a Sysmex CS-2100i coagulation analyzer (Kobe, Japan).

The Following Derived Ratios and Indices Were Calculated

Inflammatory ratios: NLR, PLR, lymphocyte to monocyte ratio (LMR), platelet to PDW ratio (PPR), MPV to platelet ratio (MPR), CRP to albumin ratio (CAR), CRP to LDH ratio (CLDR), LDH to albumin ratio (LDAR), urea to albumin ratio (UAR), albumin to prothrombin time ratio (APR), sodium to potassium ratio (NaKR) and sodium to calcium ratio (NaCaR).

Composite indices: High-sensitivity modified glasgow prognostic score (HSmGPS), systemic immune-inflammation index (SII) and PNI.

Rationale for Parameter Selection

The laboratory parameters and derived indices included in this study were selected based on their clinical relevance, accessibility during emergency admission, and prior evidence of their association with systemic inflammation, tissue ischemia, and nutritional status. Neutrophils, lymphocytes, CRP, albumin, urea, and LDH were included due to their well-established roles in the inflammatory and metabolic responses characteristic of AMI.

Derived ratios such as NLR, PLR, CAR, SII, and PNI were chosen based on existing literature supporting their diagnostic and prognostic utility in various acute and critical conditions, including gastrointestinal ischemia.

Commonly performed laboratory tests such as arterial blood gases, D-dimer, troponin, and fibrinogen were not included due to inconsistent availability or substantial missing data in the retrospective records. To ensure data quality and consistency, we prioritized parameters with high completeness across the 10 year study period. Only preoperative laboratory values obtained at the time of emergency admission were analyzed to maintain temporal relevance to the diagnostic process. We acknowledge this limitation and suggest that future prospective studies include a broader spectrum of biomarkers to improve early diagnostic accuracy in AMI.

Statistical Analysis

All statistical procedures were carried out using IBM SPSS Statistics version 27. The Kolmogorov-Smirnov test was utilized to determine whether the data followed a normal distribution. For variables with normal distribution, comparisons between groups were made using the Independent Samples t-test, while the Mann-Whitney U test was employed for non-normally distributed variables. Pearson's correlation was used to assess linear relationships among significant variables. The diagnostic accuracy of the parameters and their optimal thresholds was evaluated using receiver operating characteristic (ROC) curve analysis. Statistical significance was defined as a p-value less than 0.05.

RESULTS

A total of 40 patients diagnosed with AMI from January 2014 to January 2024 were included in the study group. Additionally, 40 patients who presented to the hospital with abdominal pain but were not diagnosed with any specific pathology after clinical evaluation were assigned to the control group.

The mean age of the AMI group was 69.2±14.2 years, with 22 males (55%) and 18 females (45%). In the control group, the mean age was 67.47±13.1 years, consisting of 21 females (52.5%) and 19 males (47.5%). Among the AMI patients, 34 had chronic comorbidities and 14 were receiving anticoagulant therapy. Nineteen patients underwent emergency surgery, six received endovascular interventions, and fifteen were managed conservatively with medical treatment. Despite these interventions, 21 patients died, corresponding to a mortality rate of 52.5%. The average length of hospital stay was 8 days.

A normality test was conducted on all laboratory parameters. For variables with a normal distribution (LYM, MONO, NEU, PDW, MPV, ALB, Na, and K), the Independent Samples t-test was used; for those not normally distributed (PLT, PT, CRP, urea, Ca and LDH), the Mann-Whitney U Test was applied. The comprehensive comparison results are presented in Table 1.

To assess correlations among parameters found to be statistically significant in group comparisons, the Pearson correlation test was performed. While most parameters (LYM, MONO, NEU, PDW, MPV, ALB, Na, K, PLT, PT, CRP, urea, Ca and LDH) exhibited weak to moderate correlations with one another, a strong positive correlation was observed between monocyte and neutrophil counts (R=0.662).

In addition to basic laboratory values, derived ratios and scores —including NLR, PLR, LMR, PPR, APR, NaKR, NaCaR, PNI, and SII— demonstrated a normal distribution, whereas HSmGPS, MPR, CAR, CLDR, LDAR, and UAR did not. Accordingly, the Independent Samples t-test was used for normally distributed variables, and the Mann-Whitney U test for non-normally distributed ones. The results of these analyses are summarized in Table 2.

Further correlation analysis was conducted among significant ratios and scores. Strong positive correlations were found among NLR, PLR, and SII; between PLR and SII; APR and PNI; CAR and CLDR; UAR and HSmGPS; and CLDR and HSmGPS.

ROC curve analysis was performed for each variable to evaluate diagnostic performance. For each parameter, the area under the curve, standard error, p-value, cut-off point, sensitivity, specificity, and 95% confidence intervals were calculated. Although these findings are detailed in Table 3 and visualized in Figures 1 and 2, it was determined that each statistically significant parameter exhibited strong discriminative power in distinguishing between the AMI and control groups.

Table 1. Comparison of laboratory parameters between two groups

	p-value
Lymphocytes	<0.001
Monocytes	0.001
Neutrophils	<0.001
Platelet distribution width	<0.001
Mean platelet volume	<0.001
Albumin	<0.001
Sodium	0.001
Potassium	0.741
Platelet	0.969
Prothrombin time	<0.001
C-reactive protein	<0.001
Urea	<0.001
Calcium	0.002
Lactate dehydrogenase	<0.001

Table 2. Comparison of biochemical ratios and scoring systems between two groups

	p-value
Prognostic nutritional index	<0.001
Neutrophil to lymphocyte ratio	<0.001
Platelet to lymphocyte ratio	<0.001
Lymphocyte to monocyte ratio	<0.001
Platelet to platelet distribution width ratio	0.521
Albumin to prothrombin time ratio	<0.001
Sodium to potassium ratio	0.457
Sodium to calcium ratio	0.156
Systemic inflammation index	<0.001
High sensitivity modified glasgow prognostic score	<0.001
Mean platelet volume to platelet ratio	0.031
C-reactive protein to albumin ratio	<0.001
C-reactive protein to lactate dehydrogenase ratio	<0.001
Lactate dehydrogenase to albumin ratio	<0.001
Urea to albumin ratio	<0.001

DISCUSSION

AMI, though rare, continues to present significant diagnostic challenges due to its non-specific clinical findings and its rapid progression to intestinal necrosis. The necessity of early diagnosis and timely intervention has intensified interest in the clinical use of rapid, easily accessible and cost-effective biomarkers, particularly in situations where time and resources are limited (1,2,10).

In this retrospective study, we compared the diagnostic performance of conventional laboratory tests and novel derived ratios and scores in AMI patients against a control group presenting with non-specific abdominal pain. Our findings suggest that certain inflammatory and nutritional parameters can provide meaningful support in the early diagnosis and clinical management of AMI.

Recent studies have particularly focused on systemic inflammation and nutrition-based indices such as NLR, PLR, and SII. These ratios, which integrate basic hematological parameters, have demonstrated prognostic value in various critical conditions (3,6,11). In our study, SII emerged as the most diagnostically powerful marker, showing high sensitivity and specificity, consistent with findings reported in the literature on ischemic stroke and myocardial infarction (11,13,14). This

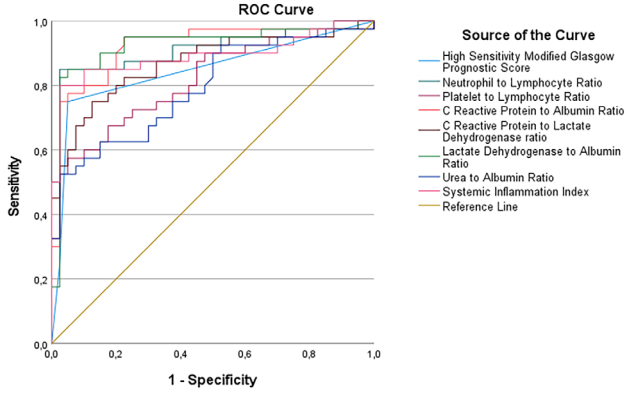

Figure 1. ROC curve of biochemical ratios and scoring systems in predicting AMI.

ROC: Receiver operating characteristic, AMI: Acute mesenteric ischemia

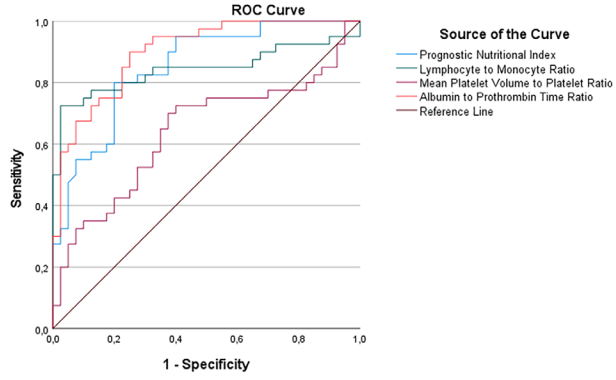

Figure 2. ROC curve of biochemical ratios and scoring systems in predicting AMI.

ROC: Receiver operating characteristic, AMI: Acute mesenteric ischemia

Table 3. ROC analysis of laboratory parameters, biochemical ratios and scoring systems

Test	AUC (95%)	SE	p-value	Asymtotic 95% confidence interval		Cut-off	Sensitivity (%)	Specificity (%)
				Lower bound	Upper bound			
High sensitivity modified Glasgow prognostic score	0.847	0.047	<0.001	0.755	0.939	0.50	75.0	95.0
Neutrophil to lymphocyte ratio	0.914	0.035	<0.001	0.846	0.982	3.71	85.0	85.0
Platelet to lymphocyte ratio	0.816	0.048	<0.001	0.722	0.909	169.89	72.5	72.5
C-reactive protein to albumin ratio	0.920	0.033	<0.001	0.854	0.985	0.26	82.5	82.5
C-reactive protein to lactate dehydrogenase ratio	0.868	0.042	<0.001	0.786	0.949	0.035	80.0	80.0
Lactate dehydrogenase to albumin ratio	0.924	0.035	<0.001	0.856	0.992	5.94	85.0	85.0
Urea to albumin ratio	0.792	0.050	<0.001	0.694	0.891	0.93	67.5	67.5
Systemic inflammation index	0.892	0.040	<0.001	0.813	0.971	956.24	85.0	85.0
Prognostic nutritional index	0.850	0.042	<0.001	0.767	0.932	410.00	80.0	80.0
Lymphocyte to monocyte ratio	0.844	0.049	<0.001	0.748	0.940	2.61	77.5	77.5
Mean platelet volume to platelet ratio	0.640	0.064	0.031	0.515	0.765	0.03	65.0	65.0
Albumin to prothrombin time ratio	0.900	0.033	<0.001	0.835	0.965	3.16	77.5	77.5

AUC: Area under the curve, SE: Standard error, ROC: Receiver operating characteristic

supports the use of SII as a surrogate indicator of systemic vascular stress.

NLR and PLR levels, were significantly elevated in patients with AMI, consistent with prior studies emphasizing their diagnostic and prognostic relevance in ischemic abdominal pathology (6,14). Khan et al. (6) reported that an NLR >9.9 is effective in differentiating AMI from other acute abdominal conditions. Augène et al. (15) also identified PLR as an independent predictor of short-term mortality.

The PNI was significantly lower in the AMI group in our study. This finding is in line with earlier studies showing that low PNI is associated with worse clinical outcomes and increased surgical risk in ischemic intestinal conditions (16,17). As such, PNI reflects both nutritional status and immune suppression.

Inflammation-nutrition composite ratios such as the CAR and the CRP to LDH ratio (CLDR) were also significantly elevated in AMI patients. CAR, in particular, has been reported to outperform CRP alone in mortality prediction across various acute diseases including AMI (14,16). While CLDR has been less frequently studied, our results suggest that it may hold additional prognostic value.

In addition to these more commonly assessed indices, our study also evaluated less frequently explored parameters such as the HSmGPS, LDAR, UAR, LMR, MPR, and APR. Although these parameters did not demonstrate diagnostic power comparable to SII or NLR, they provide new avenues for clinical interpretation.

HSmGPS, which combines CRP and albumin levels, has shown prognostic value in oncology and sepsis literature, though it has been rarely studied in AMI. In our study, HSmGPS levels were higher in the AMI group, consistent with trends reported in inflammatory conditions (16,18), although the difference did not reach statistical significance.

LDAR and UAR, which reflect metabolic stress and catabolic burden, were also elevated in AMI patients. These ratios may indicate tissue damage and renal dysfunction, though their diagnostic validity in AMI remains to be established (14,18). APR, which reflects hepatic synthetic capacity under inflammatory stress, showed potential discriminatory power but did not achieve statistical significance in our study. MPR, though conceptually promising as an index of platelet activation, and LMR, widely used in cancer prognosis, demonstrated inconsistent results in our cohort, possibly due to sample size limitations or biological variability (3,19-21).

Alternative parameters have also been evaluated in the literature. For instance, whole blood viscosity has been proposed as a marker for mesenteric arterial thrombosis, although it was not assessed in our study (22). Likewise, several meta-analyses have emphasized the role of traditional markers such as D-dimer and lactate in the early detection of AMI and proposed composite laboratory models for improved diagnostic accuracy (23).

The mortality rate observed in our study was 52.5%, which aligns with previously reported ranges of 50-70% for AMI (1,2,24). This persistently high fatality rate underscores the need for rapid diagnostic methods that can aid in earlier recognition and intervention, particularly when access to imaging is limited or delayed.

Strengths of our study include both conventional and novel laboratory parameters, providing a more comprehensive assessment of systemic response to mesenteric ischemia. However, limitations include its retrospective and single-center design, relatively small sample size, and single-time-point laboratory data collection, which may not reflect dynamic changes over the disease course.

CONCLUSION

According to this study, some nutritional and inflammatory biomarkers, including SII, NLR, PLR, PNI, CAR and CLDR, may be useful in the early diagnosis of AMI. These markers are inexpensive, simple to acquire and could help clinicians make decisions when imaging is not easily accessible, especially in emergency rooms. Newer markers like LDAR, UAR and HSmGPS may also provide insightful information, but further study is required to fully understand their diagnostic utility. Given the high death rate linked to AMI, using these biomarkers in early diagnostic processes could facilitate quicker triage and improved results. To validate these results, larger prospective investigations are required.

Ethics

Ethics Committee Approval: study received ethical approval from the Bolu Abant İzzet Baysal University Faculty of Medicine Hospital Ethics Committee (approval number: 2024/298, date: 19/11/2024).

Informed Consent: Retrospective study.

Footnotes

Author Contributions

Concept - F.B.; Supervision - M.Ş., S.P.Ö.; Design - F.B., M.F.K.; Data Collection or Processing - F.B., M.F.K.; Analysis or Interpretation - F.B., M.F.K., O.Ç.; Literature Search - F.B., B.Ö.; Critical Review - M.Ş., B.Ö., O.Ç., S.P.Ö.; Writing - F.B.

Conflict of Interest: No conflict of interest was declared by the authors.

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REFERENCES

1. *Bala M, Catena F, Kashuk J, De Simone B, Gomes CA, Weber D, et al. Acute mesenteric ischemia: updated guidelines of the World Society of Emergency Surgery. World J Emerg Surg WJES. 2022;17:54.*
2. *Bala M, Kashuk J, Moore EE, Kluger Y, Biffl W, Gomes CA, et al. Acute mesenteric ischemia: guidelines of the World Society of Emergency Surgery. World J Emerg Surg WJES. 2017;12:38.*

3. *Mihaileanu FV, Popa SL, Grad S, Dumitrascu DI, Ismaiel A, Rus E, et al. The efficiency of serum biomarkers in predicting the clinical outcome of patients with mesenteric ischemia during follow-up: a systematic review. Diagn Basel Switz. 2024;14:670.*
4. *Sakamoto T, Kubota T, Funakoshi H, Lefor AK. Multidisciplinary management of acute mesenteric ischemia: surgery and endovascular intervention. World J Gastrointest Surg. 2021;13:806-813.*
5. *Plumereau F, Mucci S, Le Naoures P, Finel JB, Hamy A. Acute mesenteric ischemia of arterial origin: importance of early revascularization. J Visc Surg. 2015;152:17-22.*
6. *Khan SM, Emile SH, Wang Z, Agha MA. Diagnostic accuracy of hematological parameters in acute mesenteric ischemia-a systematic review. Int J Surg. 2019;66:18-27.*
7. *Memet O, Zhang L, Shen J. Serological biomarkers for acute mesenteric ischemia. Ann Transl Med. 2019;7:394.*
8. *Yu H, Kirkpatrick IDC. An update on acute mesenteric ıschemia. Can Assoc Radiol J. 2023;74:160-171.*
9. *Uludag SS, Erginoz E, Gures N, Oral G, Sanli AN, Askar A, et al. Is there a faster and easier method for assessing the severity of acute mesenteric ischemia? Medicine (Baltimore). 2024;103:e38365.*
10. *Reintam Blaser A, Starkopf J, Björck M, Forbes A, Kase K, Kiisk E, et al. Diagnostic accuracy of biomarkers to detect acute mesenteric ischaemia in adult patients: a systematic review and meta-analysis. World J Emerg Surg WJES. 2023;18:44.*
11. *Zafirovski A, Zafirovska M, Kuhelj D, Pintar T. The impact of biomarkers on the early detection of acute mesenteric ischemia. Biomedicines. 2023;12:85.*
12. *Treskes N, Persoon AM, van Zanten ARH. Diagnostic accuracy of novel serological biomarkers to detect acute mesenteric ischemia: a systematic review and meta-analysis. Intern Emerg Med. 2017;12:821-836.*
13. *Otto CC, Czigany Z, Heise D, Bruners P, Kotelis D, Lang SA, et al. Prognostic factors for mortality in acute mesenteric ischemia. J Clin Med. 2022;11:3619.*
14. *Destek S, Yabacı A, Abik YN, Gül VO, Değer KC. Predictive and prognostic value of L-lactate, D-dimer, leukocyte, C-reactive protein and neutrophil/lymphocyte ratio in patients with acute mesenteric ischemia. Ulus Travma Acil Cerrahi Derg. 2020;26:86-94.*
15. *Augène E, Lareyre F, Chikande J, Guidi L, Ballaith A, Bossert JN, et al. Platelet to lymphocyte ratio as a predictive factor of 30-day mortality in patients with acute mesenteric ischemia. PLoS One. 2019;14:e0219763.*
16. *Vural V, Ozozan OV. The usefulness of inflammation-based prognostic scores for the prediction of postoperative mortality in patients who underwent intestinal resection for acute intestinal ischemia. Cureus. 2019;11:e6372.*
17. *Alhan E, Usta A, Çekiç A, Saglam K, Türkyılmaz S, Cinel A. A study on 107 patients with acute mesenteric ischemia over 30 years. Int J Surg. 2012;10:510-513.*
18. *Conde Monroy DM, Girón Arango F, Rodríguez Moreno L, Rey Chaves CE, Donoso-Samper A, Nassar R, et al. Succoring the challenging acute mesenteric ischemia: feasibility of lactate dehydrogenase for evaluation of intestinal necrosis extension and mortality. Ann Med Surg (Lond). 2022;84:104922.*
19. *Ranchordás S, Cunha C, Roque R, Féria L, Maio R. Acute mesenteric ischemia: a review of 50 cases. Int Surg J. 2019;6:2272.*
20. *Grotelüschen R, Bergmann W, Welte MN, Reeh M, Izbicki JR, Bachmann K. What predicts the outcome in patients with intestinal ischemia? A single center experience. J Visc Surg. 2019;156:405-411.*
21. *Altintoprak F, Arslan Y, Yalkin O, Uzunoglu Y, Ozkan OV. Mean platelet volume as a potential prognostic marker in patients with acute mesenteric ischemia-retrospective study. World J Emerg Surg. 2013;8:49.*
22. *Gul S, Ozan Kucuk G. Can whole blood viscosity predict the development of acute mesenteric arterial thrombosis? Ulus Travma Acil Cerrahi Derg. 2023;29:685-690.*
23. *Cudnik MT, Darbha S, Jones J, Macedo J, Stockton SW, Hiestand BC. The diagnosis of acute mesenteric ischemia: a systematic review and meta-analysis. Acad Emerg Med. 2013;20:1087-1100.*
24. *Martini V, Lederer AK, Fink J, Chikhladze S, Utzolino S, Fichtner-Feigl S, et al. Clinical characteristics and outcome of patients with acute mesenteric ischemia: a retrospective cohort analysis. Langenbecks Arch Surg. 2022;407:1225-1232.*